The Development of Children's Argument Skills

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Declaration of authorship

I, Ana Patrícia Macedo, hereby declare that this thesis and the work presented in it is entirely my own. Where I have consulted the work of others, this is always clearly stated.

Signed:

Date:

Abstract

This thesis describes five interconnected studies that systematically examined argumentative skills in children with ages ranging from 5 to 12 years old. This research is the first to explore how children, at a younger age than previously studied, produce and evaluate arguments in different tasks and contexts.

The first set of studies focused on children's ability to generate arguments and counterarguments, while they engaged in an interview with the researcher (Study One), and while discussing a topic with their peers (Study Two). Results indicated that at 8 years, but not at 5 years, children were able to grasp counterargument as a form of justification as displayed in individual interviews. However findings from group discussions suggested that counterarguments were not deployed in group settings until 11 years. Results are discussed in terms of the development of the ability to take into account others' perspectives.

The next two studies examined how children evaluate arguments and counterarguments considering their own and others' perspectives. In Study Three, a computer-based task assessed children's evaluation of argument strength. Results revealed that children, at 8- years and 11- years, relied on the strength of their beliefs to evaluate different types of arguments. Moreover, 8- year olds perceived fewer differences between weak and strong arguments, compared to 11- year olds. Study Four explored argument effectiveness using a similar computer-based task. Some developmental differences were found, for instance, 11- year olds regarded arguments with more reasons as more persuasive while 8- year olds did not.

The final study explored children's ability to perceive goal-directed arguments and strategies deployed in video-recorded dialogues. This is the first study of its kind to look at argumentation processes in real social contexts, and its importance is discussed in terms of generalising the findings to children's interactions in everyday situations.

These five studies have important implications in learning and education, and directions for intervention and future research are outlined. This needs to focus on devising specific educational programs for children at different ages.

To my parents: David and Maria.

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Chapter One - Introduction

1.1. Argumentation and its role in life and society

Argumentation is present in almost all human communication and it is familiar to everyone. People have to justify their opinions, choices and ideas on a daily basis. For example, the lawyer arguing in a trial, the politician defending a policy, the child pleading for a toy, the student presenting the pros and cons of a theory, or the consumer complaining about the quality of a product are all engaging in some form of argumentation. Engaging in written argumentation is also a common everyday life activity, for example producing an essay or a response to something read in a newspaper.

Argumentation is, thus, a verbal activity that can be performed orally as well as in writing. Moreover, argumentation has a social dimension: in advancing arguments to support a position, one directs oneself to other people (van Eemeran, Grootendorst, & Henkemans, 2002). It is also typically construed as a rational activity that is aimed at defending a position and advancing arguments with the intent to persuade (van Eemeran, Grootendorst, & Henkemans, 2002). Indeed, many researchers have claimed that the main function of reasoning is argumentative (Billig, 1996; Goldstein, Crowell, & Kuhn, 2009; Haidt, 2001; Kuhn, 1992; Mercier & Sperber, 2011; Oaksford & Chater, 2007). As Goldstein, Crowell, and Kuhn (2009) explain: asserting, supporting, and refuting claims and arguments to convey ideas and convince others is the purpose to which people apply reasoning skills. Mercier and Sperber (2011) go further and hypothesise that reasoning so conceived is adaptive, that is, it has evolved and persisted mainly because it makes human communication more effective and beneficial.

According to Mercier and Sperber (2011), this hypothesis fits well with research that has focused on the role that social interaction plays on cognitive development (e.g., Dunbar, 1996; Dunbar & Shultz, 2003; Tomasello, Carperter, Call, Behne, & Moll, 2005). These studies all stress the importance of communication for human cooperation, for example in setting common goals, and assigning duties and rights. In particular, argumentation can be used as a tool for resolving disagreements that are likely to occur in families, groups, and societies. It is, thus, a powerful and valuable cultural practice.

As Hitchcock (2002) acknowledges, argumentation has the unique potential to change ignorance into knowledge and prejudice into reasoned judgement. Societal debates include discussion of controversial topics, such as socio-moral questions and policy issues. By allowing opinion change about those issues, the practice of argumentation can have a massive impact in human lives. According to Hitchcock (2002), this impact is beneficial: Human well-being (and the well-being of animals, species, the biosphere, and our planet) is better served and protected by positions and policies that are open to reasonable debate.

1.2. Issues underlying the study of argumentation

Argumentation theory has always been of central interest to philosophers, linguists, psychologists and intellectuals of various fields. Despite the enduring interest in the topic, many issues related to how people represent, reason about, and resolve a critical discussion remain open to debate. For example, what constitutes a good argument has not been described in any systematic way. The relationship between commitment to a position and the ability to resolve a disagreement also remains poorly understood. Moreover, even though descriptions of a formal model of argument has been advanced (e.g., Toulmin, 1958), insufficient evidence has been offered to determine whether similar defining rules and evaluative criteria, as those used to analyse the logic of individual arguments, can also be applied to study informal arguments constructed in social contexts.

Educational researchers also have a long history of studying the practice of argumentation, not only because it is an important competence to be learned, but also because argumentation can be used to foster learning in various domains, such as philosophy, history, sciences, and mathematics. However, as Mirza and Perret-Clermont (2009) note, learning the skills entailed in argumentation and acquiring knowledge by arguing, at school, still raises theoretical and methodological questions. For example: How do learning processes develop in argumentation? How does one design effective argumentative activities? How can one reduce belief biases that prevent effective gathering and evaluation of available information? How can the argumentative efforts of students be sustained? What are the psychological issues involved when arguing with others?

Although it has been widely accepted among teachers and psychologists that schools should focus more on teaching their students critical thinking skills than on memorising facts, school curricula still do not offer sufficient methodological guidance on how to improve students' reasoning and problem solving skills (Mercer, 2009). In fact, there is still controversy over whether or not critical thinking should be taught as an independent subject or within established subjects. For instance, in the U.K. school system, Critical Thinking as a subject is only offered as an independent A-Level course to 17-18 year olds (National Curriculum, 2010). Yet, the question of whether critical thinking concepts and principles should be taught in school at an earlier stage, either as an independent subject or adapted to fit the content of each subject, is important.

Mercer and his colleagues (e.g., Mercer, 2000; Mercer, Dawe, Wegerif, & Sams, 2004; Mercer & Sams, 2006) made one of the earliest attempts to address this issue and, since the early 90s, they have been working with teachers to develop a practical programme of instruction and activity for schools in the U.K., called *Thinking Together*.

The present research contributes to further understanding of the argumentative skills that children exhibit at an early age and how they develop. To this date, little hard evidence exists on the development of argument skills in younger populations. For instance, are there systematic differences between the arguments produced by 5-years olds and those produced by 8-year olds? Can children learn to argue better through practice? Can children at different ages learn to argue the same way? Are children influenced by their beliefs while evaluating and generating arguments? The conceptual and empirical work described in this thesis concerns argumentation skills in school-age children (5-12 years) and aims to identify the salient features of the development of these skills in different tasks and involving a variety of topics (e.g., moral, social, scientific). Furthermore, it explores how context and topic affect understanding and generalisation of arguments. This research has, therefore, very important educational implications and highlights the role of school in fostering children's argumentative skills.

1.3. Definition of argumentation

Although the practice of argumentation occurs in various contexts, such as legal settings or among friends in informal contexts, the defining rules and evaluative criteria of each one are similar enough to suggest a single definition for argumentation. This section provides various accounts for defining argumentation and discusses its shared features.

Frans van Eemeren and Rob Grootendorst, two influential scholars in argumentation theory, define argumentation as:

> A verbal, social and rational activity aimed at convincing a reasonable critic of the acceptability of a standpoint by putting forward a constellation of propositions justifying or refuting the proposition expressed in the standpoint (van Eemeran & Grootendorst, 2004, p. 1).

This general definition accounts for many theoretically important aspects of the notion of argumentation. According to van Eemeran and Grootendorst (2004) argumentation is: (a) a *verbal activity*, expressed by the use of language, (b) a *social activity*, because it is directed at other people, (c) a *rational activity*, which is concerned primarily with reaching conclusions through logical reasoning, (d) an activity whose goal is to *convince the listener or the reader of the acceptability of the standpoint*, (e) an activity that consists in advancing *propositions* to *justify* a standpoint (in the case of a positive standpoint) or to *refute* a standpoint (in the case of a negative standpoint), and (f) a complex speech act aimed at convincing a *reasonable critic*. Accordingly, the primary goal of argumentation is the justification and rebuttal of differences of opinion or controversial positions in a logical and rational way (van Eemeran & Grootendorst, 2004). From a similar perspective, Johnson (2000) defines argumentation as "a sociocultural activity of constructing, presenting, interpreting, criticising, and revising arguments for the purpose of reaching a shared rationally supported position on some issue" (p. 12). These two definitions emphasise argumentation as a social interaction aimed at conflict resolution.

In contrast, Zarefsky (1995) stated that a central concept for argumentation is "the practice of justifying decisions under conditions of uncertainty" (p. 43). As noted by Voss and van Dyke (2001), this definition accounts for two important aspects of the concept of argumentation. First, while describing argumentation as a social activity, Zarefsky (1995) uses the term *justifying* as a contrast to *proving* which cannot be done with argumentation. Second, he notes that decision making is based on the consideration of choices and taking a position and, thus, occurs under conditions of uncertainty (Voss & van Dyke, 2001). This perspective contrasts with the former definitions (e.g., van Eemeran & Grootendorst, 2004) which have described argumentation in the context of rationality and even possibly certainty.

Other definitions focus on different goals of the practice of argumentation. For example, Perelman and Olbrechts-Tyeca (1969) argue that "the aim of argumentation is not to deduce consequences from given premises; it is rather to elicit or increase the adherence of the members of an audience to theses that are presented for their consent" (p. 9). Walton (1989, 1995, 2006) also regarded persuasion as the ultimate goal of argumentative discourse.

Thus, there are multiple definitions which differ on the emphasis placed on the goals of the practice of argumentation. In some definitions, argumentation is aimed at justifying and rebutting a controversial position through logical reasoning (e.g., Johnson, 2000; van Eemeran & Grootendorst, 2004). In other definitions, the function of argumentation is mainly one of social interaction aimed at sharing different positions, reaching a resolution and building consensus (e.g., Perelman & Olbrechts-Tyeca, 1969).

1.3.1. The common features of definitions of argumentation

All definitions stated above converge in some fundamental issues. First, the study of argumentation should focus, not only on argument as a set of isolated premises and conclusions, but also on the construction of arguments in a social context. Thus, the term argumentation refers to the use of argument as both a *product* and a *process* (Henkemans, 2003; Kuhn, 1991; Kuhn & Udell, 2003; Ricco, 2008; Rips, 1998; van Eemeren & Grootendorst, 2004). Nonetheless, implicit in argument as a product is the advancement of a claim followed by justifications and critiques, which is the main feature of argumentative discourse processes, and so the two kinds of argument are interrelated (Billig, 1996; Kuhn, 1991; Kuhn & Udell, 2003). Therefore, the study of arguments should address social interactions between people in dyads or groups. Second, these definitions suggest that argumentation arises from attempts to resolve conflicts of opinion. In a recent work, van Eemeran and Grootendorst (2004) changed the concept of conflict of opinion into the concept of *difference of opinion.* Nevertheless, all approaches share a main goal: the practice of argumentation is the resolution of these conflicts or differences of opinion. Third, the assumption that argumentative discourse exchanges rely on *different set of commitments* (Walton, 1989, 1995) is widely accepted. Walton (1989) defined a *commitment* as a presumptive or inconclusive premise given by a partner. The goal of a *critical dialogue* is to draw conclusions from the partner's commitments and also try to convince the partner to accept certain premises. Fourth, as noted by Jovičić (2006), these approaches assume that participants are rational, but also irrational agents since they tend to make fallacies (e.g., van Eemeren, 2002; Walton, 2006). Fifth, in terms of the criteria for evaluating argumentation, all approaches stated above agree that it is not enough to focus only on the criterion of logical validity. Instead, they recommend using multiple methods and analytical models to evaluate different kinds of arguments.

1.4. A brief history of theories of argumentation

The study of argumentation goes back to classical antiquity, where Aristotle's logical theory is first found. Although argumentation plays an important role in society, until the 1950s there was no relevant empirical research in the area (van Eemeran & Grootendorst, 2004). In the 1950s, debating and argumentation became an important academic topic in universities and colleges in the United States. In the 1960s and 1970s, Perelman and Toulmin became the most influential authors in argumentation research. Contemporary theories developed by various authors have contributed extensively to the revision of some aspects of previous argumentation theories (e.g., van Eemeran & Grootendorst, 2004).

The next sections review some historical and theoretical considerations of ancient theories, medieval and enlightenment theories, modern theories, and contemporary theories. The final section provides a critic reflection of all approaches and highlights the importance of integrating elements of different theories.

1.4.1. Ancient theories

Studies in argumentation theories have a long tradition and their roots go back to classical antiquity. The first known reference to oratory skills occurs in *Iliad* (Homer, ninth century B.C.), in which heroes like Achilles, Hektor, and Odysseus were honoured for their ability to advise and persuade their peers and followers (the Laos or army) in wise and appropriate action. Oratory became important in Ancient Greece as a medium through which political and legal decisions were made, and through which philosophical ideas were developed and disseminated. Teaching in oratory was popularised in the fifth century B.C. by itinerant teachers known as Sophists. Later, classical authors such as Aristotle (third century B.C.) and Cicero (first century B.C.) made great contributions to argumentation theory and many of their writings are still fundamental in modern theories of argumentation (van Eemeran & Grootendorst, 2004).

Aristotle developed the categorical syllogism, which is one type of logical argument in which one proposition (the conclusion) is inferred from two others (the premises), such as the following:

Major premise: All men are mortal.
Minor premise: Socrates is a man.
Conclusion: Socrates is mortal.

The syllogism is at the core of deductive reasoning, in which facts are determined by evaluating existing statements, in contrast to inductive reasoning in which facts are determined by repeated observations. Aristotle's categorical syllogism provided certainty in the performance of logic-based tasks, and over the last three quarters of the twentieth century, the psychological study of reasoning employed mainly this type of tasks (e.g., Johnson-Laird, 1983). Logic-basic tasks are experimentally simpler to conduct than tasks having uncertainty, and performance is easier to evaluate because it is based on whether an individual applied or not the rules of logic.

Aristotle also wrote extensively about dialect in *Topica* (1928) and *De sophisticis elenchis* (1928), and also about rhetoric in the *Rhetorica* (1928). Dialectics refers to conducting a debate that is dialectical because a systematic interaction in which arguments and counterarguments are exchanged (van Eemeran, 2004). The aim of the dialectical method is to try to resolve the disagreement through rational discussion, and ultimately, the search for truth (Blair, 2003; Pinto, 2001). For Aristotle, rhetoric is concerned with finding the most suitable means to persuade an audience (van Eemeran, 2004). Greek rhetoric contributed largely to the development of the Roman rhetoric, for example Cicero's theories on rhetoric described in *De inventione* (1949).

1.4.2. Medieval and Renaissance to Enlightenment theories

After the decline of the Western Roman Empire, the discipline of *rhetoric* continued to be important for the study of the verbal arts, such as oratory. Even though the study of verbal arts went into decline for several centuries, it reappeared in formal education when the medieval universities first formed. During this period, the study of rhetoric became highly scholastic: students were trained to create discourses on historical subjects and study legal questions. Rhetorical was also used, in this period, in the arts of sermon writing by scholars associated with the medieval Christian church. For instance, after his conversion to Christianity, St. Augustine (354-430) used rhetoric for spreading his religion. Other medieval rhetorical writings include, for example, those of St. Thomas Aquinas (1225?-1274) and Geoffrey of Vinsauf (1200-1216), (Henrick, 2004).

In the Renaissance period, rhetoric regained its classical roots. The sixteenth century scholars disfavoured medieval scholastic logic and dialectic and favoured the study of classical Latin style, grammar, philology, and rhetoric. Erasmus (1466-1536), was one of the most influential figures in this period, and he became known for writing several textbooks in rhetoric. In the later sixteenth century, his work was widely studied in Elizabethan grammar schools in the U.K. The mid-sixteenth century saw the rise of the vernacular *rhetorics* - those written in English rather than in the classical languages. However, it was in the seventeenth century that the vernacular style models developed (i.e., models that looked to English, rather than to Greek, Latin, or French). In this period, the most influential writings on rhetoric were those of Francis Bacon (1561-1626) and Thomas Hobbes (1588-1679). Both authors were concerned with finding a suitable style for the discussion of scientific topics, which required mainly a clear exposition of facts and arguments, rather the ornate style favoured at the time (Henrick, 2004).

The study of rhetoric continued through the eighteenth century in the Enlightenment period. In this period, the most influential rhetorical theorists were Campbell and Whately. In his main work *The Philosophy of Rethoric*, published in 1776, Campbell drew a distinction between “scientific evidence” and “moral evidence”. According to the author, these two types of evidence differ in structure; while scientific evidence consists of a set of interdependent premises which form one argument, moral evidence consists of a number of independent arguments. Whately contributed to advances in rhetoric writings by discussing two different ways in which reasons may be combined in order to produce a stronger argument. A first type of case consists of reasons of the same type, which separately have little or no strength, but can lend sufficient support to a conclusion when taken together. A second type consists of combining a number of different types of reasons to produce a strong argument. The analysis of argument structure, led by these two authors, contributed to the development of the logic textbooks that appeared in the second half of the twentieth century (Henkemans, 2001).

1.4.3. Modern theories

After the 1950s, argumentation theory gained a new impulse thanks to the publications of Toulmin's (1958), *The uses of argument*, and Perelman and Olbrechts-Tyteca's (1969), *The new rhetoric*. Both works argued in favour of a jurisprudence model of argumentation rather than the most commonly used mathematical model.

Toulmin's book, *The uses of argument* (1958), remains today one of the most influential works on the theory of argumentation. Toulmin regarded the previous model of formal logic to be inadequate to explain everyday arguments, so he proposed a new model of practical reasoning. Toulmin's model consists of four basic elements: a *claim* or assertion; *data* or evidence which consists of facts or observable events that an arguers offers in support of a claim; a *warrant* (belief or principle) that links the evidence to the claim; and *backing* that further supports and justifies the warrant. The *warrant* performs a connection function between the *data* and the *claim*. It is usually implicit or unstated and it requires the listener to recognise the underlying reasoning behind the claim and the data. For example, in the statement: "that dog is probably friendly. It is a Golden Retriever", the warrant is the generalization that most or all Golden Retrievers are friendly (Toulmin, 1958). Warrants are based on *ethos* (source credibility, authority), *logos* (reason-giving, induction, deduction), *pathos* (emotional or motivational appeals), and *shared values* (free speech, right to know, fairness, etc.).

Backing provides additional justification for the warrant (Toulmin, 1958). According to Toulmin, an argument is considered sound or valid by the degree to which the warrant is made acceptable by a backing (van Eemeran & Grootendorst, 2004). The kind of backing that is required depends on the topic that is the subject of the argument, and therefore the criteria for evaluating argumentation are, in Toulmin's perspective, "field-dependent".

Moreover, a good argument includes two additional elements: *qualifiers* that limit the conditions under which the claim is valid; and *rebuttals* that directly oppose the claim. Thus, for Toulmin, reasoning and argument involve not only support for points of view, but also attack against opposing points of view.

Toulmin's model has been used extensively for research in many fields, but it has also been criticised for several reasons. A first criticism is that it pertains only to a single argument and, therefore, it is not effective in the analysis of discourse of large bodies of argumentative text (Voss & van Dyke, 2001). For instance, Stein and Albro (2001) demonstrated that it is difficult to identify the components of the Toulmin categories in argumentative texts, particularly to distinguish components such as backing from datum or qualifier. A second criticism, as pointed out by Perelman (1984), is that Toulmin neglected the role of the audience; his model favours structure over pragmatics.

Along with Stephen Toulmin, Chaïm Perelman is among one of the most influential argumentation theorists of the twentieth century. His main work is the *Traité de l'argumentation - la nouvelle rhétorique* (1958), with Lucie Olbrechts-Tyteca, which was translated into English as *The New Rhetoric: A Treatise on Argumentation*, in 1969. Perelman and Olbrechts-Tyteca began research on the logic of informal arguments in 1948. Inspired by the Greek and Roman rhetorical tradition, they hypothesised that the rationale governing informal argument could be derived from the principles of rhetorical theory and in particular from considerations of audience and values. The *New Rhetoric* is based on the idea that, "since argumentation aims at securing the adherence of those to whom it is addressed, it is, in its entirety, relative to the audience to be influenced" (Perelman & Olbrechts-Tyteca, 1969, p.19). Thus, the criteria for evaluating argumentation are determined by the degree to which it is sucessful in influencing the audience for a particular purpose (van Eemeran & Grootendorst, 2004). The relation between the persuasion goal and the justification goal is that the argument to persuade may be adequately justified, but the goal of persuasion may also entail poorer justification.

As Voss and van Dyke (2001) point out, advertisers and politicians often try to make weak reasons appear strong as a persuasive strategy. According to Perelman and Olbrechts-Tyteca (1969), all argumentation must proceed from a point of agreement, that is, the speaker or writer must have the same premises as the audience in order to convince the audience of a proposition. They defined two categories of premises: the first deals with facts, truths, and assumptions; the second with values and value hierarchies (Voss & van Dyke, 2001). Both facts and truths are usually established prior to argument; these are aspects of reality that would be immediately accepted without dispute. As Perelman (2001) explains, "if we presuppose the coherence of reality and of our truths taken as a whole, there cannot be any conflict between facts and truths on which we could be called to make a decision" (p. 1394). Presumptions, like facts and truths, need not be defended; if the argument requires opposing presumptions, the arguer can induce opinion change by presenting arguments for the opposite side. Value-related premises may also constitute starting points to argument, but they should not be treated as universal. However, Perelman (2001) notes that "establishing and reinforcing common values is necessary, because they influence action and determine acceptable behaviour" (p. 1394). Because informal arguments are concerned with the adherence of an audience, rather than the mere demonstration of propositions proper to formal logic, the arguer has to ensure that the audience accepts each one of the successive elements of an argument.

Perelman (2001) outlines two ways the arguer may achieve this acceptance: the first involves associations according to quasi-logical arguments, appeals to reality, and arguments that establish the real; the second approach responds to incompatible opinions through the dissociation of concepts.

Quasi-logical arguments are "similar to the formal structures of logic and mathematics" (Perelman, 2001, p. 1396). For example, definition is a common quasi-logical approach that is used, not only for establishing the meaning of a term, but also for emphasising certain features of an object for persuasive purposes. Other quasi-logical arguments include relations of division, arguments of reciprocity and arguments of probability. *Appeals to reality* are divided in two categories: arguments that convey succession (e.g., consequences of a particular action, goals and outcomes of an event or process), and arguments dealing with coexistence, which include associations of a person to a specific act (e.g., arguments from authority). The remaining associate technique involves arguments that establish the structure of reality and includes two types: arguments from example or model, and arguments by analogy. The former rely on generalisations derived from a single situation, in the case of example, or on the conformation of a single situation to an accepted practice or *ethos*, in the case of models. According to Perelman (2001), appeals to the real that rely on analogy are very common. These appeals establish the relation between two terms by noting their similarity to another (e.g., "What a note is to a singer, a word is to a writer"). Metaphor, another common aspect of argumentation, is also a form of analogy.

Moreover, when arguers seek to reconcile incompatible opinions, they may gain adherence by a dissociation of concepts. The final technique discussed by Perelman and

Olbrechts-Tyteca (1969) is a common approach in metaphysics that opposes appearances to reality. As Perelman (2001) explains, the recognition that some appearances are incompatible, for example "an oar in water looks broken but feels straight to the touch" (p. 1400) leads to a conception of reality by which appearances may be judged. Thus, the aspects conforming to reality are considered valuable, while other aspects not consistent with reality are dismissed as illusive. As Perelman (2001) exemplifies, an arguer may try to argue in favour of "real democracy" through dissociation of ideas by opposing the term "real democracy" to "apparent democracy", or "quasi-democracy". As a result, in the process of opposition, the arguer seeks the audience acceptance of "real democracy", not on the basis of its merit as an idea, but rather through the devaluation of opposing terms.

The *New rhetoric* theory has been subject to two major criticisms; the first focuses on the concept of a universal audience (Ray, 1978), and the other on the apparent separation of audience considerations and argument techniques (van Eemeren & Grootendorst, 2004). Nevertheless, as Frank (2003) argues, the positive influence and application of Perelman and Olbrechts-Tyteca's theory far outweighs its criticisms. The *New rhetoric* and its later developments have been foundational for argumentation theory and Perelman and Olbrechts-Tyteca's work has influenced many studies in politics and social psychology.

1.4.4. Contemporary theories

According to Gilbert (1997), a common feature present in contemporary research in argumentation theory, such as pragma-dialectis (e.g., van Eemeran, 2002), informal logic (e.g., Walton, 1989) and communication theory (e.g., Jacobs & Jackson, 1982) is the evaluation of argument in the context of natural conversation.

The pragma-dialectical approach to argumentation developed by Frans van Eemeren and Rob Grootendorst (1992, 2004) is used to evaluate argumentation in actual practice. Unlike logical approaches (which focus on the study of argument as a product) or communication theories (which focus on argument as a process), pragma-dialectics emphasises the study of argumentation as a discourse activity, and therefore the study of argument as both product and process. The notion of critical discussion plays a central role in this theory, in that argumentation should ideally be part of a critical discussion. In a critical discussion, argumentative discourse is treated as a discussion in which argumentation is directed at the resolution of a difference of opinion (van Eemeran & Grootendorst, 2004). The authors proposed four stages that the arguers have to go through to resolve their difference of opinion: confrontation stage, opening stage, argumentation stage and concluding stage (van Eemeren & Grootendorst, 2004). In the confrontation stage, the arguers establish that they have a difference of opinion. In the opening stage, they decide to resolve this difference of opinion. The arguers determine their points of departure: they agree upon the rules of the discussion and establish which claims and arguments they can use to support their position. In the argumentation stage, an arguer defends his or her standpoint by putting forward arguments to counter the opponent's criticisms. In the concluding stage, the interlocutors evaluate to what extent their initial difference of opinion has been resolved and in whose favour. This model also defines the nature and distribution of the speech acts that play a constructive part in the various stages of the resolution process.

As the theory's designation reveals, this approach to argumentation is not only dialectical, but also pragmatic. According to the authors,

> The pragmatic dimension manifests itself primarily with the fact that the moves, that can be made in a discussion aimed at resolving a difference of opinion are conceived as verbal activities ("speech acts"), carried out within a framework of a specific form of oral and written language use ("speech event"), in a context of interaction that takes place against a specific cultural-historical background (van Eemeran & Grootendorst, 2004, p. 52).

Recently, this theory has incorporated insights from rhetoric into the analysis of argumentative discussion (van Eemeran & Houtlosser, 2006). Arguers involved in a difference of opinion "manoueuvre strategically" the discourse in the attempt to persuade an audience. Moreover, they use both rhetorical and dialectical means to achieve the persuasive goal, including making an opportune selection of a topic at the stage concerned, approaching the audience effectively, and carefully exploiting presentational means (van Eemeran & Houtlosser, 2006).

Pragma-dialectical theory has been applied extensively in the evaluation of various types of argumentative discourse, including legal argumentation, mediation, negotiation, parliamentary debate, interpersonal argumentation, political argumentation, and health communication (van Eemeren, 2002). Evaluation is carried out by applying the following analytical operations: (1) determining the points at issue; (2) recognising the positions the parties adopt; (3) identifying the explicit and implicit arguments; and (4) analysing the argumentation structure.

The informal logic approach (Walton, 1995) aims at assessing, analysing, and also improving "everyday" reasoning. Thus, the aims of informal logic have been related to some educational goals, particularly to those of the Critical Thinking Movement (Johnson, 2000), whose goals are to inform and improve public reasoning, discussion and debate by promoting models of education which emphasise critical inquiry. Three distinct approaches to argument characterise informal logic. The first is founded on fallacy theory, the second is rhetorical, and the third is dialogical. One of the most influential authors in this approach is Douglas Walton, who has discussed a great variety of fallacies in his work (Walton, 1989, 1995, 2006). For Walton (1995), fallacies are a subgroup of *argumentation schemes*. According to Walton (1995), an argumentation scheme is only a fallacy when used inappropriately; for instance, an *appeal to authority* may be valid when used in an appropriate context, as in the case of a testimony of an expert witness presented in the court. Walton (1989, 1995) also refers to other argumentative schemes or fallacies: *ad hominem*, *appeal to pity*, and *argument of consequences*.

The work of communication scholars, such as Daniel O'Keefe, Scott Jacobs, Sally Jackson, and David Zarefsky has also extensively influenced theories and research in argumentation. Sally Jackson and Scott Jacobs’s seminal contribution to the field of argumentation appears in the paper *Structure of Conversational Argument: Pragmatic Bases for the Enthymeme*, published in 1992. They described argumentation as a form of managing conversational disagreement within communication contexts and systems that naturally prefer agreement. As Jackson and Jacobs (1992) argue, this perspective elaborates contemporary argumentation theories in two ways. First, arguments are conceived as collaborative products, that is, they are jointly produced by speakers in a conversation. Second, it opposes to previous models that have associated argument structure with reasoning processes (e.g., Toulmin, 1958).

Jackson and Jacobs (1992) argued that arguments produced in a conversation are often incomplete, for example, they do not always link two premises with a conclusion. Aristotle used the term *enthymeme* to describe this simple form of arguments. However, rather than regarding the enthymeme as a syllogism with a missing premise, Jackson and Jacobs (1992) define enthymemes as arguments constructed socially in a conversation with the aim to address the questions and objections of a speaker. Moreover, they follow the rules of turn-taking in conversation and work towards agreement. As the authors explain, arguers often do not search for possible gaps in their partner's utterances; they agree with turns unless they have good reasons to disagree. Similarly, they accept counterarguments in response to challenges unless they are quite unable to understand the relation between the initial claim and the new evidence.

Furthermore, Jackson and Jacobs (1992) claim that giving too much information for a claim is not only unnecessary, but also disadvantageous. Giving more support than is required increases the possibility of disagreements to occur - and does so without improving prospects for agreement. Others authors prefer to emphasise the pragmatic function when reviewing the conceptual interpretation of the enthymeme (e.g., Gerritsen, 1999; Hitchcock, 1995).

1.4.5. Recent developments in research and theories in argumentation

Psychological research in argumentation has led to revisions in some theoretical approaches described above. For instance, several studies have shown that arguers rarely generate all components of an argument. Stein and Miller (1990, 1993a, 1993b) showed that children generate evidence in favour of their own position, rather than against it. Stratman (1990) has also shown the same to be true in legal settings. In particular, a lawyer rarely introduces negative evidence against his or her own case. In a trial or in virtually all contexts, it is the opponent who generates counterarguments, rather than the supporter of a position. Arguers also tend to omit warrants that support their own position, often assuming that their listeners or readers inferred the appropriate warrant (Stein, Bernas, & Calicchia, 1997). These findings have led many researchers to make adaptations of Toulmin's formal model of argument in their studies (e.g., Kuhn, 1991; Means & Voss, 1996).

Most recently, cognitive and developmental psychologists studying argumentation have been interested in the normative models of argument which include, for example, pragma-dialectics (van Eemeran & Grootendorst, 2004; van Eemeran & Houtlosser, 2006) informal logic (Walton, 1995), and communication theory (Jackson & Jacobs, 1992; O'Keefe, 2002). In contrast to mathematical models of formal logic, normative models of argument acknowledge the role of social interaction in the construction of arguments. These compelling models have led psychologists to examine how individuals construct arguments in social contexts (e.g., Felton, 2004; Felton & Kuhn, 2001; Kuhn & Udell, 2003; Stein & Albro, 2001).

The research presented in this thesis incorporates theoretical and empirical insights of these normative models. Since these models emphasise the importance of the discourse context in which individuals construct arguments (Felton & Kuhn, 2001), these were regarded as the best way to examine the development of children's argumentative competence.

1.5. The theoretical framework of the present research

The present thesis concerns the development of children's argument skills. The focus is on children at the age when they are first able to understand and construct basic forms of arguments. Several researchers have argued that preschoolers can produce basic arguments, consisting of simple reasons to justify their desires and actions, for example, arguing over the possession of a toy (Pontecorvo, 1993; Stein & Albro, 2001).

By the age of five, children become fully capable of constructing arguments on both sides of an issue regarding familiar topics (Stein & Trabasso, 1982; Stein & Miller, 1993a, 1993b). Because the methodology deployed in the present research involved giving children narrative and discourse comprehension tasks, the youngest age group selected for these samples were first graders (5-6 year old children). When children enter school they have the opportunity to interact with adults and peers. Indeed, one of the foremost challenges of childhood is to learn how to engage in interactions and resolve disagreements with peers and adults (Albro, 1996). Nonetheless, the developmental literature on children's argument skills is very limited. For the most part, it has focused on how children resolve *arguments* - disputes or quarrels (e.g., Dawe, 1934; Stein & Miller, 1990, 1993a, 1993b). In the present thesis, however, the term *argument* is used to mean the product, rather than the process of engaging in a discussion.

1.6. Research aims and structure of the thesis

The present thesis describes a series of five interconnected studies that systematically examined age differences in children's argument skills. The purpose of these studies is to assess children's skill in argument generation and what is expected to be a parallel skill – the evaluation or appreciation of stronger arguments and superior moves in dyadic argumentation. The first set of studies explored systematic age differences in children's ability to produce arguments. A third aspect of skilled argument, in addition to skill in argumentative discourse and in production of individual expository arguments, is skill in argument evaluation. The next three studies described in this thesis investigated this third component.

To date, this is the first research to explore children's argument skills at such a young age, in different argumentative settings and using various tasks. Such investigation is warranted, given the significance of argument and argumentation in education and in children's everyday thinking. Having a better understanding of the skills involved in argumentation and how they develop can contribute to its improvement.

This thesis consists of eight chapters, and an overview of each chapter is provided below.

Chapter Two provides a review of the existing literature on argumentation, with particular emphasis on studies involving children's argument skills.

Chapter Three outlines and discusses the research methodology used in the present studies and highlights important ethical issues related to conducting research with children in schools.

Chapter Four describes the first study, which explored age differences in children's ability to produce arguments while engaging in a structured interview with the researcher about socio-moral topics. Children were 5-, 8-, and 11- years of age and were recruited from schools in southern England. This study also examined the effects of argumentative discussions between peers on children's knowledge and arguments.

Chapter Five describes the second study of the present thesis. This study identified the argumentative strategies children deploy in the earlier peer group discussions, using the transactive coding scheme (Felton & Kuhn, 2001) as a framework. Results provided further understanding of the findings obtained in the first study.

Chapter Six describes two studies focused on how children evaluate arguments and counterarguments considering their own and others' perspectives. The third study employed a computer-based task to assess children's evaluation of argument strength. The fourth study explored argument effectiveness using a similar computer-based task.

Chapter Seven describes the fifth study and is the last empirical chapter. This study focused on age differences in children's ability to recognise argument strategy in video-recorded dialogues produced by other children. This is the first study of its kind to look at argumentation processes in a real social context.

Chapter Eight provides a discussion of the research findings, outlines implications of the present studies, and identifies areas for future research.

Chapter Two - Background and Previous Research in Argumentation

2.1. Introduction

The definition of argumentation and the historical review of the most relevant theories of argumentation, outlined in Chapter One, highlighted the importance of conducting further research related to argumentation processes. Argumentation has been studied in various fields of psychology, including educational, developmental, cognitive, and social psychology. This has included both qualitative and quantitative research focused on different aspects of argument skills, including emergency and early development (e.g., Stein & Miller, 1993a, 1993b), use of argument strategy in discourse (e.g., Felton & Kuhn, 2001), goals of argumentative discourse (e.g., Felton, 2004; Stein & Albro, 2001), counter-argumentation (e.g., Leitão, 2003; Means & Voss, 1996), and persuasion ability (e.g., Clark & Delia, 1976).

This chapter provides a review of the existing literature, highlights recent findings concerning the development of children's argument skills, and outlines the context and further justification for the present research.

2.2. Defining a good argument

An argument can be defined as a conclusion sustained by at least one reason (Angell, 1964). The skills in generating and evaluating arguments are closely linked – an individual has to consider evidence related to an issue in order to arrive at a conclusion or make a decision and to provide reasons for maintaining a particular claim. Arguing about different positions assumes importance when a problem is complex, controversial or ill-structured with no definitive solution (Kuhn, 1991; Means & Voss, 1996; Voss, Perkins, & Segal, 1991; Walton, 1989). In those cases, the search for reasons related to both sides of an issue has been recognised as crucial for defining good arguments. Arguments can be elaborated in different ways and at different levels, and can differ both in content and structure. Unlike categorical syllogisms, the content of informal arguments is important for their evaluation (Voss & van Dyke, 2001).

Arguments can be evaluated in terms of their soundness or strength, which refers to two criteria: the acceptability of the supporting evidence *per se* and the relevance in terms of the extent to which it supports the claim (Means & Voss, 1996; Voss & van Dyke, 2001). An example of a short argument is as follows:

> Marijuana should not be legalised. That’s because sustained use of marijuana worsens a person’s memory, and nothing that adversely affects one’s mental abilities should be legalised (Govier, 2005, p. 1).

In the argument stated above, a claim is made that marijuana should not be legalised, and reasons are given to support this claim. The argument invites the evaluator to consider whether marijuana does have a negative effect on memory and whether no substance that adversely affects mental abilities should be legalised.

Evaluation on the basis of acceptability of the supporting reasons requires the evaluator to consider the justifications advanced against the legalisation of marijuana. If the person does not agree with the claim, it is unlikely that the person thinks the argument provides good support of the claim. If the evaluator agrees with the claim, then he or she needs to judge the relevance of the supporting reasons (i.e., the extent to which the reasons offered back up the claim). If the evaluator accepts the reasons as relevant, the conclusion that marijuana should not be legalised follows from them.

The strength of an argument also depends on whether counterarguments are taken into account (Angell, 1964; Kuhn, 1991; Leitão, 2003; Voss & van Dyke, 2001). The assumption is that the strength of an argument is not independent of counterarguments, that is, an argument, although regarded as strong when standing alone, may be evaluated as less strong when a counterargument is offered (e.g., “But marijuana generally is not more harmful than alcohol or tobacco if used in moderation”).

These criteria refer to the evaluation of the quality of an argument, but there is also another important criterion, which is the effectiveness of an argument (Voss & van Dyke, 2001). An argument is effective when it succeeds at the goal of persuasion. When people present arguments in speaking or writing, they usually try to persuade others by giving reasons or citing evidence to support their claims. People may also construct and consider arguments as a means of reflecting on how they could justify a claim that they already believe (Govier, 2005).

The word argument may be used to mean a dispute or a quarrel, as in the sentence, “He had an argument with his wife”. In ordinary speech, this use is rather common. In some developmental research, the word argument is also used to refer to a dispute or conflict between children or adults and children (e.g., Stein & Miller, 1990, 1993a, 1993b). In the present thesis, however, the term argument is used to mean the product of a debate or a reasonable discussion. The distinction between argument as a product and a process is further explored in the next section.

2.3. Argumentation and psychological research

The psychological research in the field of argumentation has considered the study of argument as both a product and a process. Research that focuses on the product perspective considers the structure of individual arguments (Means & Voss, 1996; Ricco, 2003). These studies examine the role that individual claims and reasons plays in informal arguments (Kuhn, 1991; Shaw, 1996; Toulmin, 1958), and also the types of inference that lead from reasons to claims (Blair, 1992; Evans & Thompson, 2004).

Research from within the process perspective, on the other hand, considers how arguments are constructed when people engage in a dialogue or a conversation. Such research has included studies of the speech acts (Muntigl & Turnbull, 1998; Searle, 1969), attempts to analyse shifts in arguments during a discussion (Bailenson, 2001; Kuhn, 1995; Rips, 1998; Siegler, 2000; Siegler & Crowley, 1991; Walton & Krabbe, 1995), and also accounts of developmental differences in goals and strategies of arguers (Felton & Kuhn, 2001; Kuhn & Udell, 2003; Leitão, 2000).

These two kinds of argument are not unrelated, however. Arguments as products contain implicit two-sided process arguments that weight support for and against a claim, compared to support for and against alternatives to the claim (Kuhn, 1991).

2.3.1. Generating arguments

Arguments can be defined as cognitive constructions used by individuals to explain and justify an idea or a point of view (Kuhn & Udell, 2003). Research in argument skill is usually carried out with an individual being asked to discuss a topic and to take a position regarding the issue (e.g., Kuhn, 1991; Means & Voss, 1996). The person is then asked to justify the position by providing reasons to support it. In some interviews, the person is asked to provide opposing reasons as well.

In 1991, Kuhn conducted a major study to examine argumentative reasoning across the life span. In the years since Deanna Kuhn published the book on argument skills (Kuhn, 1991), the field has moved through a series of changes. Until then, the majority of studies of reasoning had explored its processes in a social vacuum, focusing on an individual's ability to solve logical problems (e.g., Johnson-Laird, 1983). Kuhn's innovative work breaks away from this tradition, by examining individuals' thinking as interiorised dialogic argument. Her studies focused on problems involving informal reasoning, that is, reasoning applied outside the formal contexts of symbolic logic and mathematics and dealing with topics that are familiar to everyone, such as the causes of unemployment and school failure. The details of Kuhn's framework and methodology deployed in her research are further described in the next chapter (see Chapter Three).

The purpose of Kuhn's study (1991) was to answer the following research questions: to what extent does argumentative thinking underlie the beliefs people hold and the decisions they make? And, most importantly, to what extent are people aware of, and have control over their beliefs?

Subjects, ranging in age from adolescence to late adulthood (14 to 69 years) and educational level (college and non-college), were asked to describe their views on everyday problems that were familiar to them, such as crime and unemployment. The central focus of the investigation was the thinking of average people, but in addition to the main sample, a group of experts from three different fields (parole officers, teachers, and philosophers) participated in the study. These expert subjects were included to examine how expertise influences reasoning; comparing experts' reasoning regarding the topic about which they have expertise with their reasoning regarding topics about which they have no particular expertise.

Interviews considered various questions. Firstly, participants were asked to offer their theories regarding the causes of returning to crime, school failure and unemployment. Then, they were asked to justify the theory by providing supporting evidence. In the next segment of the interview, participants were asked to generate opposing positions that a hypothetical other might offer. This question sometimes elicited a counterargument with respect to the subject's theory or an alternative theory. In either case, the subject was asked for a rebuttal. In the remaining part of the interview for each topic, subjects were asked for a remedy for the problem implicated in the question, as a way of assessing the consistency of the subject's causal theory. Finally, the interviewer gathered information regarding the subject's epistemological theories on their own thinking, and also the subject's skills in evaluating evidence.

Kuhn identified three major differences regarding both content and structure of subject's causal theories. Participants tended to provide theories with a single cause, or with multiple causes presented in parallel, or with interactive multiple causes. More individuals stated multiple parallel causes than single causes, with multiple interactive causes stated least.

With respect to evidence, results showed that the majority of participants were unable to produce genuine evidence to support their causal theories. Kuhn (1991) defined genuine evidence as presenting information that was different from the theory itself. Instead they tended to offer pseudo-evidence or non-evidence. In other words, the participants did not seem to know the difference between theory and evidence, despite the high level of confidence expressed by the participants that their theories were correct.

The results also showed that subjects were often unsuccessful in generating counterarguments. Asking subjects to generate opposing arguments that they do not find convincing in the first place, might seem an unreasonable thing to ask. However, Kuhn (1991) maintains that subjects' counterarguments are important indicators of the way they regard their own theories. Results also showed that even those counterarguments assessed as successful often weakly opposed a theory. Most revealing was the unwillingness to generate a counterargument, which indicated that subjects regarded the initial theory or supporting evidence as incontestable.

In addition, subjects had problems with offering a rebuttal to the opposing position and integrating the original theory with the opposing position. Kuhn (1991) reported that the ability to generate rebuttals was the most cognitively complex argument skill assessed in the interview. However, some subjects were able to achieve integrative rebuttals.

An interesting finding in evaluating these successful rebuttals is the asymmetry that emerges in the ability to examine critically one's own theory *versus* an alternative one. This asymmetry appears in two different aspects. First, subjects were more likely to be successful in rebutting an alternative theory than their own theories. Second, when subjects compare their own theories to an alternative theory, a substantial number display the subtype in which an argument is made against the causal necessity of the alternative theory. This shows that subjects tend to neglect to apply this test to their own theories and, thus, even some of the rebuttals classified as successful integrative rebuttals, constitute weak arguments.

Another striking finding of this study was the significantly superior performance of the college-educated participants compared to the non college-educated participants. These results confirm the findings of previous research which revealed that, from the sixth grade (11-12 years) to the ninth grade (14-15 years), there is a fast development of argument skills. After that, educational level makes the difference, with college-educated people performing better than ninth-graders, but with people without a college education performing at a level between sixth and ninth graders (Kuhn, 1989).

Means and Voss (1996) studied argument generation in students aged 10-, 12-, 14-, and 16-years. Students were grouped in gifted, average, and low-ability groups, as defined by the *Wechsler Intelligence Scale for Children* (WISC) evaluation results. They were then asked to solve individually a series of problem assessment tasks, such as open-ended questions (e.g. “If students misbehave at school, what should be done?”). In the second part of the study, students aged 13-, 15-, and 17- years, were grouped according to the general mental ability assessed by Wechsler questions. They were asked to analyse and comment on controversial propositions regarding drug and alcohol use (e.g., “The use of marijuana should be legalised”; “Alcohol should be legalised”). Additionally, participants were given a knowledge test about those topics. Evaluation of argument skills included number of reasons, qualifiers, counterarguments, and type of argument structure generated.

Means and Voss (1996) found that grade level and ability levels seem to play a role in argumentation. The influence of these two factors can be partly explained in terms of knowledge about the topic under consideration. Results showed that older students and also gifted students have the greatest knowledge. Moreover, knowledge of the topic was found to be related to the number of arguments generated and types of reasons supporting them. Results also indicated that argumentation skills did not increase with school grade, suggesting that education does not significantly affect the development of argument skills at this age. This finding is in broad agreement with results from other research studies (e.g., Kuhn, 1991; Perkins, 1985).

Kuhn (1991) and Means and Voss (1996) provided useful descriptions of individuals’ informal reasoning, although their studies involved adolescents and adults rather than the age group of current interest.

2.3.2. Generating arguments in dyads and groups

As noted earlier, studies in argumentation also focus on the contexts in which arguments arise (e.g., Felton & Kuhn, 2001). According to this approach, an argument is not defined as a product constructed by a single individual, but as a discussion activity in which a person engages with others. When people take part in a discussion, a different set of argument skills come into play. They should be skilled in advancing and constructing new arguments, and also in listening, questioning, challenging and criticising their partners' arguments.

Various theories offer useful frameworks for conceptualising and evaluating skills in argumentative discourse. Discourse-based models (e.g., Walton, 1989) are important because they recognise the role of discourse on the construction of argument in a social interaction. Most often, arguments arise from disagreements people have with each other. During these discussions, it is likely that arguments are incomplete or claims remain implicit. Thus, as Felton and Kuhn (2001) argue, the best way to study the development of argumentative competencies is to examine the process by which individuals construct arguments in conversational contexts (Felton & Kuhn, 2001).

Kuhn's research has been developed on the basis of Walton's model of argumentative discourse (1989). According to Walton (1989), when people engage in a critical dialogue, each speaker has two goals. The first is to construct one's own conclusion from a partner's commitments. By commitments Walton (1989) refers to inconclusive premises that the partner is willing to concede. The second goal is to challenge or undermine the partner's position by identifying inconclusive premises.

Felton and Kuhn (2001) argue that the strategies entailed in argumentative discourse are deployed in discussions to address these two goals. Kuhn, Felton, and their colleagues conducted a series of studies on how argumentative discourse skills develop in adolescence and adulthood. In order to examine this development, they proposed a coding scheme to analyse dialogues between adolescents and adults on the topic of capital punishment. The coding scheme includes three categories: transactive questions, transactive statements and non-transactive statements.

According to Felton and Kuhn (2001), "an utterance is defined as transactive if it attempts to engage the partner in discourse either by referring to the partner's preceding utterance or by prompting a response from the partner" (p. 139). This analytic scheme also includes the coding of strategic sequences. Felton and Kuhn (2001) defined strategic sequences as “patterns of utterances that might represent an attempt to advance or pre-empt an extended argumentative strategy” (p. 145). Strategic sequences include, for example, rebuttals, which are defined as sequences of counterarguments. This coding scheme is described in more detail in the methodology chapter (see Chapter Three).

Felton and Kuhn (2001) analysed multiple dialogues (in agreeing and disagreeing dyads) between peers on the topic of capital punishment. When comparing the dialogues of adolescents and the dialogues of young adults, results showed that adolescents were less able to adapt strategies or discourse to the goals of argumentative discourse. In particular, adolescents were preoccupied with the task of producing argumentative discourse, that is, with generating the form of dialogue they understand to be required in argumentative discourse. Examples of typical elements of dialogues include: speakers taking turns, addressing the topic, and expressing their views. However, as Felton and Kuhn (2001) noted, the major difference between less skilled arguers and arguers with greater skill lies at a more subtle level, having to do with their understanding of the goals of argumentative discourse. For less skilled arguers, the only goal was to have one's own position prevail. Argumentative discourse of adolescents, thus, focused on elaborating one's own position, with only superficial attention to the opponent's position. When trying to undermine the opponent's position, adolescents simply advanced their own position. Skilled arguers, in contrast, understood the goal of undermining the opponent's argument, a goal distinguishable from that of undermining the opponent's position. Thus, adults showed a better understanding of the lines of argument that underlie the opponent's position, and were able to construct effective counterarguments, and anticipate and address rebuttals.

Another way in which high skilled arguers differed from low skilled arguers was in the flexibility of their argumentation. Unlike adolescents, adults were able to adapt their use of argumentative strategies to different discourse contexts. In particular, adolescents showed minimal modification of discourse behaviour when moving from disagreeing to agreeing partners. Most notably, counterargument remained at about the same level of frequency when a difference in position did not exist as when it did. In contrast, adults in discourse with the partner who shared the same view diminished the use of strategies directed toward weakening the partner’s arguments (e.g., counterargument) and increased the use of strategies that enhanced their own position (e.g., *add* and *advance* statements).

Felton and Kuhn (2001) interpreted these results in light of Activity Theory, developed by Leont'ev (1981). According to this framework, an activity is composed of goal-directed behaviours or actions. The development of an activity develops in two fronts. First, activity develops as the individual produces goal-discourse strategies. Second, activity develops as the individual refines the goals being pursued.

Accordingly, Felton and Kuhn (2001) conceptualised argumentative discourse as an activity in the process of development. Development of argument skill proceeds simultaneously along two fronts. One is enhancing skill in directing the course of dialogue so as to meet the activity's goals; the other is deepening understanding of these goals. These two forms of development reinforce one another. Advancement in discourse skill is propelled in part by a better understanding of the goals of discourse.

At the same time, exercise of these skills in discourse activity promotes more refined understanding of goals (Felton & Kuhn, 2001). Some intervention studies in argumentation have been successful at promoting argument skills through exercise. For example, Wiley and Voss (1999) showed that engagement in constructing arguments enhance knowledge in college students.

Moreover, Kuhn and Udell (2003) conducted a study to verify if the same patterns identified in the previous research (Felton & Kuhn, 2001) were observed in a condition where change was induced experimentally. Participants (academically at-risk 13- to 14-year olds) engaged in an intervention aimed at developing their argumentative discourse skills. One condition included peer dialogues, while another did not. Results showed that both groups improved, but the former was the most effective. Participants showed increased frequency of usage of argumentative discourse strategies, such as counterargument.

2.3.3. Arguing with peers and learning

This sub-section concerns how engaging in argumentation with peers might enhance individuals' argument skills and promote knowledge acquisition. There are a number of studies demonstrating that engagement in peer group discussions enhances conceptual understanding (e.g., Doise & Mugny, 1984; Howe, Tolmie, & MacKenzie, 1995; Mason, 1996, 2001; Phelps & Damon, 1989; Zohar & Nemet, 2002) and reasoning (Chinn & Anderson, 1998) in school-age children. These studies have also found that collaboration is more successful when peers have different ideas about the topics they are considering (Doise & Mugny, 1984; Howe, Tolmie, & Mackenzie, 1995). In addition, the topics should require genuine discovery or conceptual grasp (Howe, Tolmie, Duchak-Tanner, & Rattray, 2000; Phelps & Damon, 1989). Based on these findings, hypotheses have been proposed about the forms of interaction that promote knowledge and learning. For instance, the combination of different perspectives and discovery or conceptual understanding suggests a need for the discussion of opposing ideas. This has been supported by several research studies. For example, Howe and her colleagues documented the value of direct opposition in promoting scientific knowledge (e.g., Howe & Tolmie, 1998; Howe, Tolmie, Greer, & Mackenzie, 1995). What remain unclear are the mechanisms by which collaborative interaction leads to advances in knowledge and reasoning. Leman (2002) identified two "schools of thought" to account for how these advances are achieved. One is the transmission account, which emphasises the ways in which knowledge is transmitted from one individual to another. The other one is the construction account, which conceptualises the process of interaction as a forum for the construction of new knowledge.

According to the transmission account, cognitive development is a consequence of a process of knowledge induction, from a more to a less advanced peer (e.g., Roazzi & Bryant, 1998; Russell, Mills, & Reiff-Musgrove, 1990). It has been argued that this account has its roots in Vygotskian theory, since the emphasis is upon an asymmetry in knowledge between children, or between children and adults (Leman & Duveen, 2003).

Other researchers have provided evidence that challenges the need for asymmetry in knowledge, a central feature of the transmission account. Ames and Murray (1982) found that interaction between two non-conservers who had both given different answers was enough to induce development in conservation ability. Based on this finding and their own work, Doise and Mugny (1984) proposed a construction account, which proposes that cognitive development results from the integration of diverse perspectives, rather than the transmission of knowledge. According to Doise, Mugny, and Pérez (1998), interaction facilitates the process of integration of different perspectives, leading to more adequate, decentred and sophisticated forms of reasoning. Perret-Clermont, Brun, Saada, and Schubauer-Leoni (1984) also argue that a further difficulty for transmission accounts is that, whilst processes of transmission of knowledge can result in advances in reasoning and skill, the transmission account does not explain why an expert's argument is accepted by a novice. In an expert-novice paradigm, Leman (2002) found that more advanced arguments were more compelling to children at an intermediate stage of development, whereas less advanced arguments were accepted only when a novice had argued persistently and persuasively for his or her position. As Leman and Duveen (2003) point out, the issue of acceptance of arguments is particularly relevant for understanding transmission and construction accounts. They argue that the question of how and why arguments are accepted can be further investigated by focusing on issues of legitimacy and legitimisation, that is, how children and adults conceive of their beliefs as valid, and why they may accept or not alternative perspectives. Leman and Duveen (1996) suggested that epistemic and social status constitute two sources of influence in interaction, by presenting alternative ways of legitimising beliefs. In particular, their study focused on epistemic authority, that is, the power or authority that arguments possess (as opposed to individuals or social groups) in influencing judgements. According to the authors, the two forms of influence are distinct. With epistemic influence, arguments possess persuasive power, whereas with social status, persuasive power is a consequence of an individual's position within a social organisational structure of hierarchy.

Leman and Duveen (1996) examined age differences in children's interactions during a perceptual judgement task. Children in two age-groups (6-7 and 11-12 years) were asked to judge whether two lines in an optical illusion were the same or different lengths. In some conditions, children were given expertise in the task; for example, in the form of sticks, in other conditions they were not. They found that younger children's conversations were more conflictual than those of the older children. Moreover, gender differences in conversations were found; particularly, the younger children had difficulty accepting the arguments of a girl expert compared with a boy expert. These results led Leman and Duveen (1996) to conclude that younger children (6-7 years) tend to regard interaction as a contest between two competing views rather than a forum for discussion and debate in which children could evaluate arguments. Thus, younger children's responses were more likely to be affected by social status influence, which was associated with a child's gender identity. Older children (11-12 years), on the other hand, were more likely to be persuaded by epistemic influence, that is, they were more predisposed to evaluate the validity of arguments.

Leman and Duveen (2003) further explored the relationship between gender, processes of argumentation and cognitive change in children's interactions. In their study, children aged 9-10 years were asked to discuss a moral dilemma with a same age peer. The possible effects of social status were examined by balancing the gender mix of the pair (i.e. either same-sex or boy-girl pair). Additionally, all pairs were asymmetric in terms of their previous independent responses to the task. Children's dialogues were analysed and coded to establish the number and sophistication of supports (arguments in favour) and rebuttals (arguments against) used by children to justify a particular position. The authors had anticipated that children who had adopted a particular position pre-interaction would seek to support that position in a subsequent discussion. However, contrary to what was expected, children demonstrated a good strategic grasp of arguments in conversations. They were able to support their own position and also address another's positions, suggesting that 9-year old children start exhibiting awareness, though perhaps in an unsophisticated way, of interaction as a forum for the exchange of perspectives and for epistemic construction.

Results also showed that a child's gender identity constrained the process of exchange of perspectives in conversations. Specifically, in boy-girl pairs, children spent a considerable amount of time presenting their own position and less time talking about a partner's position. On the other hand, in same-sex pairs, children appeared more willing to address another's position. This finding had already been found in previous work (e.g., Leman, 1998; Leman & Duveen, 1996, 1999). Moreover, in terms of the outcomes of interactions, the majority of argument elements appeared to work well in terms of producing an influence, contrary to basic rebuttals. As Leman and Duveen (2003) note, basic rebuttals are simple refutations of another's position. They are the equivalent of telling another person that they are wrong without giving a reason why that person is wrong, nor stating one's own position, thus, they do not function on the level of perspectives. Children's engagement with (or discussion of) each other's perspectives, in contrast, was linked with effective influence. Leman and Duveen (2003) suggested that it is not the case that any sort of conflict, for example social asymmetries in relations associated with a child's identity, is related to advances in cognitive development. Co-operative peer interaction can clearly yield more benefits than interaction that is conflictual. More importantly, the socio-cognitive conflict (i.e., the exchange of different perspectives) was found to be crucial for promoting developmental advance and knowledge acquisition.

2.4. Children's argumentation

Researchers have focused on several different aspects of children's arguments, including the nature (e.g., Eisenberg & Garvey, 1981; O'Keefe & Benoit, 1982), structure (e.g., Chambliss & Murphy, 2002), emergence (e.g., Stein & Albro, 2001), generation of justifications (e.g., Anderson, Chinn, Chang, Waggoner, & Yi, 1997; Orsolini, 1993; Stein & Miller, 1993b), power and dominance (e.g., Meyer, 1992), and resolution of argumentative discussions (e.g., Benoit, 1981). The next two sub-sections concern the social factors associated with the emergence and the development of argument skills in infancy.

2.4.1. Emergence and early development of argument skills

A fundamental question addressed in argumentation research is at what age children demonstrate an ability to construct arguments and engage in an argumentative discussion (Voss & van Dyke, 2001). The ability to understand and produce arguments is claimed to emerge early in development (Anderson et al, 1997; Clark & Delia, 1976; Orsolini, 1993; Orsolini & Pontecorvo, 1992; Stein & Miller, 1993a, 1993b). This claim seems to contradict the work of Kuhn outlined earlier in this chapter, which has documented adolescents and adults' poor performance in argumentative tasks (e.g., Kuhn, 1991).

These apparently contradictory results may be explained by the types of tasks used in these two lines of research. For instance, Kuhn (1991) studied argumentation about the causes of social phenomena by asking participants to offer causal theories and evidence for social topics (e.g., school failure or unemployment). Kuhn also used interviews and questionnaires to measure the success of educational programmes to check the acquisition and transference of new skills. For example, Zohar and Nemet (2002) used similar tools to study argumentation skills applied to scientific issues (e.g., genetics and ethics). They found that when the teacher scaffolded argumentative skills through explicit prompts, the learned skills could be applied in near transfer and far transfer tasks. On the other hand, Stein's work (e.g., Stein & Miller, 1993a, 1993b) has focused on children's arguments that arise in natural occurring contexts (e.g., family interactions). Anderson and colleagues (1997) have also observed children's arguments resulting from interactions with peers. Unlike Kuhn, these researchers studied children's argumentative skills using less complex tasks in familiar contexts. It is then clear from a theoretical point of view that the implementation of argumentation skills is highly sensitive to context (Schwarz, 2009).

According to Stein and Albro (2001), by the age of two children are already familiar with conflict interactions and, by the age of four, children become able to understand and participate in family disagreements. With the development of language, cognitive skills, and social knowledge about rules and rights (Benoit, 1981; Tesla & Dunn, 1992), children's ability to argue and negotiate improves. They may even win some disputes with parents or older siblings (Eisenberg, 1992; Perlman & Ross, 1997). Later, when children enter school, they have more opportunities to engage in conflicts or argumentative discussions and learn how to resolve them with their peers. Through a series of studies, Stein and her colleagues (e.g., Stein & Miller, 1993a, 1993b; Stein & Albro, 2001) have shown that the emergence and development of argumentation skills have a social origin, and that children learn to master these skills through the conflicts they experience with their parents, siblings, and peers.

Family interactions

Children first learn to argue with others in the context of family, through interactions with their parents (Dunn & Munn, 1987; Hay & Ross, 1982; Shantz & Hobart, 1989), and siblings (Ross, Ross, Stein, & Trabasso, 2006). In mother-child conflicts over the "right" to perform certain actions, 3-years-olds have justified their own position by arguing about the consequences of the actions (Dunn & Munn, 1987). By the age of 4, young children learn how to raise opposition with their parents and become active participants in family conflicts. Stein and Albro (2001) argue that the way in which children and parents resolve these disagreements influences children's thinking and skills in participating in other social conflicts. Sibling conflicts also offer opportunities for persuasive negotiation in which children clarify their differing perspectives (Herrera & Dunn, 1997; Rinaldi & Howe, 1998; Slomkowski & Dunn, 1992).

Erikson (1963), Piaget (1932), and Sullivan (1953) all agreed that children's early conflict experiences influence the development of knowledge about social rules, relationships, family processes, and the self. For example, Johnson and McGillicuddy-Delisi (1983) credited socialisation factors within the family environment as seminal in promoting children's knowledge of rules and conventions. They found that preschool children's awareness and rationale for rules and conventions were related to social class variables (e.g., socioeconomic status of the family), but parental behaviours were predictive of children's level knowledge above and beyond demographic characteristics.

Peer interactions in preschool years

Quarrels and conflict talk are very common and frequent among preschool children. Dawe (1934) attempted to classify quarrels of preschoolers and divided them into four categories: possessions, physical violence, interference with activity, and social adjustment. Observations of children aged 2 to 5 years, interacting spontaneously with others in the playground, showed that the majority of quarrels started by a struggle for possessions (e.g., a child's desire for another's doll, or a child's refusal to give up a swing). Most quarrels analysed in this study were short, with an average duration of 23 seconds. Furthermore, children were able to settle quarrels themselves almost in all occasions, most frequently by one child's forcing another to yield. Dawe (1934) also found that boys were involved in more conflicts, and were more aggressive during these conflicts than girls. Boys' typical behavioural responses included pushing, striking, and pulling. Although verbal activities, such as crying, forbidding, and commanding, were also common, silence was a more frequent reaction than any other activity. Talking, and in particular engaging in dialogues, was rare among the youngest preschoolers.

However, there was some indication that reciprocal comments and discussions of the argumentative type, during peer conflict, increase with age. Although quarrels among young preschoolers (2-3 years) are short and characterised by the presence of intense motor activity, the increase in talking among older preschoolers (4-5 years) appears to be paralleled by increasing duration of quarrels (Dawe, 1934; Dunn & Munn, 1987; Herrera & Dunn, 1997).

Meyer (1992) also analysed the naturally occurring conflict episodes between preschoolers, aged three years, and found a broad range of linguistic and non-linguistic strategies displayed by children to win a dispute. Verbal tactics used by preschoolers included: shifting liability to a third party, verbal exchanges, postponing direct confrontations, increasing volume, topic changing, offering empty compromises, and threatening the opponent. Nonverbally, preschoolers tried to win peer conflicts by violating interactive space, having the physical advantage of standing while the opponent is sitting, producing loud noises (such as hand clapping), and exerting superior strength while pulling or struggling. According to Meyer (1992), these early attempts to construct simple arguments and strategies to win disputes contribute to children's development of communication and argument skills they exhibited later in life.

Orsolini (1993) investigated older preschoolers' production of justifications in three main contexts: classroom conversations, symbolic play, and classroom activities. An analysis of the discussions showed that the social context constrains the arguments used by 4-year-olds to justify actions and claims. For instance, reference to causes, norms, and rules was a frequent type of justification only in disputes occurring in conversations led by the teacher. References to motives, on the other hand, tended to occur in non-teacher-led activities. Results also showed that the most frequent format for justifications during children's conversations was focused on backgrounding. Orsolini (1993) defined backgrounding as a descriptive communicative act used by a speaker to show his or her knowledge on the topic, and to provide more information to enable the recipient to understand better the speaker's position.

Furthermore, in both disputes and classroom conversations, a considerable number of justifications are produced when there is a break of some normative expectation. Disputes start with disagreeing with a claim or action. In classroom conversations children's *because utterances* usually follow negative assertions and negative events.

Results from this study also corroborated the hypothesis that the interactive and sequential organisation of conversation is a basic learning mechanism for children's justifications. According to this hypothesis, children are expected to provide justifications within some sequences of communicative acts. When justifications are not produced, the recipient is very likely to request an explanation. This request advances the production of justifications. In fact, results showed that the conversational antecedents of a teacher's why-questions were correlated with the antecedents of spontaneous children's utterances using *because*. The major conversational antecedents for children's justifications were: (a) description of a negative event, (b) production of a negative assertion, and (c) reference to general events, with a high commitment to the truth of what is said. As Orsolini (1993) explained, these results suggest that the interactive and sequential organisation of conversation may lead children to understand two pragmatic meanings of reasons. First, justifications compensate for the breaking of some norm. Second, justifications enable the recipient to "better understand" something that is unexpected or questionable. For instance, a teacher's request for elaboration on what has been said are probably what lead children, even in their spontaneous justifications, to use a descriptive talk such as backgrounding.

In a previous study focused on teacher-child discussions, Orsolini and Pontecorvo (1992) also suggested that teacher-led discussions facilitate preschoolers' (5-year-olds) learning of justifications. In these interactions, children are required to justify opposition and points of view, and provide an answer to teacher's requests for explanation or evaluation. Thus, in this particular context and sequential environment preschoolers' early attempts to talk about conditions of actions, causes, and consequences emerge.

Previous research has offered important contributions regarding preschoolers' use of arguments, and the possible conversational mechanisms underlying young children's justifications (e.g., Orsolini, 1993; Orsolini & Pontecorvo, 1992). However, remaining to be learned are the specific arguments that can work as good justifications for particular topics. One of the aims of the research in this thesis is to tackle this issue, that is, to document age differences in children's use and evaluation of good arguments. Specifically, Study One (Chapter Four) provides a description of the number and type of reasons that children generate in an interview about socio-moral topics. The set of studies described in Chapter Six examined the types of justification children at different ages consider to be strong (Study Three) and effective (Study Four).

Peer interactions in primary school years

When children enter school, normally at the age of five in the U.K., they continue to experience peer conflict on a daily basis. Within peer groups, children learn the importance of cooperating and sharing, and to deal with incompatible goals. Some researchers have claimed that young children are unable to negotiate effectively because of their inability to appreciate the goals of the opponent or take the perspective of the other (e.g., Selman, 1980). In contrast, other research (e.g., Anderson et al., 1997; Levine, Stein, & Liwag, 1999; Stein & Miller, 1993a, 1993b; Stein & Trabasso, 1982) has demonstrated that young children (around 7 years of age) are quite capable of understanding and using the goals of an opponent during a discussion.

For instance, Anderson and his colleagues (1997) explored the properties of children's naturally occurring arguments in the classroom. The arguments were identified from transcripts of 20 discussions by children in the fourth grade (8-9 years), which took place in a format of collaborative reasoning. Children gathered in a small group and discussed a dilemma faced by story characters. The teacher initiated the discussions and encouraged children to listen and evaluate each other’s arguments, and also to share their positions and offer reasons to support their ideas. Results indicated that, although children’s arguments were replete of missing information (e.g., clear reasons, explicit conclusions, and warrants to authorise conclusions), children showed a basic understanding for others’ points of view and responded accordingly.

2.4.2. Development of argument skills in infancy

An important question in understanding the development of argument skills concerns whether primary school children have the same logical ability to understand and reason about arguments as secondary school children and college students. Two different perspectives have been advanced about the development of argument skills. One perspective relies mainly upon Piagetian theory and stipulates that young children cannot argue in a logical manner until the onset of formal operational reasoning. According to this point of view, children under the age of ten or eleven cannot engage in sophisticated argumentative reasoning, because they lack the ability to reason and understand many of the rules of formal logic. Studies in moral reasoning (e.g., Berkowitz, Oser, & Althoff, 1987) have provided evidence to support this perspective.

Berkowitz, Oser, and Althoff (1987) asked subjects from six to twenty years of age to participate in dyadic interactions. Subject dyads were matched for gender, grade level, and differed in the position they favoured in regard to a moral dilemma. An analysis of the discourse produced by these subjects led Berkowitz and colleagues to conclude that justification for moral claims does not appear spontaneously or in a complex form in children between the ages of six to eight years. Arguments produced by these children were reported to be simple repetitions of position, and justifications were offered only when requested by an opponent and then they were regarded as “personal, idiosyncratic, and illogical”. Children from six to eight years of age were reported to resolve their disputes by either physical or verbal power manipulations, but without recourse to argumentative discourse. Berkowitz and colleagues do claim that children from nine to eleven years recognise the need for advancing justifications to convince the opponent, but they cannot generate effective evidence due to inadequate consideration of the opponent's view. According to Berkowitz and his colleagues, it is only after the age of eleven that children engage in reasoned dyadic interaction and demonstrate adequate argument skills.

A contrasting perspective to the Berkowitz and Piaget view emerged with a series of studies conducted by Stein and colleagues (Stein & Miller, 1993a, 1993b; Stein & Trabasso, 1982). According to Stein and her colleagues, children at age five or even younger demonstrate some of the argumentative competence of older children and even adults in domains that are familiar to them. For instance, Stein and Trabasso (1982) argued that 5-year old children were able to construct complex moral justifications when asked to resolve a moral dilemma that was familiar and made interesting to them. In Stein and Trabasso's study, all groups of subjects, including preschool children, third graders, and secondary students provided logically consistent reasons to support their positions. When the evidence was evaluated, holding constant the choice made by children, reasons did not differ across age groups. Children who supported the same position generated justifications that were similar in kind and content, across all age groups. These results led Stein and Trabasso (1982) to reflect on the importance of using materials that are comprehensible across the age groups. A lack of understanding of the basic concepts of the dilemmas could easily result in a failure to provide "logically" consistent reasons, particularly for the youngest children. The issue of familiarity and knowledge of the topics was addressed in all studies in this thesis, and is further discussed in the methodology chapter (see Chapter Three).

Further research studies carried out by Stein and her colleagues have taken into account, not only the amount of knowledge children and adults have about a topic, but also the role that commitment and prior value judgements play in determining the choice for a position, and the ability to retain an accurate representation of a conflict. In these studies (Albro & Stein, 2000; Stein & Albro, 2001; Stein, Bernas, & Calicchia, 1997; Stein, Bernas, Calicchia, & Wright, 1996; Stein & Miller, 1993a, 1993b), children and adults are asked to remember past conflicts using different strategies, and to remember the nature and content of face-to-face interaction that occurred during a negotiation. These studies focus on young children and their understanding of conflicts experienced with their parents and peers. Stein and her colleagues have found that young children have complex knowledge of argument in social situations that are personally significant. These studies are reviewed in the next section.

2.5. Theories and empirical findings on the development of argument skills

The ability to argue and counter-argue effectively seems difficult to master, particularly at a young age (Golder & Coirier, 1994; Leitão & Almeida, 2000). Several hypotheses have been proposed relating to why this skill seems difficult to improve with age. For instance, studies following the Piagetian tradition consider that the development of argument skills depend on socio-cognitive decentring. In contrast, the work of Stein and her colleagues (e.g., Stein & Albro, 2001; Stein & Miller, 1993a, 1993b) has shown that the mastery of argument skills occurs at an earlier age than previously predicted, and that the structure and content of arguments are regulated by the goals and relationships of arguers. Moreover, the role that epistemological understanding plays on the development of argument skills has been studied systematically by Kuhn and colleagues (e.g., Kuhn, 1991, 1999a, 2001, 2003; Kuhn & Udell, 2007).

2.5.1. Decentring and perspective-taking ability

As stated earlier in this chapter, studies following the Piagetian tradition consider that the emergence and improvement of argument skills are primarily age-linked and are dependent on socio-cognitive decentring (e.g., Golder & Coirier, 1994, 1996). According to this perspective, young children fail to consider the perspectives of others, because they are centred in their own views. Although education and language development play a fundamental role on the development of argumentation skills, further improvement in argumentative discourse is the result of the mastery of formal operations, which occurs only in early adolescence.

To the best of the author's knowledge, only Clark and Delia (1976) have attempted to relate skill in constructing persuasive arguments directly to perspective-taking ability. In their study, children aged 7- to 15 years (in grades two through nine) were presented with three hypothetical persuasive communication situations: asking a parent to buy a gift, asking a parent to attend an overnight party, and asking a person to keep a lost puppy. Children's task was to say everything they could think of to gain agreement. Children's responses were coded in two sets of categories, and ordered according to the level of perspective-taking skill required. The first set coded the strategic form in which the request itself was phrased in a persuasive attempt (e.g., an unelaborated statement of desire was coded as low level, whereas an elaborated proposal to demonstrate that little is required of other, saying for example “the gift wouldn’t cost much”, was high level). The second set coded the functional strategies used to support the request (e.g., a request that demonstrates a matter of right, for example, “all the other kids have a three-speed” was coded as low level, whereas a request that included counterarguments was high level). Overall, the youngest children demonstrated very little perspective-taking, and the older children used strategies reflecting progressively greater ability to understand and adapt to the perspective of others. The most significant developmental advances occurred between the second and third graders, third and fourth graders, and eighth and ninth graders. Clark and Delia (1976) interpreted these results as being consistent with a Piagetian constructivist perspective and seminal findings on social role-taking (e.g., Flavell, Botkin, Fry, Wright, & Jarvis, 1968).

However, results from studies carried out with different theoretical and methodological approaches have raised reasonable doubts about the validity of this hypothesis. For example, research conducted by Stein and her colleagues (e.g., Stein & Miller, 1990, 1993a, 1993b) has shown that at the age of eight, or even earlier, children are able to deal with opposition and to engage in successful negotiation in conflicts experienced with their parents and peers.

2.5.2. Goals and relationships of arguers

According to the Goal-based Model of Argument, proposed by Stein and her colleagues, the structure and content of arguments are regulated by the goals and relationships of the arguers. Their studies (e.g., Stein & Albro, 2001; Stein & Miller, 1993a, 1993b) have focused on the analysis of children’s arguments experienced in everyday conflicts with their family and peers. As Stein and Albro (2001) note, a dispute starts when two (or more people) try to accomplish incompatible goals. When both parties recognise that they have a goal conflict and both of their goals cannot be attained at the same time, they start defending and advancing justifications to support their positions. Arguers usually enter a negotiation with the goal of persuading their opponent of the value of their claim.

Stein and colleagues’ theory assumes that the evaluation and regulation of social relationships is always present in interpersonal conflicts. An arguer may believe that maintaining a relationship with an opponent is more important than defending his or her position. If so, the arguer may choose not to continue a dispute. When the reverse is true, and the relationship is less important than the claim, the arguer may disregard the logic and validity of the arguments given by the opponent (e.g., Stein & Miller, 1990; Stein & Miller, 1993a, 1993b). In many situations, children and adolescents enter into a dispute not to see who will win, but to determine who will be the most dominant person (e.g., Laursen & Collins, 1994; Meyer, 1992).

Stein and colleagues have shown that the complexity of an argument depends on who wins and who loses. Stein and Liwag (1999) found that winning was associated with complexity of argumentation in both children and parents.

When the outcome of a conflict was one in which the parent won, it was the parent who provided the most complex form of arguing. Similarly, when the child won a dispute, it was the child who evidenced the most complex form of argumentation. Stein, Bernas, and Calicchia (1997) replicated this finding on disputes between adolescents. In their study, the winner provided a more complex form of argument than the loser. Stein and colleagues (1997) also showed that winners had more knowledge about their own position than their opponent did before the dispute began. Additionally, they found that winners had less knowledge about the reasons for their opponents' position than the opponents had about the winners' position. This asymmetry in mutual understanding favoured the winners. Arguers who were able to reach a compromise had more prior knowledge about both positions than did either winners or losers.

Stein and colleagues (1997) also assessed memory for the negotiation between adolescents. The two types assessed were source memory, which refers to the accuracy of recalling who uttered a particular statement, and content memory, which refers to what was said. Results indicated that losers evidenced the best memory for who said something. Losers tied those who compromised for remembering accurately what was said. These results led the researchers to conclude that, during a negotiation, losers acquire knowledge about the problems with their own position and the strengths of their opponent's position. Winners had less accurate memory than did the losers for what was said in the argumentative discussions, but remembered accurately the source.

Winners offered the most counterarguments to their opponents and this helped their subsequent recall of who said what. However, they made significantly more errors in remembering accurately what their opponent said, either against their own position or in favour of their opponent's position, consistent with their prior knowledge of the positions. Additionally, winners almost always misrepresented a loser's initial reasons to support a particular position. Although winners recalled well the loser's claims for choosing his or her own side, the winners were poor at remembering the reasons losers gave for justifying their positions.

Those who compromised were the best at remembering the content of what each person said in support of a position, and at understanding both sides of an argument in resolving the conflict. Stein et al. (1997) proposed that arguers who compromised focused their negotiation on the construction of new goals to resolve the problem. However, they had difficulty in identifying accurately who gave suggestions for the new solution. Stein and Liwag (1999) found similar results in parent-child argumentation.

Stein and colleagues have also focused on the role that emotion plays in the understanding and resolution of conflicts that children experience with their parents and peers. Stein and Albro (1997) assessed young children's arguments under different feeling states and social contexts. Their data are part of a larger study that involved 180 families (Liwag & Stein, 1995; Stein & Liwag, 1997, 1999). In their study, parents were asked to choose and talk about a series of events that made preschool children experience different types of emotions (happiness, sadness, anger, and fear). Thirty parents were asked to talk further about two recent conflicts that they had with their children, one in which they had observed their child express anger, and one in which they had observed their child express sadness. Children were also asked to remember and recount the same conflicts. Stein and Albro (1997) chose to study events evoking anger and sadness, because prior work showed that events involving anger were understood differently than events involving sadness. For instance, Levine et al. (1999) noted that although parents reported their children feeling angry during conflict, the majority of children (60%) disagreed with their parents and said that they felt sad during the conflict.

The aim of the Stein and Albro's study (1997) was to analyse whether these two different emotional responses to a conflict influence strategies and types of outcomes in negotiations. Results indicated that the conflicts that aroused anger in children most frequently were those in which parents took children's possessions away from them, and those in which parents' and children's goals for pursuing a future course of action were in conflict. The conflicts that resulted in sadness in children most frequently were those in which the child was denied affection or interaction, or when the child was punished. Both children and parents reported conflicts in which children expressed anger as more memorable. Results also showed that outcomes of parent-child conflict were predicted by the jointly reported emotions of parents and children. Over the 48 conflicts reported, in which children and parents agreed on the outcome, 58% ended with parents winning, 19% ended with children winning, 12% ended in a standoff, and 9% ended in compromise. When parents and children both reported reacting with anger, they were unable to negotiate and come to a resolution, because they focused on their own goals; in such case, neither party was willing to change or attempt to understand the other's perspective. The most frequent outcome was a standoff. When both children and parents expressed sadness, parental wins and parent-child compromises occurred. This result led Stein and Albro (1997) to conclude that the experience of sadness provoked a joint consideration of what they could do to maintain a positive relationship.

Albro (1996) also showed that the degree of liking and caring that two people express toward each other predicts the nature of the conflict resolution. In her study, 4-year-old children were asked to remember and spontaneously report both good times and conflicts with their best friend and their lost disliked peer. Results showed that the degree of liking did not influence recalling the conflict (67% of children recalled conflicts with their best friends and 64% recalled conflicts with the peer they disliked). However, the degree of liking did influence the recall of good times (88% of children recalled good times with their liked peers, and only 24% recalled good times with peers they disliked). The role of liking in a relationship also influenced outcomes of conflicts. Disputes with liked peers frequently ended in win-loss scenarios, whereas conflicts with disliked peers ended in standoffs. Furthermore, compromises were infrequent in liked peer conflicts and never occurred in conflicts with disliked peers.

These series of studies have shown that preschool children are able to understand and generate the principle components of an argument. They also provide evidence that the ability to construct detailed, complex and logically cohesive justifications in defence of a favoured position improves with age. However, this development does not guarantee a deeper understanding of opposing views. A conflict may exist between displaying good argument skills and reaching a beneficial resolution for both parties in an argumentative discussion. For instance, a theory compromising a goal-based model of argument does not explain why older children choose not to incorporate counterarguments in argumentative discussions or essays, even when they have sufficient knowledge to argue on both sides of an issue (Leitão, 2003; Stein & Bernas, 1999). Leitão (2003) addressed this question, by looking at how children evaluate and select retrieved ideas from texts according to the communicative goal of writing-related tasks.

2.5.3. Epistemological understanding

According to Kuhn and her colleagues (e.g., Kuhn, 1991, 2001, 2003; Kuhn & Udell, 2007), epistemological understanding underlies and shapes reasoning and argumentation. These researchers argue that to fully understand processes of knowing and arguing, it is important to examine people's understanding of their own knowledge. In providing justification for a claim, young children have difficulty differentiating explanation and evidence in an argument (Kuhn, 2001). Although epistemological understanding progresses developmentally, there is substantial variation among adults, with few adults achieving understanding of the complementary strengths and weaknesses of explanation and evidence in argument (e.g., Kuhn, 1991).

Kuhn and Pearsall (2000) investigated how young children justify simple knowledge claims. The researchers predicted that below a certain age, children would fail to distinguish between theoretical explanation and evidence as a basis for their knowledge claims. For example, 4- to 6-years-olds were shown a sequence of pictures in which two runners competed in a race. Certain cues suggested a theoretical explanation as to why one would win; for example, one had fancy running shoes and the other did not. The final picture in the sequence provided evidence for the outcome; for example, one of the runners held a trophy. When the children were asked to indicate the outcome ("Who won the race?") and to justify this knowledge ("How do you know [he won]?"), 4-year olds did not show a clear distinction between evidence for the claim and the explanation for it. In the race example, when asked "How do you know?" children tended to respond in an explanation-based manner, referring to the running shoes cue ("Because he has fast sneakers"), rather than the trophy cue ("He's holding a trophy").

Similarly, in another set of pictures in which a boy was shown first climbing a tree and then down on the ground holding his knee, the "How do you know [that he fell]?" question was often answered "Because he wasn't holding on carefully." Children who gave these kinds of responses to the "How do you know?" question were asked a follow-up question, "How can you be sure this is what happened?" This prompt elicited a shift from a theory-based to an evidence-based response for some children on some items. Still, even with this prompt, 4-year olds gave evidence-based responses on average to less than a third of the items. Six-year-old children, on the other hand, distinguished the difference between explanation and evidence more readily than 4-year-olds. These results led Kuhn and Pearsall (2000) to conclude that children who have not yet achieved the epistemological understanding in question do not clearly distinguish explanation from evidence when multiple clues that offer different types of justifications are present. The findings also suggest that epistemological understanding progresses developmentally and, by the age of six, children start appreciating the distinction between theory and evidence.

Another study (Kuhn & Felton, 2000) showed that epistemological understanding does continue to develop. In their study, eight graders, college students, and beginning graduate students were asked to choose the stronger of two arguments to support a claim (e.g., “Why do teenagers start smoking?”). One argument provided a theoretical explanation that made the claim plausible (e.g., “Smith says it’s because they see adverts that make smoking look attractive. A good-looking guy in neat clothes with a cigarette in his mouth is someone you would like to be like”). The other argument provided empirical evidence that the claim was true (e.g., “Jones says it’s because they see ads that make smoking look attractive. When cigarette ads were banned from TV, smoking went down”). Participants were asked to give reasons to justify their choices, including the strengths of the chosen argument and weaknesses of the other argument.

Additionally, they were also asked if the chosen argument had some weaknesses and the non-chosen argument any strengths. Results showed that the older age group (graduate students) achieved the highest levels of epistemological understanding. Yet, few participants exhibited an understanding of the epistemic strengths and weaknesses of each argument type. According to Kuhn and Felton (2000), epistemic characteristics apply to the form of the argument; non-epistemic characteristics relate to the content of an argument. Non-epistemic responses most often addressed the correctness of an argument (e.g., “This is a good argument because it’s true”), rather than the quality of the argument supporting a claim. The percentages of students citing the epistemic strength of explanation (e.g., “It gives a reason”) ranged from 30% among the young adolescents to 60% among the graduate students. Fewer students cited the epistemic weaknesses of explanation (e.g., “It’s only a theory” or “It could be wrong”), ranging from 0% to 26%. Moreover, the percentages of students citing the epistemic weaknesses of evidence (e.g., “It doesn’t say why”) were the lowest, ranging from 2% to 10%.

These findings are in broad agreement with other empirical investigation of epistemological beliefs that have identified three major levels of epistemological understanding (see Hofer & Pintrich, 1997, for review). Table 2.1., shown below, illustrates the levels for the development of epistemological understanding proposed by Kuhn and colleagues (e.g., Kuhn, Cheney, & Weinstock, 2000). In addition to the three levels that Hofer and Printich identify, Kuhn's model includes a pre-absolutist level characteristic of early childhood. Kuhn and colleagues (2000) refer to the other three broad levels as absolutist, multiplist, and evaluativist.

At the *absolutist level*, individuals believe that knowledge is objective, certain, non-problematic, right and wrong, and does not have to be justified since observations of reality or authorities are its sources. This absolutist conception is most likely to change dramatically during adolescence, and then be replaced by a multiplist or relativist conception. At the *multiplist level*, individuals believe that knowledge is ambiguous and consists of personal opinions that people possess that usually cannot be challenged or discussed. Only at the most advanced, the *evaluativist level*, is knowledge seen to consist of claims which require support by alternative theories, evidence, and arguments (Kuhn, 1999a; Kuhn et al., 2000). At this level, individuals believe that knowledge is uncertain and that there are shared norms of inquiry and knowing, and consequently that some positions are reasonably more justified and grounded than others.

Table 2.1. Levels of epistemological understanding (Kuhn, Cheney, & Weinstock, 2000, p. 311)

Level	*Assertions*	*Knowledge*	*Critical thinking*
Realist	Assertions are copies of an external reality.	Knowledge comes from an external source and is certain.	Critical thinking is unnecessary.
Absolutist	Assertions are facts that are correct or incorrect in their representation of reality.	Knowledge comes from an external source and is certain but not directly accessible, producing false beliefs.	Critical thinking is a vehicle for comparing assertions to reality and determining their truth or falsehood.
Multiplist	Assertions are opinions freely chosen by and accountable only to their owners.	Knowledge is generated by human minds and therefore uncertain.	Critical thinking is irrelevant.
Evaluativist	Assertions are judgments that can be evaluated and compared according to criteria of argument and evidence.	Knowledge is generated by human minds and is uncertain but susceptible to evaluation.	Critical thinking is valued as a vehicle that promotes sound assertions and enhances understanding.

Further research on epistemological beliefs, led by Kuhn and her research team, explored the dimensions that define these developmental levels and how they connect with each other. They proposed that the cognitive task that underlies the achievement of mature epistemological understanding is the coordination of objective and subjective components of knowing (e.g., Kuhn, Cheney, & Weinstock, 2000; Kuhn & Weinstock, 2002). The objective dimension dominates, initially sacrificing subjectivity; subsequently, the subjective dimension assumes a dominant position, and finally, the two are coordinated. A key event in this evolution is the replacement of the source of knowledge from the known object to the knowing subject.

At this stage, a multiplist's recognition of the existence of conflicting assertions (e.g., "even experts disagree") is likely to emerge, leading to awareness of an uncertain and subjective nature of knowing. The evaluativist reintegrates the objective dimension of knowing, by acknowledging the uncertainty without neglecting evaluation. Thus, two people can have different opinions and both "be right", but one position can have more merit ("be more right") than the other, because it is better supported by argument and evidence. It is only at this stage that people evidence a disposition to engage in the intellectual effort that reasoned argument entails, such as justifying claims (Kuhn, Cheney, & Weinstock, 2000).

According to the authors, the origins of the coordination process are identifiable in the early childhood achievements highlighted by research findings on children's theory of mind. Children, aged three, show some epistemological awareness in making reference to their own knowledge states, using desire and belief terms such as *want*, *think* and *know* (Bartsch & Wellman, 1995). However, the flood of empirical research over the last 30 years on early understanding of mental states has generated consensus that children below the age of four regard people's claims as independent to reality. The conceptual acquisition most studied by these researchers has been the achievement of an understanding of belief in the classic false-belief task. Three-year olds believe that a newcomer will share their own accurate knowledge that the chocolate is no longer in the blue cupboard, and can now be found in the green cupboard (Wimmer & Perner, 1983). They do not recognise that the other person can be misled by his or her false beliefs. By four or five years of age, most children can attribute beliefs, even false beliefs, to both self and others (e.g., Astington & Gopnick, 1991; Wellman, 1990; Wimmer & Perner, 1983). Kuhn (1999b) argues that the ability to recognise assertions as the expression of someone's belief constitutes a milestone in young children's cognitive development. This contributes to further achievement in epistemological understanding.

Kuhn, Cheney, and Weinstock (2000) further postulated that this progression tends to occur in a systematic order across different judgment domains (personal taste, aesthetic, value, and truth), with the orders the reverse of one another in the two major transitions of this progression. In their study, Kuhn and colleagues (2000) analysed a sample of seven groups of children, adolescents, and adults, varying in age, education and life experience. As the researchers predicted, the subjectivity is most readily acknowledged in personal taste and aesthetic judgements and least readily in truth judgments. Once subjectivity is accepted and becomes dominant, objectivity is reintegrated in a reverse order, that is, most readily with respect to truth judgments. Results also showed that, for a number of individuals, both transitions proved most difficult in the values domain.

A number of studies has shown that beliefs about knowledge are associated with performances in conceptual change (Mason, 2002, 2003; Southerland & Sinatra, 2003), argument generation skills (Mason & Scirica, 2006), argumentative writing skills (Mason & Boscolo, 2004), and juror-reasoning skills (Weinstock & Cronin, 2003).

A crucial consideration regarding this research topic is that epistemological understanding is considered as dispositional rather than as a competence factor or general intelligence (Kuhn, 2001; Weinstock & Cronin, 2003). As noted by Stanovich (1999), individual differences in performance on argumentation tasks must be explained by reference to epistemological dispositions, for example, a disposition to think flexibly and to change one's beliefs in the face of contradictory evidence. Other factors, such as knowledge and cognitive ability are also necessary to account for individual differences in cognitive performance.

2.6. Argument, inquiry and critical thinking

For some time, argumentation has been linked to critical thinking (e.g., Ennis, 1962; Nickerson, Perkins, & Smith, 1985). However, although argument skills are related to and part of critical thinking, they are not the same thing. In a seminal study on critical thinking and education, Glaser (1941) proposed that the ability to think critically involves three elements: (1) a disposition to consider in a thoughtful way the problems and subjects that come within the range of one's experiences; (2) knowledge of the methods of logical inquiry and reasoning; and (3) some skill in applying those methods. Contemporary educational and developmental psychologists have addressed, in one way or another, these central elements. Broadly speaking, the skills involved in effective critical thinking include: argument generation, inquiry and meta-cognition (Kuhn, 1999a).

In argument generation, as pointed out by Govier (2005), the statement of an argument is most frequently the product of reasoning and critical thinking. To generate arguments, individuals are required to examine a statement and take a position regarding an issue, and to provide reasons to support it. Additionally, they may have to consider the alternative side of an issue and provide opposing reasons as well (Voss & van Dyke, 2001).

Inquiry skills are recognised as being very important to critical thinking. The primary reason is that an individual, when asked to reason about an argumentative topic, in a text or speech, should be able to recognise the argument (i.e., the claim and reasons to support it) and coordinate his or her knowledge with the new evidence.

Metacognition is also crucial to develop strong critical thinking skills (Felton & Kuhn, 2007; Kuhn, 1999b; Olson & Astington, 1993). In fact, Kuhn (1999b) argued that the most relevant skills in critical thinking are metacognitive rather than cognitive. In contrast to first-order cognitive skills that enable one to know about the world, second-order meta-knowing skills involve knowing about one’s own and others’ knowing. Kuhn’s developmental model of critical thinking (1999a) identifies three broad categories of second-order cognitive skills: metastrategic, metacognitive, and epistemological. The distinction between metastrategic and metacognitive knowing derives from a widely established dichotomy in philosophy and cognitive psychology between procedural knowledge (knowing how) and declarative knowledge (knowing that). Procedural or metastrategic competencies entail the application of strategies to achieve goals. On the other hand, metacognitive competencies operate on one’s base of declarative knowledge and are needed to reflect on one’s own theories and the bases for believing them.

Finally, epistemological competencies are required to understand one’s own and others’ knowledge. Evidence that meta-knowing skills are the intellectual skills most closely associated with critical thinking comes from microgenetic studies of the strategies children or adults employ in coordinating theory and evidence (Kuhn, 1989; Kuhn, Garcia-Mila, Zohar, & Andersen, 1995; Kuhn, Schauble, & Garcia-Mila, 1992). These studies have shown that it is through coordination processes of existing understanding with new evidence that knowledge is acquired. Kuhn (1989) proposed that a critical change that occurs with the development is the attainment of increasing control over this process. This attainment is meta-cognitive, because it involves an awareness, understanding and management of one’s cognition. Kuhn’s work supports the claim that this control increases both with age, in cross-sectional studies (e.g., Kuhn & Udell, 2007), and over time, in microgenetic studies (e.g., Kuhn, Garcia-Mila, Zohar, & Andersen, 1995).

Having provided a description of the component skills of critical thinking, the next section addresses the significance of critical thinking in learning.

2.6.1. Implications for education

John Dewey was one of the first educational philosophers to recognise that a curriculum aimed at building thinking skills would benefit not only the individual learner, but the community and the entire society (Govier, 2005). Critical thinking is considered important in education because it enables students to analyse, evaluate, explain, and restructure their thinking. In most school and college subjects, students need to critically analyse the material they are studying. For example, if they are studying social sciences, students will need to think and discuss themes such the causes of crime or the importance of family. In History, students have to deal, for example, with arguments related to the causes of war, or the role of religion in social change. If students are studying Biology, they will have to evaluate arguments on the nature of evolutionary change, or the effects of global warming. Later in life, individuals will also need to be proficient in defending their positions and understanding others' points of view in order to participate successfully in debates on societal questions and to critically evaluate different information sources, such as the Internet.

Educational and developmental studies have shown that many students have difficulties in recognising arguments and commenting analytically on argumentative texts (e.g., Pontecorvo & Girardet, 1993) or understanding the value of counterarguments (e.g., Kuhn, 1991; Stein & Bernas, 1999). As mentioned earlier in this chapter, Brem, Russell, and Weems (2001) suggested that students' poor evaluations of scientific information found on a website was a result of students' failure to analyse sufficiently.

In recent years, Kuhn and colleagues conducted several studies focused on understanding and promoting thinking skills in adolescents and adult learners. They studied the process of knowledge acquisition through the method of *inquiry learning* (e.g., Kuhn, 2007a; Kuhn, Black, Keselman, & Kaplan, 2000). For instance, Kuhn et al. (2000) asked middle-school students, aged between eleven and thirteen years, to engage in computer-based inquiry learning and work together in pairs on an earthquake problem.

The objective of this task was to analyse a database to determine which of a set of varying factors did and did not make a difference to earthquake risk. Students' progress was followed via the microgenetic method. This yielded insight into students' strategies of investigation, analysis, and inference and the ways in which these strategies change as they become more proficient inquiry learners. Results indicated that students seem to lack the cognitive skills needed to make their inquiry learning productive. Some of these skills are crucial in the initial inquiry phase of the process, including recognising that there is a question to be asked, and that there is information to be examined to sustain their beliefs and claims. As Kuhn et al. (2000) argue, in the absence of this recognition, students are rarely effective in the later phases of inquiry learning, involving *analysis, inference* and *argument*. The implication of this evidence for educators is that answers cannot be provided to questions that the student does not have.

2.7. Persuasion: The pragmatic function of argumentation

This section addresses a different but related aspect of argumentation. Earlier in this chapter, the focus was placed on the argumentative process. In this section, the focus is redirected to the effectiveness of argumentation or persuasion. In particular, this section closely inspects existing persuasion research to see what light might be shed on whether (and the degree to which) children choose to persuade when they are engaged in argumentation. In other words, do children understand persuasion as a goal or a desirable outcome of argumentation? Moreover, do children pursue this goal?

The ultimate goal of argumentation, whether in face-to-face interactions or in written argumentative texts, is changing the audience's view (Leitão, 2003; Voss & van Dyke, 2001). Persuading people to change their points of view or attitudes is difficult to achieve. Arguers are required, not only to present reasons to support the claim they want others to come to accept (e.g., "I am not in favour of capital punishment because it is not effective in deterring people from crime"), but also to consider the strength and relevance of the others' current views (e.g., "O.K. Perhaps I would think in a different way if a crime was committed against someone I love"). As Watkins (2001) points out, "persuasion is, in fact, a negotiation that results in concrete impacts on the behaviour of other people" (p. 115). In some cases, the persuader's intent is to gain others' agreement; or in other situations it is necessary to gain others' active support and, thus, to change their attitudes. In both situations, the persuader must be able to influence others' points of view through communication (Leitão, 2003; O'Keefe, 2002; Watkins, 2001).

Empirical evidence has suggested that persuasion skills develop considerably throughout childhood. For example, Clark and Delia (1976) presented children in grades two through nine (from 7- to 14- years) with three hypothetical persuasive communication situations (e.g., asking a neighbour to keep a lost puppy) and asked them to say everything they could think of to gain agreement. Children's responses were coded in two sets of categories, and ordered according to the level of perspective-taking skill required. The first set coded the strategic form in which the request itself was phrased in a persuasive attempt (e.g., an unelaborated statement of desire was coded as low level, whereas an elaborated proposal to indicate that the persuader needs help from the other, saying for example "I'm asking you to keep this dog because my mom doesn't let me have it", was high level). The second set coded the functional strategies used to support the request (e.g., a request that included counterarguments, saying for example, "It does cost much to feed a dog, but I will bring you food to feed the dog if you'll keep it" was high level). Overall, the youngest children demonstrated very little perspective-taking, and the older children used strategies reflecting progressively greater ability to understand and adapt to the perspective of other.

The authors interpreted these results as being consistent with a Piagetian constructivist perspective and seminal findings on social role-taking (e.g., Flavell, Botkin, Fry, Wright, & Jarvis, 1968). These findings suggest that children may not use mental state information in persuasion, although they might be able to perform well in false-belief tasks. More recently, Bartsch and London (2000) conducted a study addressing directly this hypothesis of whether children use information about others' mental states to invent and select persuasive strategies. Participants were preschoolers, third graders, and sixth graders and were told about story characters persuading parents to buy pets or toys. Children were either given or not given information about story parents' beliefs and asked to invent or select appropriate arguments. Results showed that older children (third and sixth graders), but not preschoolers, used belief information to select appropriate persuasive arguments. Bartsch and London (2000) concluded that these results were consistent with the notion that use of belief information in persuasion tasks develops progressively through childhood and early adolescence, as advanced in the study by Clark and Delia (1976).

Other studies, particularly in educational research, have also pointed out children's relatively slow growth in the area of persuasive and argumentative writing (e.g., Coirier, 1996; Coirier, Andriessen, & Chanquoy, 1999; Knudson, 1992). Students' difficulty in writing good quality essays is also a major concern of teachers and educators. Recently, educational psychologists have examined how task instructions mediate the effects of quality of argumentative writing.

For example, Felton, Garcia-Mila, and Gilabert (2009) compared the effects of two distinct kinds of activity in argumentative discourse, dispute and deliberation, on the content learning in science instruction and argument quality of first-year secondary school students. Dispute and deliberation can be distinguished by their different goals (Makau & Marty, 2001). In dispute the goal is to defend a view and challenge alternatives, whereas in deliberation the goal is to choose a point of view by evaluating the alternatives (Felton, Garcia-Mila, & Gilabert, 2009). Results from this study showed that disputative goals may diminish the value of argumentation by prompting students to defend their views and minimise alternative views. In contrast, deliberative goals led to greater gains in content learning and argument quality by encouraging students to collaboratively construct and contrast different views.

Similar results were obtained by Ferretti and colleagues who compared the effects of a general goal to persuade and an elaborated goal (that contained specific sub-goals on the argumentative writing) of 9- year old and 12-year old students with and without learning disabilities (Ferretti, Lewis, Andrews-Weckerly, 2009; Ferretti, MacArthur, Dowdy, 2000). Both studies showed that the elaborated goal induced students to include more alternative views and arguments, and therefore to produce more persuasive essays than the general goal of persuasion. These studies are important for designing interventions that use argumentation to foster students' persuasive and argumentative skills.

Empirical evidence in educational research shows that persuasion ability, which is related to more general argumentative skills, is important to children's academic experience. The ability to persuade others is also important to children's social experience (Bartsch & London, 2000). In preschool years, children already use verbal and non-verbal tactics to get parents and siblings to share toys and food, to receive gifts, abandon bedtime rules, and so forth (Bartsch, Wright, & Estes, 2010). Later, when children enter school, they are inundated daily with a variety of persuasive appeals asking them to adopt certain behaviours, such as not smoking, to share a game or to write convincing essays.

Persuasion is an ubiquitous form of human interaction and deserves great attention in argumentation studies. Nevertheless, with the exception of old studies on children's persuasion skills (e.g., Clark & Delia, 1976; Delia, Kline, & Burleson, 1979) and the work conducted by Bartsch and colleagues on children's attention to beliefs in persuasion (Bartsch & London, 2000; Bartsch, London, & Campbell, 2007; Bartsch et al., 2010), no recent developmental studies have been conducted on how persuasion ability develops with age.

The research described in this thesis seeks to address this gap in literature by focusing on argumentation as a goal-oriented process. For instance, Study Four (see Chapter Six) explored what types of argument children at different ages select in a persuasion task.

2.8. Areas for investigation

To summarise, a review of the literature has revealed a need to develop empirical research focused on children's argument skills. Previous research has focused on how young children use arguments during family or peer conflicts (e.g., Stein & Miller, 1993a, 1993b) and in naturally occurring school contexts (e.g., Anderson et al., 1997), but less is known about their ability to produce more complex arguments related to socio-moral topics (e.g., the value of friendship) or policy issues (e.g., whether students should wear school uniforms). Moreover, educational studies in argumentation have focused on how students generate arguments related to academic topics, and few studies have examined how children select arguments in evaluation tasks. The study of evaluation skills is highly practical for education and in children's everyday life. For instance, in family interactions, children need to understand and carefully examine the views and arguments exchanged, in order to argue and counter-argue effectively. In school, students are also required to critically evaluate the relevance of claims and arguments provided in textbooks and other sources, such as the Internet (Glassner, Weinstock, & Neuman, 2005).

This chapter highlighted a number of implications of argumentation studies, particularly in education. Piagetian and Vygotskian views concerning the importance of social interaction to learning has contributed largely to an interest in studies focusing on discussions, particularly in classrooms. A series of studies conducted by Doise and Mugny (e.g., Doise & Mugny, 1984) has shown that conflicts generated through the advancement of a myriad of different perspectives stimulate discussion between children, hence contributing to social and cognitive development. Several studies have also shown the benefits of interaction on the construction of specific knowledge, such as conservation tasks (e.g., Ames & Murray, 1982; Leman & Duveen, 1996); scientific concepts (e.g., Howe, Tolmie, Greer, & Mackenzie, 1995), historical topics (Pontecorvo & Girardet, 1993), and socio-moral topics (e.g., Felton, 2004).

Whilst a number of studies have explored the use of social interactions as a means of cognitive engagement, less is known about what sort of elements in a discussion promote children's argument skills. The ability to engage in conversation and to communicate effectively is critical to successful functioning in life. Understanding how engagement in a discussion enhances children's critical thinking and learning has important implications for education.

Past studies have identified links between argumentation competence and persuasion ability. Justification of an argument implicitly carries with it the idea that the argument is persuasive. Also, conflict situations involve attempts to persuade, which becomes part of negotiation and conflict resolution. However, no previous research has developed measures and discourse coding schemes to examine in particular these abilities in younger age groups.

2.9. Conclusion

To conclude, this review of the literature identified a number of areas requiring further investigation. These include: examination of age differences in children's generation of informal arguments, to enable a clearer picture of the skills 5-, 8-, and 11-year olds possess and deploy both individually and with their peers, and exploration of whether engagement in argumentation influences their argument skills; investigation of how 8-year olds and 11-year olds differ in terms of preference and evaluation of what constitute strong and persuasive arguments; and a further examination of the links between argument strategy and persuasiveness. The present research aims to address these areas through a series of qualitative and quantitative studies. Having provided the context and further justification for the present research, the next chapter describes and evaluates the chosen research methodology.

Chapter Three - Methodology

3.1. Introduction

Both the introductory chapter (Chapter One) and the literature review (Chapter Two) highlighted a number of challenges regarding the assessment of children's argumentation skills. For instance, there is little consensus among researchers on the criteria for defining the quality of arguments. Moreover, the relative lack of research tasks and analytical coding schemes for assessing skills in argumentation of young children constitutes a real challenge in this sort of research.

This chapter initially provides a description of the samples collected for the studies in this thesis. Participants were age-school children recruited from schools in the U.K; therefore a particular emphasis is given to the characteristics of the educational context in this country. The methods employed in the research studies outlined are then discussed alongside some problems that arise in the study of argumentation and reasoning with children. A more detailed description of these methods, including their strengths and limitations, is then provided in each of the four empirical chapters. A concluding section discusses common ethical issues which were considered across studies.

Before discussing these methodological issues, the next section provides some general background on the assessment procedures applied in the present research. A variety of techniques was employed, including surveys and interviews, correlational and experimental studies.

3.2. The selection of an appropriate method

Most of the studies described in the literature review (Chapter Two) used *either* qualitative *or* quantitative methods to describe and examine individuals' argument skills. Qualitative research usually functions to develop a theory from the data collected (an inductive process) and, thus, focuses on describing a phenomenon, and collecting and analysing detailed observations, narrative histories, conversation scripts or video transcriptions. On the other hand, quantitative research is typically designed to test predetermined hypotheses that are formed based on existing theory (a deductive process). Hence, quantitative research methods focus on quantification of a phenomenon, relying on numbers, counts, and frequency-type data (Weathington, Cunningham, & Pittenger, 2010). Methods of data collection in quantitative research include, for example, surveys (questionnaires), structured interviews, content analysis according to a coding scheme, and group experiments (studies that involve control and experimental groups).

Despite the prevalence of qualitative methods in some psychology areas (e.g., social, educational, clinical), there has not been widespread acceptance of qualitatively influenced research within other areas of psychology. The reasons for this are varied and not fully understood or agreed upon. According to Teddlie and Tashakkori (2003) the main reason for resistance to use qualitative methods has been the lack of education regarding these methods. It has also been suggested that qualitative researchers differ greatly from quantitative researchers in terms of their perspectives on methods and goals for research studies (Weathington, Cunningham, & Pittenger, 2010). Although this may be correct, many researchers have argued that there are more advantages in combining these two general approaches to research, than in continuing to separate them out (e.g., Shaw, 2003). For instance, in the case of educational interventions for children, which are implemented in complex environments (e.g., schools, nurseries), answering the question of why some interventions work while others fail is not easily done within a quantitative framework. Such a question can be more comprehensively addressed with the use of a qualitative and quantitative (i.e., mixed-methods) strategy.

As Schwarz (2009) discusses, in a recent review chapter on methodological issues, productive argumentative activity may be encouraged by elicitation procedures, argumentative scripts, confronting subjects with hypothesis testing, and pairing peers that have different opinions. Kuhn's work on argumentation and education has employed many of these data collection methods. These included semi-structured and structured interviews (e.g., Kuhn, 1991) and pair interactions (Felton & Kuhn, 2001; Kuhn, Shaw, & Felton, 1997; Kuhn & Udell, 2003). Many of Kuhn's studies, in which the present research is grounded, have employed content analysis according to a coding scheme, which is a common mixed-methods analysis technique.

Recent research conducted by Creswell (2002) and Nussbaum, Hartley, Sinatra, Reynolds, and Bendixen (2002) also worked toward a synthesis of theoretical perspectives using a mixed-quantitative-qualitative approach. Based on this previous research, the use of a variety of qualitative and quantitative methods was deemed necessary and more appropriate for the studies presented in this thesis.

3.3. Quantitative and qualitative methods combined

As described in the previous section, a combination of qualitative and quantitative methods was used in the present research. Mixed-methods research can be seen as a;

> Type of research in which a researcher or team of researchers combines elements of qualitative and quantitative research approaches (e.g., use of qualitative and quantitative viewpoints, data collection, analysis, inference techniques) for the broad purposes of breadth and depth of understanding and corroboration (Johnson, Onwuegbuzie, & Turner, 2007, p.123).

A mixed-methods approach was chosen because the research questions involved in the studies in this thesis concerned, not only exploring the skills involved in argumentation, but also identifying age differences in children's ability to evaluate and produce arguments. Furthermore, other researchers who have studied the topic of skills in argumentation have also relied on a combination of quantitative and qualitative methods, such as interviews (e.g., Kuhn, 1991; Means & Voss, 1996), and content analysis using analytical schemes (e.g., Kuhn & Felton, 2001; Udell, 2007).

In sum, several reasons were considered before designing the research studies that favoured the use of a mixed-methods research. The set of considerations is listed below:

1. Research questions included exploring children's argument skills, and examining age differences in argument skills;
2. The main goal was investigating in detail children's argument skills in a natural context (i.e., in schools);
3. Other researchers who have studied the topic of argumentation have relied on a mixed-methods approach;
4. Research employing either quantitative methods or qualitative methods exclusively to study the topic of argumentation present several limitations;

5. The researcher had time and interest in engaging in qualitative inquiry. This was also feasible, because the timetable developed at the start of the PhD specified that the researcher had three years to complete data collection and analysis of a series of studies, thus there was enough time to use a variety of techniques;
6. The researcher was comfortable in using both qualitative and quantitative research techniques.

The different techniques for data collection and analysis used in the present research are described in the next sections.

3.3.1. Mixed-methods data collection

Data collection techniques included the development of new questionnaires constructed in various formats (e.g., computer programs), and face-to-face interviews and group discussions. When planning for the construction of these measurements, qualitative techniques were also used to ensure that the tasks were appropriate for children in the age groups selected. For example, in the pilot stage of Studies Three and Four, focus groups were used to gather information on the sorts of topics and arguments children understand and talk about. These topics and arguments were then used to construct questionnaires. More specifically, the five studies included in this thesis consisted of:

1. Interviews with children at different ages to explore the use of argument elements (Chapter Four);
2. Group discussions with children at different ages to identify the use of argumentative discourse strategies (Chapter Five);
3. Computer-based tasks in questionnaire format to measure children's evaluation and preference for different types of argument (Chapter Six);
4. A video-based task and a questionnaire to assess children's understanding of the function of persuasive strategies in an argumentative dialogue (Chapter Seven).

The first study (Chapter Four) charted age differences in children's (5-, 8-, and 11-years) ability to generate arguments in response to socio-moral questions. Further, it investigated whether engagement in peer group discussions on similar topics led to subsequent improvement in children's individual use of sophisticated argument elements (e.g., two-sided arguments) compared to a control group who did not engage in group discussion. This study used individual interviews to examine the specific elements that children generate at different ages. The interview format method has been used in other relevant research, for example, to study children's disagreements for moral and non-moral issues (Wainryb, Shaw, Laupa, & Smith, 2001), or to explore age differences in adults' argument skills (Kuhn, 1991). Moreover, Weathington, Cunningham, and Pittenger (2010) argue that the interview method is best suited to describe complex phenomena, and to determine future research questions. Thus, as little was known about the topic under study, conducting interviews was deemed necessary before attempting to design quantitative measures.

Indeed, the results obtained in this first study revealed new features of children's competencies that were further examined. The objective of the second study was to identify the argumentative strategies used by children in group discussions. Although there is a rich literature on peer collaboration that is relevant for this topic (e.g., Doise & Mugny, 1984; Forman & Larreamendy-Joerns, 1995; Howe, Tolmie, Anderson, & Mackenzie, 1992; Leman, 2002; Leman & Oldham, 2005; Williams & Tolmie, 2000), none of these studies have looked particularly at children's argument strategy, that is, children's ability to direct discourse and use specific elements of argumentation (e.g., rebuttal strategy) to convey their points of views effectively and win discussions. Accordingly, Kuhn and colleagues' recent research on argumentative strategies, and their development of the *transactive coding scheme*, was the best suited theoretical and methodological approach to use in this second study. Since the objectives, rationale and data analysis of this study were different from those used in Study One (Chapter Four), the methods and findings are reported in a new chapter (see Chapter Five). These two interconnected studies were important to gain an understanding of the complex processes involved in the study of argumentation and were then used to inform the development of quantitative measures for the next studies.

In particular, having identified in the previous set of studies developmental differences in children's ability to take into account others' perspectives, two new studies (Chapter Six) were designed to examine how children evaluate arguments and counterarguments considering their own and others' perspectives. In Study Three, a computer-based task assessed how 8-year olds and 11 year-olds differ in terms of their understanding and evaluation of argument strength. Study Four explored evaluative skills in argument effectiveness using a similar computer-based task. Prior to these studies, focus groups (a qualitative research technique) with the youngest age group (8-

year olds) were conducted. The objective of the pilot study was to identify children's knowledge regarding several topics and determine which topics and arguments were best suited to be deployed in the main studies. These studies are detailed in Chapter Six.

The final study further explored the developmental differences in children's argument evaluation skills that were identified in the previous studies. Specifically, Study Five (Chapter Seven) explored children's ability to understand and evaluate goal-directed arguments and strategies deployed in video-recorded dialogues. An experiment was designed using scenarios which featured a blend of technology and human interaction. This is the first study of its kind to look at children's argumentation processes in a real social/ dialogical context. In addition, qualitative research techniques were also used, including surveys (questionnaires).

3.3.2. Mixed-methods analysis

The data analysis technique chosen to be deployed in the first set of studies in this thesis was content analysis; one of the most commonly used mixed-methods analytical approaches. Content analysis involves the coding of data into categories. The qualitative aspect of this analytical approach comes into play during the formation of content categories (Weathington, Cunningham, & Pittenger, 2010). Content categories were defined beforehand, based on the existing theory and relevant literature on argumentation (e.g., Felton & Kuhn, 2001; Kuhn, 1991; Means & Voss, 1996). For instance, the reasons offered by children in the interviews to justify their points of view (Study One) were coded according to the criteria defined by Means and Voss (1996).

Also, children's conversations in peer group discussions were analysed in Study Two (see Chapter Five) according to the *transactive coding scheme* developed by Felton and Kuhn (2001). This coding scheme is described in more detail further in this chapter. In addition, once children's responses were categorised and data were sorted in the first set of studies, further discussion about the initial categorisation findings led to the development of subsequent research designs.

For the reasons outlined above, the present research argues that a mixed-methods approach is more informative when attempting to explore and describe age differences in children's argument skills. To summarise, Table 3.1., shown below, highlights the methods deployed in the present research, illustrating how they were used for primarily quantitative and qualitative research means.

Table 3.1. Application of similar methods for quantitative and qualitative research in the present studies (portions adapted from Weathington, Cunningham, & Pittenger, 2010, p. 533)

	Quantitative methods	*Qualitative methods*
Formal interview	Rating children's responses to specific questions for assessing quality of arguments	Recording and transcribing the entire interview, including researcher's questions, children's responses, gaps in conversations, etc., viewing all as meaningful information to help develop the larger program of research
Peer group discussion	a) Using an analytical coding scheme to rate children's argument strategies in peer discussions b) Using peer discussions as an experimental condition and later quantifying differences between experimental and control groups	Recording and transcribing the entire discussion, children's utterances, speakers' turns, gaps in conversations, etc., viewing all as meaningful information
Questionnaire	Gathering self-ratings of agreement with descriptive items and scales	Eliciting writing responses to open-ended questions or comment-request boxes

3.3.3. Benefits and challenges of mixed-methods research

Using a mixed-methods approach presents several benefits. Firstly, it can provide more comprehensive answers to research questions, going beyond the limitations of a single approach. Moreover, it can also provide a basis for *triangulation*, which refers to the process of operationalising and measuring constructs or variables in multiple ways to converge upon a more accurate assessment (Webb, Campbell, Schwartz, & Sechrest, 2000). In the present research, in particular, combining qualitative methods (e.g., conducting focus groups at a preliminary stage) and quantitative methods (e.g., random sampling, quantifying differences between groups) offered the possibility of engaging in both theory testing and theory building within the same research study. As a result, the researcher gained more knowledge about the phenomena.

There are also more practical reasons for using a combined, mixed-methods approach. A first reason is that research in psychology is challenged with the goal of understanding phenomena that exist within and between people. In particular, any efforts to operationalise and quantify social and psychological constructs are always limited by the possibility of error (Weathington, Cunningham, & Pittenger, 2010). Some challenges posed by this research were mainly due to idiosyncrasies of study participants (i.e., young children) and the context in which the research was conducted (i.e., schools).

In order to overcome these challenges, the present research used many strategies for minimising error, for example, through careful design and planning of experiments, and collecting data with a variety of methods. Another reason is that using a mixed-methods approach has positive implications for the generalisability of results, in that a combination of quantitative and qualitative data provides a clearer picture of the phenomena. Moreover, the use of mixed methods provides sufficiently rich data to draw accurate and rational inferences (Weathington, Cunningham, & Pittenger, 2010).

In sum, using a research strategy that integrates different methods can produce better results in terms of quality and scope. However, there are also many challenges associated with this effort to integrate the two types of research methods. As Bryman (2007) is careful to note, researchers have a tendency to report only the quantitative or the qualitative data, but not both; or to report findings from one method, followed by findings from the other method, without any attempt to integrate them. Moreover, the researcher had a personal preference for quantitative methods, so inevitably more quantitative techniques were used. In order to overcome these issues, at the end of each study chapter and in the final discussion of this thesis (Chapter Eight), the findings from the five studies with different methods are compared and convergence is sought.

3.4. Participants

This thesis focuses on argument skills of school-aged children. The participants were recruited from primary and secondary schools. The first two studies presented in this thesis focused on three developmental stages. Children were 5-, 8-, and 11- years of age and were in the first, fourth and seventh level of school education, respectively. The next three studies examined age differences in argument evaluation skills. The complex nature of the tasks in these studies required recruiting older participants, namely with ages ranging from 8 to 12 years.

3.4.1. Recruitment

Between March 2008 and July 2010, twelve schools situated in the areas of Berkshire, Middlesex, Windsor *and* Maidenhead, Slough, and Surrey, in South East England, were approached for recruitment into five studies on age differences in children's argument skills. A total of five hundred and eighty children, aged 5-, 8-, and 11- years, participated in five experimental studies. Both genders were equally represented. Students were of heterogeneous ethnic (mostly European) and socioeconomic (mostly middle class) backgrounds.

3.4.2. Sample characteristics and scope in this project

As stated in Chapter Two, the main purpose of the current project was to study age differences in children's argument skills. This research extends the previous investigation by involving participants younger than those who participated in the studies mentioned in the literature review chapter (e.g, Kuhn, 1991; Means & Voss, 1996), and takes into account personal variables such as knowledge of, and interest in the topic to be argued. These two variables should be controlled, given the findings of previous research. For instance, Means and Voss (1996) found that knowledge about the topic was related to the number of arguments and types of justifications generated by secondary students. Previous research on learning from a text in college students has documented that knowledge and interest are both significant predictors of comprehension of a text's meaning (Alexander & Murphy, 1999; Alexander, Kulikowich, & Schulze, 1994; Boscolo & Mason, 2003; Schiefele, 1996). Moreover, Stein and colleagues have found that preschool children have complex knowledge of argument in social situations that are familiar or personally significant, such as past conflicts between mother and child (e.g., Stein & Albro, 2001; Stein & Miller, 1993a, 1993b). Given these findings, it was expected that the two motivating variables - knowledge and interest - would influence children's willingness to persist in the tasks and their ability to construct arguments about the topics. Although the effects of topic knowledge and interest on argumentation were not directly examined, the tasks designed for the present studies were carefully piloted to ensure that children were familiar with and engaged in the topics. This is a challenging but an important research goal, because the study of arguments related with topics that children understand and are interested in may reveal knowledge and strategies not found when children are asked to respond to arguments that carry little personal meaning.

The first set of studies focused on how children generate arguments, when engaging in an interview with the researcher (Study One), and when discussing an argumentative topic with their peers (Study Two). In these two studies, tasks involved socio-moral topics drawn from children's story books, written for children aged 5 to 12 years (e.g., *helping others, trusting others, stealing* and *lying*). Because preschool children would not be able to engage in the tasks designed for this set of studies, it was decided to carry out the project with school-age children only. The starting point was to select children in the first level of primary education, when they were 5-6 years old. A two-year gap was added to the youngest group for selecting the next two groups. The first two studies were, therefore, based on samples of children at three different age groups: 5-6 years, 8-9 years, and 11-12 years.

The next two studies (Studies Three and Four) involved more demanding tasks in terms of children's knowledge of current social issues (e.g., *wearing school uniforms* and *receiving pocket money*). They also required that children had acquired reading and writing skills and had learnt how to use a computer. Hence, the youngest group included in these studies were 8-9 year old children. At this age, children are in the fourth level of primary education, and they are supposed to have acquired literacy skills, and also basic computer skills through *Information and Communication Technology* (ICT) lessons. Moreover, at 8 years of age, children are in an important transitional stage in terms of starting to take into account other's perspectives (as concluded from the results of the previous studies). The interest here was to compare how 8-year olds and 11-year olds evaluate arguments and counterarguments considering their own and others' perspectives.

The fifth and last study focused on age differences in children's ability to recognise argument strategy in argumentative dialogues. The task required children to be good readers in order to comprehend and to fill out a questionnaire, therefore, the youngest group included in this study was again 8-9 year old children.

In order to better understand the contextual characteristics of the sample collected for the present research, a description of the patterns of schooling in England is provided in the next section.

3.4.3. Contextual characteristics: schools in England

Children normally start primary school around the age of five, but many schools have a reception year for four-year-olds. Primary or elementary education forms the first years of formal, structured education that occurs during childhood. Children normally move on to secondary school at the age of 11. The division between primary and secondary education is somewhat arbitrary, but it generally occurs at about 11-12 years of age (adolescence). Some educational systems have separate middle schools for that period (UK Government website for citizens, 2010).

There are two main categories of schools in England: state and independent schools. All children between the ages of five and 16 are entitled to a free place at a state school, so the majority of children attend state schools (UK Government website for citizens, 2010). Most state schools admit both boys and girls, though some are single-sex. There are four main types of state school: community school, foundation and trust school, voluntary-aided school, and voluntary-controlled school. Within the state schools system, there are some schools with particular characteristics, which include for example: specialist schools, faith schools, and grammar schools. They all receive funding from local authorities and follow the *National Curriculum* (UK Government website for citizens, 2010). They are also regularly inspected by the *Office for Standards in Education, Children's Services and Skills* (Ofsted).

The main functions of Ofsted are to inspect and regulate schools to assess the quality and standards of education and identify whether students are achieving as much as they can. After the inspection, schools receive an overall grade from 1 to 4: grade 1 (outstanding), grade 2 (good), grade 3 (satisfactory), and grade 4 (inadequate). The inspectors' findings are published in a report for the school, parents and the wider community. The inspection report provides information about how effective the school's work is and contains recommendations about what the school should do to improve further (Ofsted website, 2010)

Independent schools differ from state schools because they are funded by fees paid by parents and income from investments. Independent schools set their own curriculum and admissions policies, but their standards are also regularly monitored by either Ofsted or an inspectorate approved by the Secretary of State (UK Government website for citizens, 2010).

The National Curriculum includes a set of programmes of study defined for each subject and each key stage. The programmes of study (as defined by the Education Act 1996, section 353b) set out what students should be taught, and attainment targets set out the expected standards of students' performance. It is for schools to choose how they organise their school curriculum to include the programmes of study. When planning, schools should consider the four general teaching requirements: use of language, use of information and communication technologies (ICT), health and safety, and inclusion (National Curriculum, 2010c).

The primary curriculum is organised on the basis of two key stages. At key stages 1 and 2 the statutory subjects that all students must study are art and design, design and technology, English, geography, history, information and communication technologies (ICT), mathematics, music, physical education and science. Religious education must also be provided at key stages 1 and 2. At the end of key stages 1 and 2, children are assessed by National Curriculum Tests (National Curriculum, 2010a; TDA, 2010).

The National Curriculum for England at key stages 3 and 4 was first published by *Qualifications and Curriculum Authority* (QCA) in 2007, and implementation started in September 2008 (QCDA, 2010; National Curriculum, 2010b). As in the primary curriculum, the same four general statutory requirements apply across the secondary curriculum. These include the following areas: inclusion of all learners, use of language, use of ICT, and health and safety. At the end of key stages 3 and 4, students are assessed by national exams.

The National Curriculum is an important element of the school curriculum. The school curriculum comprises all learning and other experiences that each school plans for its students. The two main goals are: (1) to provide opportunities for all students to learn and to achieve, and (2) to promote students' spiritual, moral, social and cultural development and prepare all pupils for the opportunities, responsibilities and experiences of life (National Curriculum, 2011).

As emphasised in the introductory chapter (Chapter One), most teachers recognise that intellectual engagement, and critical thinking plays a significant part in students’ ability to learn and to achieve. In order to learn content, students need to do their own thinking, their own construction of knowledge. However, both National Curriculum and school curriculum offer no guidance on how to put critical thinking concepts and principles into practice.

The topic of this thesis is, thus, extremely relevant for educational practices. Indeed, most of the teachers whose students participated in this thesis were interested in the activities and experiments conducted in their schools and requested more information about the studies, including its results and implications, after they had been concluded.

3.4.4. Data collection

The data presented in the five studies of this thesis were collected at schools. In total the researcher visited 12 schools, including eight primary schools and four secondary schools. Most of these were state schools, and only two were independent schools.

Practical issues such as the availability of research participants, researchers, equipment, and space determined the selection of the school. As a result, it was not possible to match the sample characteristics for each study in all criteria (such as type of school and school performance as reported by Ofsted). Nevertheless, whenever possible, children in different age group targets (e.g., 5-year-olds and 8-year-olds) were recruited from the same school. In addition, for each of the five studies, samples were drawn from schools located in the same broad geographical area.

In the first two studies, samples were collected from one independent school and three different types of state school (voluntary-controlled, voluntary-aided, and community schools). Although these schools differed in type, their overall effectiveness and student's achievement results, reported by Ofsted, were similar. Specifically, all schools received a report with good results (grade 2). Schools were located in the local counties of Windsor *and* Maidenhead, Surrey and Middlessex, in South East England.

In the pilot study conducted prior to the next two studies (Studies Three and Four), participants were recruited from an independent school with outstanding school performance results (grade 1) in Surrey. The sample collected for Study Three was from two community schools with similar school performance results (grade 3 or satisfactory) from Middlessex and Windsor *and* Maidenhead. In Study Four children were also recruited from community schools, but the secondary school situated in the county of Berkshire had better performance results (grade 1 or outstanding) than the primary school (grade 3 or satisfactory), located in Slough.

For the last study, primary school children were recruited from two community schools with satisfactory school performance results (grade 3) located in Windsor *and* Maindenhead, and in Middlessex; whereas secondary school children were drawn from a grammar school with outstanding school performance results (grade 1) in Slough. Grammar schools select all or most students based on their academic ability.

The way in which the different sample characteristics may have affected comparisons between groups and the results of the present studies is unclear. To date, there has been no systematic research on the effects of culture, educational context, and academic performance in children's argument skills. Nevertheless, this issue receives more attention and is further discussed in the concluding chapter (Chapter Eight).

3.5. Instruments and procedures

At the start of the preparation of the present research studies, a survey of existing instruments was conducted to determine whether new instruments were needed to measure argumentation skills in children at different ages. Both Chapter One and a review of the literature (Chapter Two) highlighted the important contribution of Kuhn's approach to the study of argumentation skills. Therefore, a significant part of the present research applied and adapted the methods developed by Kuhn and colleagues, including individual interviews and analytic schemes to assess argument skills in social/ dialogical contexts. The following section describes and evaluates this chosen methodology and highlights important practical issues. Methodological challenges and constraints led to the need to develop new instruments more appropriate for children.

3.5.1. Transactive coding scheme

Deanna Kuhn, Mark Felton, and colleagues have conducted several research studies on how argumentative discourse skills develop with age, starting from adolescence. These skills refer to the ability to conduct effective discussions, by proposing and defending their own ideas and challenging the opponent's arguments. In order to examine this development, the authors devised a coding scheme for analysing dialogues of adolescents and adults on the topic of capital punishment (Felton & Kuhn, 2001). This coding scheme was also applied on subsequent research studies (e.g., Felton, 2004; Kuhn & Udell, 2003, 2007; Udell, 2007). The completed scheme was obtained in manual form from Mark Felton, of the San Jose State University, California.

Purpose of the coding scheme

The coding scheme was designed to describe the interactions between partners engaged in a dialogue. The primary purpose of the coding is to classify the interactive function of a statement rather than the content of the statement (Felton, 2000). The coder must ask, "How is the speaker engaging or interacting with the partner?" Looking at the last utterances of both speaker and the partner gives to the coder a window into the conversational purpose of an utterance. For example, the coder can determine whether the speaker has ignored the partner or not, or how the content of the speaker's utterance relates to the immediate conversation. Because the focus is on how the partners' are interacting, the coder should not relate an utterance to something said long ago in the conversation. Instead, the coder focused on the last utterance of the speaker and of the partner.

Terminology of the coding scheme

As a convention, each conversational turn participants take through the course of a dialogue is referred to as an *utterance*. Participants in a dialogue consist of a *speaker* and a *partner*. The speaker is the person who has produced the utterance under consideration; it applies to whichever person is speaking at the moment. The partner is the person to whom the utterance is addressed. Every utterance exchanged between the speaker and the partner is assigned a code from the transactive coding system (some utterances will warrant more than one code). According to this scheme, any utterance addressed to someone other than the partner (most often the investigator) is assigned a Null (see list of codes, below).

An important note here is that, in Study Two, this coding scheme was applied to group discussions, rather than dialogues. In this case, the coding scheme was adapted to fit the characteristics of the discussions. Specifically, groups were formed by five children, and all participants took turns during discussions. Participants were referred to as *speakers*. Usually, through the course of a discussion, it was expected that participants address the utterance of the last speaker. However, from time to time, the investigator asked a child to clarify his/ her position in relation to the last speaker's utterance (e.g., "So, do you disagree with what [child's name] said?"). In those situations, and every time participants responded to the investigator's prompt questions, participants' utterances were assigned a Null code.

Format of the coding scheme

The codes in the analytic scheme are divided into two categories: transactive questions, and transactive statements. “An utterance is defined as transactive if it attempts to engage the partner in discourse either by referring to the partner’s preceding utterance or by prompting a response from the partner” (Felton & Kuhn, 2001, p. 139).

Transactive questions are those utterances which request a response from the partner, for example “What do you mean?” or “Why do you prefer capital punishment over life in jail?” (p. 140). They are often stated in the form of a question, but they can also take the form of a command or a request to clarify something (e.g., “Now tell me why you say that”). Conversely, transactive statements are those utterances which do not request a response from the partner. Transactive statements refer to the speaker’s thoughts or reactions to the conversation utterances expressed in response to the partner. They can also be interpretations of the partner’s thoughts. A list of codes and a brief definition of each code are provided in Table 3.2.

Table 3.2. Analytic scheme for argumentative discourse (from manual by Felton, 2000, p. 46-47)

Transactive questions	
Agree-?	A question that asks whether the partner will accept or agree with a claim made by the speaker
Clarify?	A request for the partner to clarify his or her proximal utterance
Justify?	A request for the partner to support his or her proximal position or argument
Meta-Question?	A question which relates to the dialogue itself, rather than the content of the dialogue
Position?	A request for the partner to state his or her position on an issue
Probe?	A case or a scenario (hypothetical or real) followed by a request for the partner to take a position
Question?	A simple informational query which does not refer back to the partner’s proximal utterance

Transactive questions	
Respond?	A request for the partner to react to the speaker's immediately preceding utterance
Transactive statements	
Agree	A statement of agreement with the partner's preceding assertion
Clarify	A clarification of speaker's own position or argument in response to the partner's immediately preceding utterance
Continue	A continuation or elaboration of the speaker's own last utterance, adding something new
Counter-A	A disagreement with the partner's immediately preceding utterance, accompanied by an alternate argument
Counter-C	A disagreement with the partner's immediately preceding utterance, critiquing it
Coopt	Acknowledgment, implicit or explicit, that the partner's immediately preceding utterance supports or plays into the speaker's position
Disagree	A simple disagreement without further argument
Dismiss	An assertion that the partner's immediately preceding utterance is irrelevant to the speaker's position
Extend-O	An extension or elaboration of the partner's immediately preceding utterance, adding something new
Interpret	A rewording of the partner's immediately preceding utterance without simply repeating the utterance verbatim or adding something new
Meta- statement	[see meta sub codes] An utterance which relates to the dialogue itself, rather than the content of the dialogue
Null	An unintelligible or irrelevant utterance
Refuse	An explicit claim by the speaker to be unable or unwilling to respond to the partner's transactive question
Respond	The answer to a Question? which does not advance or clarify the speaker's position
Restart	A statement following a string of utterances coded null that

Transactive questions	
	attempts to re-engage the partner in conversation about the topic
Unconnected	A statement with no obvious connection to the immediately preceding utterances of either the partner or the speaker

The coding scheme also includes Meta Sub Codes. These include: (1) Meta-directive: asking the other side to do something; (2) Meta-comprehension; (3) Meta-position; (4) Meta-argument: regarding the argument; (5) Meta-argumentation: regarding the process of argumentation; (6) Meta-t: reference to a technical issue or time; (7) Meta-clarify task; (8) Meta-scenario; (9) Meta-clarify; and (10) Victory claim.

However, because the focus of the present research was not on the study of the meta-cognitive abilities, these codes were not applied to the discourse of children who participated in the studies of this thesis. As referred in the literature review chapter (Chapter Two), there is now a substantial body of literature on issues regarding argument skills and epistemological understanding (e.g., Hofer & Pintrich, 1997; Kuhn, in press; Kuhn & Felton, 2001; Kuhn & Pearsall, 2000; Kuhn & Udell, 2003; Kuhn & Weinstock, 2002; Kuhn, Cheney, & Weinstock, 2000; Stanovich, 1999; Weinstock & Cronin, 2003). It is not within the scope of this thesis to address these issues, but rather to explore the salient features of children's argumentative discourse.

Theoretical framework for the coding scheme

The codes of this analytic scheme are related to some of the elements of Searle's (1979) taxonomy, developed in his theory of speech acts. Transactive questions and statements (Felton & Kuhn, 2001) include both *assertives* and *commissives* from Searle's taxonomy (1979).

Speech Act Theory appears as extremely relevant in the study of argumentation theory, particularly argumentative discourse. The two classic books on speech act theory are *How to do things with words* by Austin (1962), and Searle's (1969) *Discussion of speech acts*, which constitutes an important update of the theory. In 1962, Austin stated for the first time that stating or describing is only one function of language and, thus, some utterances are not statements or questions about some relevant information, but are actions. Searle (1979) classified speech acts into five basic categories, based on the classification of Austin (1962):

1. *Assertives*: according to Searle, the purpose of the components of the assertive class is to "commit the speaker to something being in the case, to the truth of the expressed proposition." Searle explain that all these components "are assessable on the dimension of assessment which includes *true* and *false*" (p. 12)

2. *Directives*: these consist of "attempts by the speaker (in varying degrees) to get the hearer to do something, i.e., to perform a speech act" (p. 13). Searle gives some examples of verbs of this class: *ask, order, command, request, beg, plead, pray, entreat,* and also, *invite, permit,* and *advise.*

3. *Commissives:* consist of speech acts whose point is "to commit the speaker (again in varying degrees) to some future course of action" (p. 14). The difference between directives and comissives is that the latter consist of requests to try to get the hearer to do something, not necessarily to commit or obligate him to do it.

4. *Expressives:* the purpose of this class is "to express the psychological state specified in the sincerity condition about a state of affairs specified in the propositional content" (p. 15). Expressive verbs include: *thank, congratulate, apologize, condole, deplore,* and *welcome.*

5. *Declarations:* these include making a statement in which the propositional content corresponds to the reality. Searle exemplifies: "If I successfully perform the act of nominating you as a candidate, then you are a candidate" (p. 17).

In some cases, the speaker utters a sentence that does not mean exactly and literally what he says. For example, in hints, insinuation, irony and metaphor, the speaker's utterance meaning might not correspond to the sentence meaning. These are indirect speech acts (Searle, 1979). As noted above, the analytic scheme proposed by Felton and Kuhn (2001) relates to only two of the five categories of speech acts classified in Searle's taxonomy (1979), which are assertives and commissives.

The development of this methodology also drew on the framework originating with Walton (1989), who conceived two goals of argumentation. The first is to obtain commitments from the opponent that can be used to support one's own claims. The second is to challenge and weaken the opponent's position, by critiquing his or her claims. Both of these goals mandate that arguers pay attention to the ideas of the opposing side (Felton & Kuhn, 2001). Thus, the analytic scheme is transactional in nature because the strength of an argument, or the extent to which an argument is effective, is determined by whether and how an arguer addresses the ideas advanced by the opposing side (Goldstein, Crowell, & Kuhn, 2009).

The strategies that can be found in argumentative discourse of adolescents and adults (Felton & Kuhn, 2001) function to direct discourse to address these two goals. The definition and coding of these strategies are detailed in the next section.

Development of the analytic scheme and definition of strategic sequences

The coding scheme was first used to identify the strategies that appeared in simple argumentative discourse, that is, the argumentative discourse of individuals not explicitly trained in these aspects. The scheme was then employed to compare the argumentative discourse strategies exhibited by a group of adolescents to those exhibited by a group of adults (Felton & Kuhn, 2001). Provisional codes were applied to the pilot data, and a total of four researchers came together to ascertain reliability and identify new codes for any utterances that were not classifiable in the provisional system. This process involved some revisions and additions to the initial scheme drafted in 2000 (obtained in manual form from Mark Felton). These changes included:

1. Inclusion of a third category in the analytic scheme - nontransactive statements. "Nontransactive statements are utterances that do not connect to the partner's preceding utterance, that is, they neither address the partner's preceding utterance, nor prompt the partner to respond" (Felton & Kuhn, 2001, p. 140) These include utterances coded as *Continue* and *Unconnected*. *Continue* should be coded when the speaker ignores the partner's preceding utterance and continues his or her own idea. *Unconnected* should be coded when the partner breaks from the preceding conversation and introduces a new argument or idea.
2. Rename the code *Probe?,* defined as a case or a scenario (hypothetical or real) followed by a request for the partner to take a position. This code was later called *Case?*
3. Replacement of the code *Extend-O*, defined as an extension or elaboration of the partner's immediately preceding utterance, adding something new, by two more specific transactive statements: *Add,* and *Advance*. The code Add is defined as an extension or elaboration of the partner's preceding utterance, and the code

Advance is defined as an extension or elaboration of the partner's preceding argument.

4. Inclusion of the code *Aside*, defined as a comment that does not extend or elaborate the partner's preceding utterance; and the code *Substantiate,* defined as an utterance offered in support of the partner's preceding utterance.
5. Exclusion of the code *Restart*.

This revised and summarised version of the analytic scheme, published in 2001 by Felton and Kuhn, was used in the studies presented in this thesis. However, Felton's manual (2000) was also consulted for more detailed information on the definition and description of each code.

This analytic scheme also includes the coding of strategic sequences. Felton and Kuhn (2001) defined strategic sequences as, "patterns of utterances that might represent an attempt to advance or pre-empt an extended argumentative strategy" (p. 145). Based on this analytic system, four sequences of codes were identified: (1) *Corner sequence,* identified when the speaker asks the partner to clarify his position (Clarify-?), or when the speaker tries to interpret the other's response (Interpret), and then, challenges his view advancing a Counter-C; (2) *Case-? sequence***,** which is a variant of the corner sequence defined by Clarify-?, followed by a Counter-C. Instead of Clarify-?, the opening statement is Case-?; (3) *Rebuttal* is defined as presenting a counterargument that follows another counterargument (Counter-A or Counter- C) produced by the partner; (4) *Blocking* occurs when the speaker presents a Counter-C, to reject or counter-argue the premise of a leading question (e.g., Case-?) posed by the preceding speaker.

In Study Two (Chapter Five), these strategic sequences were identified in peer discussions produced by children in three different age groups. Furthermore, in Study Five (Chapter Seven), these strategies were used in argumentative dialogues as stimuli to test whether children recognise the pragmatic function that these strategies play in discussions between arguers.

Multiple coding

Following studies by Kuhn and colleagues, in which the coding scheme was applied (e.g., Felton & Kuhn, 2001; Kuhn & Udell, 2003), all discussions were transcribed and coded by two trained coders blind to treatment, time, and identity of the participants. The coders were the researcher, and the researcher's supervisor. Discussions were examined for inter-coder reliability, and disagreement between coders was resolved by discussion. The researcher coded all discussions, while the researcher's supervisor randomly sampled 20% of the coded discussions and recoded them to establish reliability. Reliability is reported in each study chapter.

Advantages of the coding scheme

This coding scheme can be applied to a broad range of topics. It was originally applied to the topic of capital punishment (Felton & Kuhn, 2001; Kuhn & Udell, 2003). Later, Kuhn's colleagues applied the coding scheme to the topics of abortion (Felton, 2004) and teen pregnancy (Udell, 2007) in a population of adolescents.

For instance, Kuhn and Udell (2003) and Udell (2007) conducted intervention studies with adolescents in which this coding scheme was applied. In particular, the study conducted by Kuhn and Udell (2003) tested the effectiveness of an intervention designed to foster adolescent's argument skills on the topic of capital punishment. Later, Udell (2007) conducted a study to replicate the previous findings, so she tested the effectiveness of an intervention in developing adolescent's argument skills on a personally relevant topic (teen pregnancy) or one of general social relevance (capital punishment). Additionally, Udell (2007) explored the differential effects of the two topics in promoting the transferability of skills to the new topic. In both studies, participants were assigned to pro and con teams formed with peers with contrasting views. All participants then engaged in sessions with a collaborative, goal-based activity providing practice for argumentative thinking. Key-features of these activities included: (1) generating reasons, (2) elaborating reasons, (3) supporting reasons with evidence, (4) evaluating reasons, (5) developing reasons into an argument, (6) examining and evaluating the opposing side's reasons, (7) generating counterarguments to others' reasons, (8) generating rebuttals to others' counterarguments, (9) contemplating mixed evidence, (10) conducting and evaluating two-sided arguments. Participants were then assigned to two conditions; one condition included peer dialogues, and another did not.

Interventions in both studies were successful in developing adolescents' argument skills. Specifically, participants who engaged in the full intervention activity showed an increase in the use of high quality counterarguments (Counter-C) in the posttest assessment. Unlike the previous study, the intervention in the second study was not effective in improving adolescents’ use of the rebuttal strategy (Udell, 2007). The study conducted by Udell (2007) also showed that only the intervention focusing on the personally relevant topic (teen pregnancy) resulted in the transfer to the less personal topic (capital punishment). Transfer to the opposite direction did not occur.

These studies showed that argument skills develop and that engagement in an argumentative discourse activity can promote that development. However, the findings also indicated that skills in argumentation are not transferable to all topics, and the mechanisms governing transfer remain unclear (Udell, 2007). These intervention studies confirm the relevance of studying cognitive development and the reasoning that underlies people’s claims, although they involve adolescents and young adults rather than the age group of current interest. Nonetheless, because the coding scheme was successfully applied in studies with adults using several socio-moral topics, it was worth testing whether it could also be applied to studies with young children. The topics chosen to be deployed in Study Two (Chapter Five) was also of a socio-moral nature (e.g., helping friends, trusting others, and stealing).

This method offers other advantages. First, the coding scheme is based on a theoretical framework, as noted in a previous section in this chapter. Moreover, it allows a direct look at communication via transcripts, and thus gets at the central aspect of social interaction. At the same time, it constitutes an unobtrusive means of analysing those interactions. It also has the advantage of allowing both quantitative and qualitative operations (Weathington, Cunningham, & Pittenger, 2010). Table 3.3, presented below, summarises the advantages and challenges of using this coding scheme in the present research.

Potential limitations of the coding scheme

This coding scheme was originally created to be applied to dyadic discussions, so the major limitation of using this scheme in the present research was that the coding system had to be adapted to fit the discourse of more than two speakers. Specifically, groups were formed of five children, and all participants took turns during discussions. As mentioned earlier, when necessary, in order to verify whether a speaker had addressed the utterance of the last speaker, the investigator had to ask a child to clarify his or her position in relation to the last speaker’s utterance (e.g., “So, do you disagree with what [child’s name] said?”). In those situations, and every time participants responded following the investigator's prompt, participants' utterances were assigned a Null code. However, this happened rather infrequently, as children tended to address or reply to the last speaker in a discussion.

Another disadvantage of applying this coding scheme is that it is extremely time-consuming. Moreover, it can be subject to error, especially when the coder tries to make inferences or interpret the data. Thus, particular attention was given to intercoder reliability to ensure validity of the coding. However, as shown in Table 3.3., the potential advantages of applying this coding scheme far outweigh its disadvantages.

Table 3.3. Advantages and challenges of applying the transactive coding scheme in the present research

Advantages	*Potential limitations and how they were overcome in the present research*
• Can be applied on a broad range of topics (e.g., capital punishment, abortion, teen pregnancy)	• It was originally developed to be applied to dyadic discussions, but it was adapted to fit the discourse of group.
• Its validity was tested in several studies (e.g., Felton, 2004; Felton & Kuhn, 2001; Kuhn & Udell, 2003; Udell, 2007)	• It is time-consuming
• It was developed on a theoretical framework, including the Goal-based Theory (Walton, 1989), and the Theory of Speech Acts (Searle, 1979).	• Subject to human error. For this reason, multiple coding was applied in the analysis. All discussions were transcribed and coded by the researcher. A second coder (the researcher's supervisor) randomly sampled 20% of the coded discussions and recoded them to establish reliability. Both coders were blind to treatment, time, and identity of the participants.
• It permits looking directly at communication via transcripts, and thus gets at the central aspect of social interaction	
• It is an unobtrusive means of analysing discourse in social interactions	
• It allows both quantitative and qualitative operations in further analyses	

3.5.2. Surveys: interviews and questionnaires

Stangor (2007) defines a survey as “a series of self-report measures administered either through an interview or a written questionnaire” (p. 103). Surveys are used to collect descriptive data from a sample of individuals. The goal is to produce a “snapshot” of the points of view, attitudes or behaviours of a group of people at a given time. Both interview and questionnaire approaches were used in the studies outlined in this thesis.

The research interview is used to assess individuals’ thoughts, feelings, and behaviours (Kvale & Brinkmann, 2009). The researcher in one-to-one interviews collects personal information from participants using a series of oral questions. One advantage of in-person interviews is that they may allow the researcher to develop a closer rapport and sense of trust with the participant (Stangor, 2007). This is of particular relevance when interviewing a young population, because children may often feel shy or fearful around strangers (Breakwell, 1995). When children start feeling comfortable around the researcher, they are more motivated to continue the interview and to give more honest and open responses. However, one disadvantage of face-to-face interviews is that they are extremely time-consuming both in terms of conducting and transcribing them.

Interviews can give both qualitative and quantitative data, depending on the standardisation and/ or free ranging nature of questions asked (Kvale & Brinkmann, 2009). In order to obtain more objective data, a structured interview, which uses quantitative fixed-format items, was chosen for the methodology of Study One (see Chapter Four). The questions were prepared ahead of time, and the researcher read the questions to the participant. A detailed interview structure is outlined in the next subsection.

The structured interview has the advantage over an unstructured interview in allowing better comparisons of the responses across participants, because the research topic is investigated in a consistent way, that is, the questions, time frame and response format are the same for each participant. It is then possible to generalise the findings to the population from which the interview sample was drawn (Stangor, 2007). Stein and Miller (1993a) also recognised the need to conduct more developmental studies on the ability to understand and generate discourse under more structures circumstances, rather than rely on the results obtained on the basis of children’s spontaneous generation of arguments. Spontaneous argumentative discourse is constrained by quality and type of evidence offered by the arguers. Sophisticated reasoning may be used only if necessary or demanded in response to a question or a counterargument. Thus, using a structured interview allows a better examination of children’s complex argument skills.

There are also disadvantages associated with the structured interview format. For instance, this format can make it difficult to examine complex skills, such as the skills involved in producing and defending points of views and arguments. Moreover, restrictive questioning may lead to restrictive answers. There is also the consideration of whether the questions are valid, that is, whether they measure the skill that they were supposed to be measuring.

Interview to assess argument generation (adapted from Kuhn, 1991)

In the book *The Skills of Argument* (1991), Kuhn described a carefully designed and executed set of interviews about the understanding and use of arguments in the broad sense. The study involved subjects across the life span, ranging in age from adolescence to late adulthood. Kuhn (1991) asked questions that most people have occasion to think and talk about in everyday life, such as "What causes prisoners to return to crime after they are released?"; "What causes unemployment?"; "What causes children to fail in school?" Participants were asked to offer their own explanations regarding the cause of the phenomenon and then asked to provide supporting evidence for their assertions. The fact that people were asked about real, meaningful issues that were familiar to them in their own experience is an important feature of this study and one that sets it apart from traditional research on reasoning. Another defining feature of Kuhn’s methodology (1991) is that it allowed an examination of individuals’ ability to produce arguments and counterarguments (in a similar way that would occur in a dialogic, social context), but in a one-to-one interview. More specifically, after participants produced justifications to support their points of view, they were challenged with opposing assertions and asked to evaluate the new evidence. For example, to elicit opposing positions and counterarguments, the interviewer asked: “Suppose now that someone disagreed with your view that this is the cause. What might *they* say to show that you were wrong?” Then, the participant was asked for a rebuttal: “What could you say to show that this person was wrong?” (Kuhn, 1991, p. 17).

This approach made it possible to examine individuals' mastery of argumentative reasoning skills while avoiding many of the complicating factors, of a social nature, that are involved in dialogic contexts (Kuhn, 1991). This idea of connecting social and mental processes had already been noticed by some researchers. The most influential were Vygotsky (1978) and Piaget (1950) who incorporated it in their theories. However, Kuhn's research (1991) offered an important update to these early theories and contributed to a better understanding of how people reason about everyday phenomena. Since its publication, Kuhn's study (1991) has had a great influence on investigators concerned with the development of reasoning competences, such as Leitão (2003), Means and Voss (1996), and Voss and van Dyke (2001).

In this research, Kuhn's work also served as a theoretical and methodological basis to establish the criteria of quality of arguments. In the present research, however, the focus was on early development: childhood and early adolescence. For instance, Study One (Chapter Four) evaluated whether children, aged 5-, 8-, and 11- years, were able to generate various elements of argumentation, such as counterarguments. Table 3.4. provides an illustration of the interview used in the pretest assessment of children's argument skills. The interview structure was adapted from Kuhn (1991), who assessed similar skills in adolescents and adults. Follow-up questions and probes were used in interviews to reinforce instructions, in order to clarify meaning and to give encouragement to research participants. These included both verbal (e.g., "Uh huh"; "Mmm"; "Can you tell me more about that?"; "Can you think of other reasons to justify your point of view?), and non-verbal probes (e.g., nod of the head; silent pause).

Table 3.4. Interview for assessment of argument skill illustrated for the sharing topic (adapted from Kuhn, 1991, p. 299-300)

Generating arguments and reasons

1) Do you think that ___? (e.g., people should share their things with others or keep what they like for themselves?)
2) Why? Try to give reasons to explain your position.
   a) (*Probe, if necessary*) Can you give some reasons why you think "people should ___?"
   b) If you were trying to convince someone (or a child with the same age) that your view is right, what reasons could you mention to convince that person that "people should ___?"
   c) (*Probe, when child completes initial response*) Can you think of anything else?

Generating opposing positions and counterarguments

1) Imagine now that someone disagreed with your opinion that "people should ___ because ___" What opposing reasons could this person say to show that you were wrong?
   a) (*If child does not understand)* Suppose a person has a view very different from yours - what might they say to convince you that you were wrong?
   b) *(Probe, if necessary)* Can you think of anything else?
   c) *(If both sides of the question mentioned and counterarguments already indicated)* You mentioned some reasons why "people should ___" Just to be sure I understand, can you explain a little bit more about these reasons, or think about other reasons to justify this alternative position?

Generating rebuttals

1) And what could you say to convince this person that he or she is wrong?
   a) *(Include if no counterargument generated)* Suppose that someone disagreed with you and said that people should ___ because ___. What could you say to show that the person was wrong?
   b) (*If not already indicated)* What could you say to show that your own opinion is the correct one and what reasons would you give to defend it?

A questionnaire is a set of fixed-format, self-report items that is completed by participants (Stangor, 2007). Self-administered questionnaires include instructions to the respondent, for example answering procedures ("Tick-one"; "Put a circle on the item you prefer"), and participants can answer at their own pace, often without supervision. In computer-assisted questionnaires (used in Studies Three and Four), instructions, definitions and routing directives appeared on the screen in the particular coding used by the system. In comparison to interviews, questionnaires may produce more honest responses, because participants are more likely to perceive them as being anonymous, and thus may be more likely to respond truthfully. Moreover, questionnaires are more likely to be less influenced by the characteristics of the researcher, because the researcher is not directly asking the questions like in interviews (Stangor, 2007).

Since the target population in the present research involved young children, the researcher was always present when the questionnaire was being completed and ready to clarify any questions. Also, for the youngest group of children (8-9 years), the researcher "worked through" the questionnaire, by reading the questions aloud and providing further clarifications whenever necessary. Thus, like in the previous method (interviews), it is likely that the researcher's characteristics (for example, gender, age, accent, etc.) influenced children's willingness to participate and to answer accurately. Although such researcher effects could not be eliminated, steps were taken to control them. For instance, the female researcher conducted all studies involving questionnaires and interviews. This allowed holding constant the stimulus provided by the researcher. Moreover, the researcher followed guidelines to clarify children's questions consistently and debrief participants in a systematic manner.

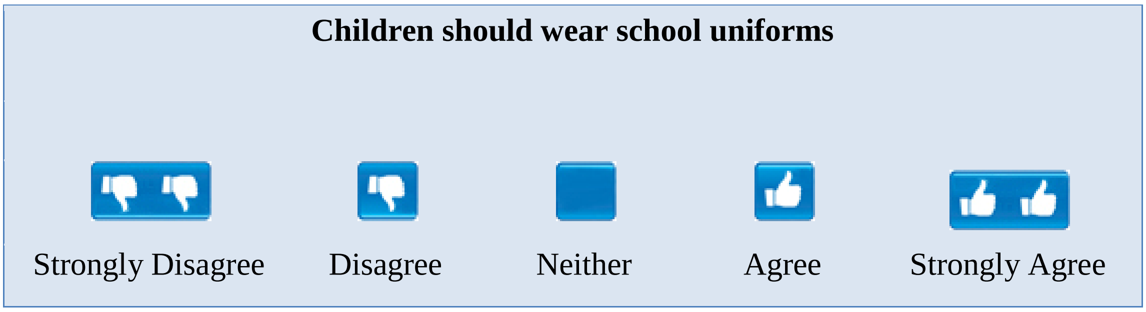
The design of questionnaires was carefully planned to appear brief and interesting. Additionally, the researcher tried to increase children's response rate and motivation, by ensuring the confidentiality of all data, by emphasising the importance of their participation in the research and by providing praise and stickers (e.g., "Well done!"; "Keep up the good work!") for completing the questionnaire.

Question response formats

There are two main types of questions: open-ended questions that ask participants to generate their own responses to the questions, and closed-ended questions that require participants to select a response choice from a set of options (Weathington, Cunningham, & Pittenger, 2010). For the purpose of the present research, and accordingly for the research questions and hypotheses formulated, questionnaires were constructed with only closed-ended questions. Furthermore, closed-ended questions were preferred over open-ended questions for two reasons. First, many children, especially the youngest group (8-9 years), would have had difficulty in writing out their own responses or would had provided minimal or vague answers to open-ended questions. Second, the closed-ended response format is easier to evaluate objectively.

The formats for closed-response question used in the present studies were numerical response format, and forced choice alternatives. In some studies, these two formats were combined. The numerical response format, often referred to as the Likert format (Likert, 1932), is one of the most common options for the closed-response format questionnaire for two main reasons (Weathington, Cunningham, & Pittenger, 2010). First, it offers a clear and unambiguous ordinal scale of measurement. Second, the same format can be used for several different questions, so that responses to multiple questions can be combined to obtain an average score.

The scales designed for Study Three (detailed in Chapter Six) used a Likert response format. A five-point response set was employed in these scales. The middlemost response option in these scales was a neutral choice (e.g., neither or neutral). The advantage of offering a middle alternative position is that participants will not feel forced or constrained to choose one of the polar positions (e.g., agree or disagree), which could produce an unreliable measure (Clark-Carter, 2009). Figure 3.1. presents examples of a Likert-type response format used in Study Three. As shown in Figure 3.1., visual cues (figures of thumbs up and down) were added to facilitate children’s understanding of the scale.



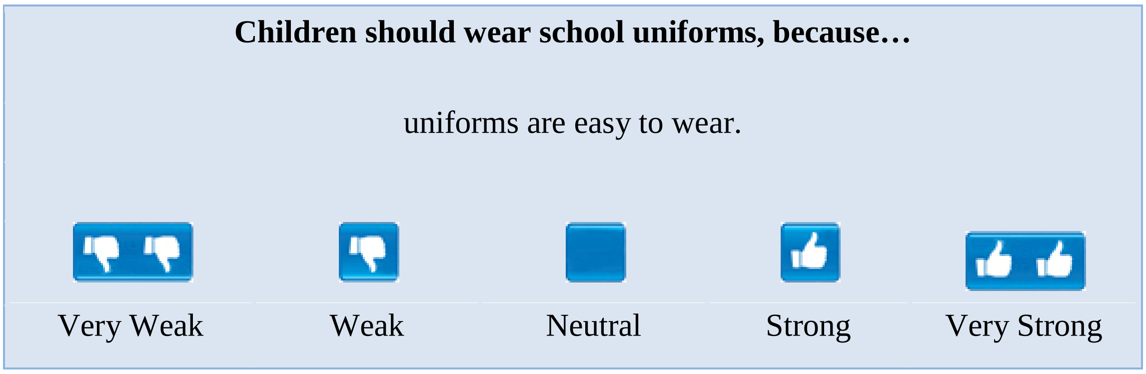


Figure 3.1. *Examples of the Likert format drawn from methodology of Study Three*

Study Four (Chapter Six) and Study Five (Chapter Seven) used both the Likert format and forced choice format. In the forced choice format, participants were asked to select a response that best represented their answer to the question. In Study Four, children were asked to *click* (using the mouse of the computer) on the statement that best answered the question (see Figure 3.2). In Study Five (see Chapter Seven), children were given a paper-and-pencil format questionnaire and asked to choose one of the several alternative items. Figure 3.3 represents examples of forced choice alternative items used in Study Five.

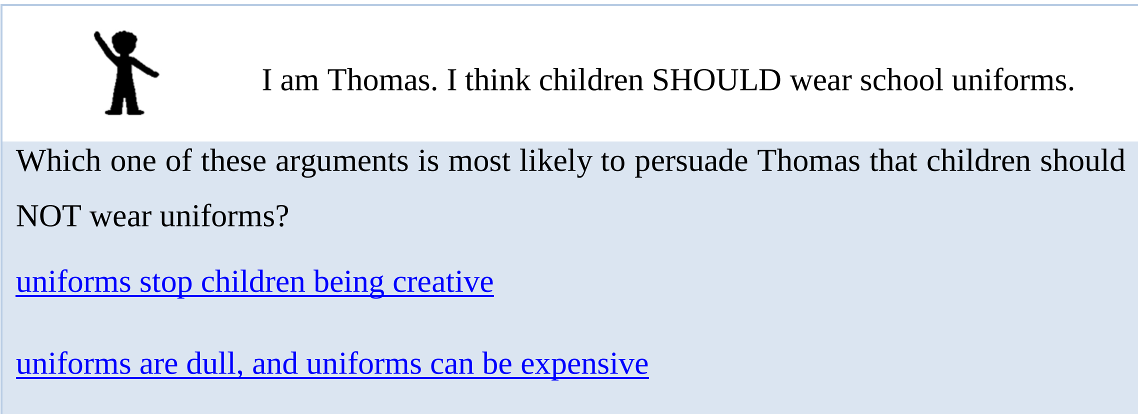


Figure 3.2. *Example of forced choice alternatives used in Study Four*

Please check or circle the appropriate number:	
If you had to choose, which thing on the list would you pick as the most important thing to explain your previous answer?	(1) The inventor had the best arguments
	(2) The opponent had the best arguments
	(3) Both inventor and opponent had strong arguments
	(4) I do not know
Who do you think should be the winner for the category "Technology" in this competition?	Inventor of the translation telephone
	Inventor of the flying car

Figure 3.3. Example of forced choice alternatives used in Study Five

3.5.3. Challenges of conducting surveys with children in schools

Conducting surveys (interviews and questionnaires) with children in schools presents several challenges. For example, there are the logistics of lessons and breaks to cope with, which result in limited time to interview children on an individual basis (Oppenheim, 1992). There are the additional problems of overcoming the children's possible fear of strangers and obtaining honest and valid responses. Children are often unwilling to assert themselves or to contradict an adult and, therefore, they tend to answer questions in the way they think the researcher expects them to do (Breakwell, 1995). In order to overcome this difficulty, children were told by the researcher that she was only interested in their ideas and that there were no right or wrong answers.

Children were also reassured that their participation was voluntary and that they were allowed to withdraw from the study at any point if they did not wish to continue.

In addition, particular attention was given to the wording of the instructions and the questions, to avoid acquiescence bias. There is a strong acquiescence response bias in children: they tend to say "yes", irrespective of the question or what they think about it, particularly when they are eager to please (Breakwell, 1995). Therefore, when children gave yes/no answers, prompt questions were used to elicit more ideas. Children also exhibit a preference for "don't know" responses. They say "don't know" for various reasons: they are not interested in answering, they do not understand the question, they are too shy to say more, they do not know how to explain what they know, and they really do not know. Thus, conclusions based on "don't know" responses were treated with caution in the discussion of the studies. Each of the four empirical chapters presented in this thesis addressed this question in more detail.

Another difficulty in conducting surveys with children is that they are relatively easily distracted. Young children tend to pay attention to unpredictable aspects of the interview or the questions. In order to improve children's concentration, the researcher chose, whenever possible, a quiet location in school, for example an empty classroom or the library. Interviews and questionnaires were also kept short, for example, in Study One, individuals interviews took less than 10 minutes to complete. Moreover, the researcher tried to retain children's attention by covering different topics in the interviews, changing the pace, and asking questions accompanied with visual materials. For instance, in Studies Three and Four computer-based questionnaires included figures and visual clues (e.g., thumb-up or thumbs-down, see Figure 3.1).

In many situations, either during interviews or completion of questionnaires, children tended to ask the researcher a lot of personal questions. They were curious about the researcher, for example whether she was new, and why she was there. The strategy adopted here was to respond to the questions briefly, without showing any exasperation. Occasionally, a child got into the infinite series of "Why?" questions. In these cases, the researcher tried to distract the child with a new topic.

Some children, who were shy or had vocabulary deficits, showed hesitation in answering questions. In these occasions, the researcher avoided offering suitable words. Instead, children were told that they could take as much time as they needed to think about and answer the question. An alternative strategy was to rephrase the question or move on to the next topic.

Moreover, because children were tested at schools, they had to leave the classroom, complete the survey and return to the class. Once back, they were liable to talk about the interview or the questionnaire with other classmates who would subsequently participate in the study. This introduced the possibility of a feedback loop with early participants acting as informants for later participants. As a result, the later participants could develop a distorted expectation of what the research task entailed. In order to overcome this problem, later participants were asked what they heard and what they expected and then any misconceptions were clarified. This was better controlled in Studies Three and Four, in which computer-based tasks were used, because all children in the class completed the test at the same time. Another advantage of using computer-based tasks was that the questions and topics were randomised, making it more difficult for early participants to inform later participants.

Recording interviews and children's interactions can be especially difficult when the researcher is taking notes. For instance, children may give contradictory responses, or they may lose interest while the researcher is taking notes. For these reasons, the interviews (Study One) and group discussions (Study Two) were recorded using audio or video recording.

Another difficulty in conducting surveys with children at different ages is to design interviews and questionnaires adequate to their level of literacy and knowledge. In order to overcome this problem, the procedures were reviewed carefully in the pilot stage. Furthermore, prior to the design, the researcher spent some time observing and assisting in classroom activities, to become more familiar with the activities that students normally undertake in school. For instance, the idea of designing a task about scientific inventions (Study Five) came up after observing that s*cience competitions* were a popular activity among fourth graders in various schools.

In sum, there are a number of challenges in interviewing children in schools that were carefully evaluated before designing and conducting the research studies presented in this thesis. These include: duration of lessons and breaks in schools; fear of strangers; the tendency to say "yes"; the tendency to say "don't know"; susceptibility to distraction; the urge to prompt; feedback loops; recording difficulties; and creating appropriate surveys for children.

3.5.4. Sampling and generalisation

Random sampling requires the specification of a population of subjects and then the assurance that each subject has an equally likely chance of being selected for the study (Keppel & Wickens, 2004). In order to meet these conditions, students were selected randomly from a class in a specific year group, and then each student was invited to participate in the study in a random order.

Besides selecting randomly the sample of students in schools, each subject was then assigned randomly to different conditions in the experiments. For instance, in Study One (see Chapter Four), children were assigned randomly to one of the treatment conditions - the control group and the experimental group. Both random sampling and random assignment are important requirements for the generalisability of the results of the studies to the population (Keppel & Wickens, 2004).

3.5.5. Piloting

Conducting studies with school children requires additional care in the pilot stage (Oppenheim, 1992). Small-scale studies were designed to test logistics and gather information prior to the larger studies in order to improve the latter's quality and efficiency. In this preliminary stage, different methods were used, including focus groups and survey questionnaires. These procedures are further explained in the sections that follow.

Focus group

Focus group is a method of inquiry designed to collect qualitative data. Byers and Wilcox (1991) describe focus groups as discussion groups that address a particular topic or topics. One of the characteristics that distinguishes focus groups from other qualitative methods is the group discussion. Krueger and Casey (2009) define focus group interviews as "a planned series of discussions designed to obtain perceptions on a defined area of interest in a permissive, non-threatening environment" (p. 2). The major assumption of the focus groups is that with a permissive atmosphere that fosters a range of opinions, a better understanding of the topics will be obtained. There are a variety of definitions of focus groups. These definitions usually contain the following core elements (Vaughn, Schumm, & Sinagub, 1996, p. 5): (i) the group is an informal assembly of target persons whose points of view are requested to address a selected topic; (ii) the group is small, 6 to 12 members, and is relatively homogenous; (iii) a moderator with prepared questions and probes sets the stage and induces participants' responses; (iv) the goal is to elicit perceptions, feelings, attitudes, and ideas of participants about a selected topic; and (v) focus groups do not generate quantitative information that can be projected to a larger population.

Focus groups differ from other small-group interview procedures for two reasons (Vaughn, Schumm, & Sinagub, 1996). First, in contrast to informal small groups conducted to collect people's points of view, focus groups are more organised, more formal, and the findings result from analysis of the transcriptions from the interviews. A second distinction between focus groups and small groups is that small groups are usually carried out with the goal of consensus building or problem solving. In contrast, reaching a consensus is not an explicit goal of focus groups. Rather, the main goal is to find out people's points of view on a topic.

This method was chosen for the pilot study of Studies Three and Four, discussed in Chapter Six. The main goal of using focus groups for this pilot study was to gather children's points of view and knowledge on different topics. Two focus groups (of 6 children each) were formed, rather than just one in order to obtain a better sense of which topics were most important. Having more than one group enables an identification of which issues are specific to a single group and which ones come up repeatedly (Morgan, 1998). A less structured approach of focus group was chosen, because the purpose of using the focus group technique was exploratory. The specific objectives were to discover children's perspective on the proposed research topics, and to generate new ideas and insights related to those topics. Because the emphasis was on discovery and exploration, the researcher gave children the freedom to determine the content of their discussions and used a flexible approach to create a productive group dynamic.

The researcher exercised direct control over the discussion only in rare occasions, for example, when one child was dominating the entire discussion and not letting other children participate. Open-ended questions were used to explore the topics and generate ideas. The resulting responses from the group discussions were then used as a basis for developing a meaningful set of closed alternatives for these studies.

Focus groups are best used to obtain participants' opinions but not to determine the exact strength of their opinions (Vaughn, Schumm, & Sinagub, 1996). Although the researcher can probe to determine how strongly participants feel, quantitative methods are more appropriate for that information. For this reason, the pilot studies conducted also included the use of survey measures, which are described in the next section.

Survey questionnaire

Survey questionnaires are extremely useful for obtaining a large quantity of data quickly and with minimal expense (Weathington, Cunningham, & Pittenger, 2010). For these reasons, a questionnaire was developed prior to conducting Study Five (see Chapter Seven) to gather information on the sorts of arguments individuals consider strong. The data obtained in this pilot stage were then used to devise materials for the main study. For this particular pilot study, a convenience sample was used, that is, undergraduate students were chosen to take part in the study because they were easy to find.

3.5.6. Using computers to collect data

Collecting data from research participants with computers has several important advantages. First, computers can help standardise conditions, by ensuring that each participant receives the same stimuli, in the same order, and for the same amount of time. Computers are also helpful in presenting and collecting information in ways that would be difficult or impossible to do without them. In terms of presenting information, computers can randomly select stimuli from lists, allowing counterbalancing across research participants. Moreover, computers can also keep track of which stimuli have been presented, and which order (Stangor, 2007). In terms of collecting information, computers can collect virtually any data, for example, responses in a specific format and reaction times. Computers can also be programmed so that participants must answer each item before they continue, thereby reducing the amount of missing data. Furthermore, using computers to collect data allows the researcher to leave the lab room after research participants start the procedure, thus reducing the possibility of distraction and also researcher bias.

Computer program to assess how children evaluate arguments

In Studies Three and Four (both detailed in Chapter Six), children’s ability to evaluate strong and persuasive arguments was assessed using a computer. The task consisted of a self-completion computer test, with instructions and questions appearing on the screen. The software package used was Active Server Pages (ASP), developed by Microsoft. This package allows the researcher to create web pages that are connected to a database. The database had three functions: (1) hold lists of stimuli, including text and pictures; (2) present stimuli chosen randomly from lists and place them in specific locations on the screen, and (3) collect demographic information, responses and reaction times from participants. This allowed the researcher to present different stimuli in different conditions, thus counterbalancing arguments and topics.

Despite these many advantages, using computers also has some disadvantages. First, because each child had to have his or her own computer, the number of participants that could be tested at the same time was limited. More specifically, the number of computers available in schools varied from 10 to 30. Furthermore, it is possible that some children may not have paid full attention to or did not follow the instructions given by the computer, and the researcher would not have been able to check up on whether they had. Computers may also malfunction in some cases. Another disadvantage is that the software used in these studies did not allow importing the data file directly into the statistical software packages used, including Excel and SPSS. Therefore, the data were entered manually.

3.6. Analyses and statistical procedures

Specific details of how data were analysed, and the rationale for using particular statistical tests are provided in each of the four empirical chapters. However, some general issues are discussed in this section. Firstly, data were analysed using SPSS version 14.0.1 for Windows. In accordance with the recommendations of Howitt and Cramer (2008), the data were screened for accuracy of data entry, missing values, outliers, and normality, prior to any analyses. This included using frequency distributions, graphs and descriptive statistics to screen the data.

There are several options for handling missing data, including deletion of cases or variables and replacement of missing data (i.e., imputation). Howitt and Cramer, (2008) advise that the former can be used if only a few cases have missing data and they are randomly distributed through the data. Thus, for every missing value in the datasets, subjects with the missing values were deleted. For example, in Study One (see Chapter Four), six out of 190 participants missed at least one day of the one-week testing program; therefore, these cases were deleted from the dataset. The disadvantage to this approach is that it reduces the sample size of the data. However, because this study had a large dataset, there were enough subjects even after deleting the cases with missing values. Similarly, for the datasets of studies that employed web designed questionnaires (Studies Three and Four) and paper-and-pencil questionnaires (Study Five), cases with missing values were deleted, once the examination had revealed the missing data to be randomly distributed.

In order to check the distribution of the data, histograms were plotted and the values of skewness and kurtosis were examined. Skewness involves the symmetry of the distribution. Skewness that is normal involves a perfectly symmetric distribution. A positively skewed distribution has scores clustered to the left, with the tail extending to the right. A negatively skewed distribution has scores clustered to the right, with the tail extending to the left. Kurtosis involves the peakedness of the distribution. Kurtosis that is normal involves a distribution that is bell-shaped and not too peaked or flat. Positive kurtosis is indicated by a peak. Negative kurtosis is indicated by a flat distribution (Howitt & Cramer, 2008). Thus, the further the value is from zero, the more likely it is that the data are normally distributed (Brace, Kemp, & Snelgar, 2006). In addition to this, Shapiro-Wilk was used as an objective test of normality. This gives an indication of whether a distribution follows the normal curve. If the test is non-significant ($p > .05$), this indicates that the distribution of the sample is not significantly different from a normal distribution. However, if the test is significant ($p < .05$) then the data are normally distributed (Brace et al., 2006).

Following screening of the data, descriptive statistics were used to describe the data. In all studies presented in this thesis, descriptive statistics are reported, including measures of central tendency (e.g., mean, median), and measures of dispersion (e.g., range, standard deviation, variance) (Brace et al., 2006). Inferential statistics were then used to examine the research hypotheses, of which there are two main types: parametric and non-parametric.

Parametric statistical tests make assumptions about the population parameters and the nature of the distribution of scores in the population. The common assumptions are that the scores are normally distributed in the population (or have the classic “bell-shape” curve), or that the distribution of (hypothetical) sample means is normally distributed. Also they assume that the random sample has been drawn from this population of scores. Some parametric tests also assume that the variances of population scores are the same in the treatment groups (Fife-Schaw, 1995). Whenever appropriate for the data of these studies, parametric tests were chosen in preference to their non-parametric equivalents, because they are more powerful and are better able to detect treatment effects. However, the data in most studies in this thesis did not satisfy the assumptions of parametric tests. Hence, the non-parametric alternatives to the parametric tests were used, including in first study, and also in Studies Three, Four and Five. Selecting non-parametric statistical tests for analysing the data in these studies was the appropriate choice, because the measures were ordinal and categorical. As Fife-Schaw (1995) is careful to note, to truly establish the normality of a distribution, it is required to estimate its mean and variance. However, it is difficult to establish this assumption with ordinal and categorical data.

Hypothesis testing with non-parametric tests proceeds by creating sampling distributions which apply to the specificities of each study, including the data, design and null hypothesis, and calculating all possible values of the relevant test statistics. Then non-parametric tests examine whether the observed value obtained in the test statistic is relatively extreme and therefore unlikely to have occurred by chance, considering the null hypothesis to be true (Fife-Schaw, 1995). While not identical to the procedures used with parametric tests, the basic logic of hypothesis testing remains the same for both types of tests. By convention, if the probability of observing a mean as different from that predicted by the null hypothesis (under the hypothesis that the H_0 is true) is less than $p = .05$, then the null hypothesis is rejected. However, if the probability is not less than .05 then the null hypothesis is not rejected (Fife-Schaw, 1995).

When hypothesis testing, it is important to decide whether to make a one-tailed or two-tailed test of the null hypothesis (Brace et al., 2006). In an one-tailed test, the null hypothesis is rejected if the difference between the observed mean and that predicted under the H_0 is relatively small but is in a previously specified direction. On the other hand, a two-tailed test requires a somewhat larger difference but is independent of the direction of difference (Brace et al., 2006). In the first set of studies presented in this thesis, the focus was in finding strong relationships regardless of whether they were positive or negative, and so two-tailed tests were used. In the following studies, stronger hypotheses were formulated that specified the direction of the expected effect. In these cases, the less conservative one-tailed test was used.

As all studies employed cross-sectional designs, the data were analysed in terms of group comparisons and in terms of associations and correlations (Brace et al., 2006). For example, the independent *t*-test and the Mann-Whitney Test (the non-parametric equivalent of the *t*-test), were used as tests of difference for two sample designs, and the Spearman’s r_s was used as a test of correlation. Details of these analyses are provided in the relevant study chapters.

3.7. Common ethical issues across studies

The way in which participants are treated and how they can benefit, even indirectly, from participating in research is one of the most important issues in research

(Salkind, 2003). Several basic principles were addressed to ensure ethical research across the studies presented in this thesis: applying and obtaining ethical approval, protection from harm, anonymity and confidentiality, informed consent and debriefing, and considerations about using college students in research.

3.7.1. Ethical approval

All research studies presented in this thesis obtained ethical approval from the Department Ethics Committee (DEC). The series of five studies conducted involved different research designs and methods; therefore, separate approval was requested to cover the different projects. The researcher requested ethical approval from the Royal Holloway, University of London Research Ethics Committee for the first set of studies in January 2008. This involved completing the Psychology Departmental Ethics Approval Form, which required the specification of the following criteria: title of project, purpose of project and its academic rationale, description of methods and measurements, participants, consent and participant information agreements, debriefing, statement of ethical considerations, estimation start date and duration of project. Ethical approval for Studies One and Two was obtained within one month after submission of the request form. New ethical approval was requested in December 2008 to cover the next set of studies (Studies Three and Four), through the same application process. Once more, new ethical approval was requested in September 2009 for the fifth and last study in this thesis. All research projects were approved without raising any significant ethical questions. As these research studies were conducted with children, across a number of schools, the researcher was also required to have a Criminal Record Bureau (CRB) check. A valid CRB check was obtained on the 4th of March 2008, and data collection for the first study started in late March 2008.

3.7.2. Protection from harm

All studies were innocuous and the tasks and methods involved did not differ substantively from the sorts of activities that children would engage in on an everyday basis at school, during classes or *Personal, Social, and Health Education* (PSHE) lessons. In fact, most tasks were planned and designed in accordance with children’s educational level and school curriculum. Moreover, the researcher benefited from the input of professionals who had first hand experience of children's abilities on a daily basis.

The objectives of the studies developed in this research included not only preventing physical or psychological harm by designing appropriate tasks for children, but also considering the potential benefits to children by participating in these studies. For instance, all children received incentives for participation. Moreover, according to teachers, children also benefited from discussing some research topics, for example the socio-moral issues addressed in the first two studies (e.g., sharing with others, helping others, etc.). In fact, some teachers used these topics for further debate and discussion in their classes after research had been conducted.

3.7.3. Anonymity and confidentiality

Anonymity was maintained across studies through the use of a single master sheet which contained both the names of the participant and their participant number. Only the number was placed on scoring sheets and databases. The list of corresponding names and numbers was kept in a secure and locked place at the university.

Data and audio or video recorded material and information on each child were held in the strictest confidence and seen only by the researcher and her supervisor. Children were asked for informed consent prior to the use of recording.

3.7.4. Informed consent and debriefing

Consent letters for parents or legal guardians were written according to British Psychological Society (BPS) and American Psychological Association (APA) guidelines, specifically the format outlined in the fifth edition of the *Publication Manual of the American Psychological Association* (2001). Active parental consent was requested for children participating in recording material (audio or video). An example of a template letter asking for active parental consent is attached in Appendix 2. For studies that only required children to fill out a questionnaire, passive parental consent was requested. An example of a template letter asking for passive parental consent is attached in Appendix 14. Information letters were first read and approved by Head teachers and class teachers, and then sent to parents (consent forms included opt-out return sheets). An example template letter for the Head teacher is attached in Appendix 1. A full agreement of schools to allow pupils to engage in the study was ensured.

Additionally, children's assent to participation was requested before data collection. Children were also told that they were allowed to withdraw from a session at any time if they did not wish to continue. For the youngest age group, 5-6 year-old children, there was the additional concern of whether they were old enough to make a decision about withdrawing. In that case, the researcher relied on her good judgment and personal ethics.

Children were debriefed immediately following the session about the general intent of the study and all questions were answered in a way that children could understand. School staff were informed of the outcomes of the work through a newsletter. Some teachers also requested the presentation of results during class assembly, for debriefing all students and teachers who were involved in the research. However, the researcher did not share the individual results with participants. Instead, the researcher and her supervisor gave a brief presentation at schools, regarding the details of the research and potential implications of the main findings for learning and education.

3.7.5. Using college students in pilot research

The Psychology department in which the researcher works requires students to participate in research and offers extra credit for their participation. The rationale for this requirement is that participation in research is educational. Because it was easy to collect data from college students, they were used in the piloting stage of Study Five (see Chapter Seven). The same basic ethical principles, described in the previous sections, were applied to the research with college students. Specifically, each participant was offered a detailed explanation of the pilot study and its importance.

College students were also reassured that their participation was voluntary and had no effect on the credit they would receive for the course in which they were enrolled and from which they were recruited. More specifically, all students received an extra credit for participating in the study and they were not offered more or less credit based on their performance in the study. Similarly, participants who decided to withdraw from the study were not penalised.

3.8. Conclusion

The aim of this chapter was to describe and discuss relevant methodological considerations. General issues relating to each of the five empirical studies conducted for this thesis were outlined, with particular focus on integrating qualitative and quantitative methods to explore and identify age differences in children's argument skills. In addition, common ethical issues across studies were also addressed. The next chapter describes the first study of this thesis: age differences in children's generation of individual arguments.

Chapter Four - Study One: Age differences in children's generation of individual arguments

4.1. Introduction

Research in the field of argumentation has received growing attention in recent years, particularly in education. Many studies of argumentation in children have addressed argumentation in a social context, focusing on the importance of peer interaction and collaboration (e.g., Anderson, Nguyen-Jahiel, MacNurlen, Archodidou, Kim, Reznitskaya et al., 2001; Marttunen, Laurinen, Litosseliti, & Lund, 2005). This focus stems from the observation that argumentative discussions create a forum for children to listen to one another and evaluate different points of view and the arguments for and against each others' positions. Engaging in argumentation requires the ability to present sound arguments for one's opinions, advance counterarguments, and refute critiques by others (van Eemeren, Grootendorst, & Henkemans, 2002). This is an important skill because engaging in argument and discussion with another child is a key means of promoting acquisition of scientific knowledge (e.g., Howe, Tolmie, Greer, & Mackenzie, 1995), problem-solving (e.g., Fawcett & Garton, 2005), sound decision-making (e.g., Udell, 2007) and socio-moral judgement (e.g., Leman & Bjornberg, 2010; Leman & Duveen, 1999).

Previous research has shown that the ability to understand and produce arguments emerges early in development (e.g., Anderson, Chinn, Chang, Wannover, & Yi, 1997; Clark & Delia, 1976; Orsolini, 1993; Orsolini & Pontecorvo, 1992). Yet, debate endures as to *how* argumentative skills develop during childhood. Stein and Albro (2001) suggested that argumentative skills develop in parent-child or peer-child conflicts. The way in which children and parents or peers learn to resolve conflict influences their thinking and their skills at participating in constructive social interchanges with other people (Stein & Albro, 2001). Nevertheless, the role of peer interaction on children's ability to articulate their positions and reasons (i.e., to argue effectively) remains unclear.

The present study was designed to identify age differences in the types of arguments children generate when asked about socio-moral issues. The specific aims of this study were to explore developmental differences in children's skill in generating arguments, and also to examine the contribution of peer group discussions to improvement of individual arguments. Children aged from 5 to 12 years engaged in interviewer dialogue and in peer group discussions. The group task involved discussing three different topics of a socio-moral theme in response to a stimulus story. Using folktales and fables to challenge students to think about honesty, friendship, right and wrong, and other questions of ethics is a common activity in classrooms. Moreover, it permitted assessing children's reasoning regarding simple, everyday topics, rather than complex problem solving or scientific tasks.

4.1.1. Evaluating children's arguments

Arguments are cognitive constructions used by individuals to explain and justify an idea or a point of view (Kuhn & Udell, 2003). Evaluating arguments is not a simple task and much debate has been devoted to what elements constitute a good argument. Criteria for defining arguments are often based on models of formal argumentation (e.g., Toulmin, 1958). According to Toulmin (1958), a good argument should include six categories: claim, data, warrant, backing, rebuttal, and qualifier. The first three elements (claim, data, and warrant) are considered as the essential components of practical arguments, while the second triad (qualifier, backing, and rebuttal) may not be needed in some arguments. An argument is considered sound or valid by the degree to which the justification (data) supports the claim (Toulmin, 1958). Argument structures may also include one or more opposing statements (rebuttals) that support the contradiction of the claim. Although Toulmin's (1958) notion of qualifier is not a main criterion of argument soundness, the use of qualifiers usually incorporates an acknowledgement and examination of both sides of an argument. Thus, if an argument structure incorporates more elements (such as multiple arguments) it is regarded as stronger (Means & Voss, 1996). Toulmin's model has received various criticisms, but its most important principles are still in use today for evaluating the structure of different types of argument. However, a comprehensive evaluation of informal or everyday arguments should focus not only on the structure of arguments but also on its content. The content of informal arguments may vary with a person's beliefs about the topic (Kuhn, 1991; Means & Voss, 1996).

In the present study, arguments were evaluated according to the criteria stated above. Indeed, similar criteria have been used by Anderson et al. (1997), Kuhn (1991), Means and Voss (1996), and Orsolini (1993). Kuhn (1991) noted the importance of considering the generation of counterarguments (i.e., arguments that contradict one's original position) as an indicator of the way individuals regard their own positions. In a study regarding argumentative reasoning in adolescents and young adults, Kuhn, Shaw, and Felton (1997) classified two-sided arguments (arguments based within a framework of alternatives) as a higher quality type of argument. Means and Voss (1996) also classified the quality of reasons stated to support a claim, distinguishing different types: abstract, consequential, rule-based, appeal to authority, personal, and vague reasons.

In developmental research, although studies have shown that young children are able to produce arguments in natural conversations (e.g., Anderson et al., 1997; Orsolini, 1993), little attention has been directed specifically toward exploring what types of argument children generate, particularly regarding students at the elementary school level. In the first part of this study, the individual arguments that children at three age groups, 5-, 8-, and 11-years, produce in an interviewer dialogue about moral issues were assessed. Kuhn's approach (1991) of examining informal reasoning as interiorised dialogic argument was adopted to analyse how children generate arguments considering both their own perspective, and also the perspective of a hypothetical other.

The previously stated criteria were applied in this study to evaluate children's arguments. More specifically, high quality argumentation was classified based on the presence of the following elements: (a) full arguments (as opposed to unjustified claims); (b) two-sided arguments, that is, arguments that address more than one side of the question (as opposed to one-sided arguments); (c) number and type of reasons; (d) counterarguments (as opposed to unjustified counterclaims); (e) rebuttals (i.e., arguments that refute a counterargument).

4.1.2. Exploring the role of argumentation in cognitive change

A further objective for this study was to analyse the effect of peer group discussion in the quality of children's individual arguments. There is now substantial research giving evidence of the benefits of argumentation in the promotion of knowledge construction in classrooms (e.g., Nussbaum & Sinatra, 2003; Schwarz, Neuman, & Biezuner, 2000). For example, studies in science education have shown that collective argumentation often results in conceptual growth of scientific concepts (Howe, Tolmie, & Mackenzie 1995). Recently, Asterhan and Schwarz (2007) tested the role of argumentation within peer collaboration settings that are designed within a socio-conflict paradigm. In that study, undergraduates were assigned to dyads and collaboratively tried to explain a concept of evolutionary theory. Half of the dyads were instructed to engage in argumentative dialogue; the other half was simply instructed to collaborate. The results of this study showed that, whereas peer collaboration by itself leads to immediate gains in conceptual understanding, only those students who engaged in argumentative discussions preserved these gains in a delayed posttest. Schwarz and Linchevski (2007) analysed the role of task design and argumentation in cognitive development during mathematical thinking in the context of peer interaction. Similarly, the results showed that beyond the importance of given characteristics of tasks, the process of argumentation that takes place between the peers explains the subsequent gains of the individuals. In addition, these studies and also the extensive work conducted by Howe and colleagues (e.g., Howe, McWilliam, & Cross, 2005; Howe, Rodgers, & Tolmie, 1990) have shown that peer collaboration often results in conceptual growth that is detectable several weeks after interaction. Moreover, these benefits were not found to result from the ideas shared *during* the collaborative group work. In following studies, Howe and colleagues explored the *incubation* effect to explain these results. These studies were conducted with primary school, and addressed the understanding of physics concepts (e.g., floating and sinking; heating and cooling).

The results suggest that delayed conceptual growth can result from the productive use of events experienced after the interaction; and that usage is stimulated by unresolved conflicts that occurred during the group work (Howe, Rodgers, & Tolmie, 1990; Howe, Tolmie, Greer, & Mackenzie, 1995). Other research studies have explored the effects of interaction on argumentative reasoning. The cognitive skills involved in argument have been shown to develop with engagement in dyadic interactions (Kuhn, Shaw, & Felton, 1997), and in response to intervention (Anderson et al., 2001; Felton, 2004; Felton & Kuhn, 2001; Kuhn & Udell, 2003). Kuhn and colleagues (1997) conducted a study to test whether the engagement in thinking about a specific topic (capital punishment) would enhance the quality of reasoning about that topic. Results indicated that both adolescents and young adults who engaged in a single dyadic discussion showed improvements in the quality of reasoning.

Types of qualitative improvement included, for example, a shift from one-sided to two-sided arguments. This latter form of arguments is based in various possible alternatives and meta-cognitive awareness of existence of multiple views. Felton (2004) examined the development of discourse strategies in adolescent argumentation and also the effect of practice in promoting cognitive change. Participants engaged in pretest and posttest measures of strategy use on two topics (capital punishment and abortion) and then engaged in five weekly dialogues on the main topic only (capital punishment). Control group participants engaged in dialogue only, while experimental group participants engaged in a combination of dialogue and paired reflection in dialogues. Results showed that the combination of practice and reflection was more effective in promoting advances in argumentative discourse than practice alone. Based on these findings, Kuhn and Udell (2003) developed a successful intervention designed to foster development of argument skills in academically at-risk adolescents.

Although it is reasonable to conclude that children's argument skills develop with age and experience (engagement in argumentation), little is known about the interaction between these different processes. Such interaction is, however, important. At different ages children may pick up different skills from conversations with their peers. Engaging in argumentation might foster specific skills depending on the age of the children involved, and this would have implications for those professionals in education who seek to devise and manage children's classroom discussions.

4.1.3. The present study

Drawing on previous studies (e.g., Kuhn, 1991; Kuhn & Udell, 2003), argument skills were defined as cognitive abilities that enable individuals to justify a claim and to evaluate, respond and criticise the claims of others. Cognitive skills entailed in argument include the ability to generate arguments, and also to take into consideration opposing arguments. There were several specific predictions. In terms of age differences in argument skills, the first hypothesis was that argument skills would vary with age. Specifically it was predicted that older children (11-12 years-old) would be more skilled in generating high quality arguments (i.e., full arguments, more and more varied arguments, two-sided arguments, counterarguments and rebuttals) than younger children (5- and 8- year olds). Secondly, it was hypothesised that engaging in argumentative discussions about socio-moral topics would promote the quality of arguments on a similar topic. In other words, it was predicted that children at all ages who had engaged in sessions of peer discussion would produce more high-quality arguments after these sessions compared with a control group of children who did not engage in peer discussion. The third research question focus was on any possible interactions between age and the benefits (or otherwise) on argument skills of peer argumentation. Given the absence of previous research in this area there were no specific predictions here.

4.2. Method

4.2.1. Participants

One hundred and ninety children (78 boys, 122 girls) participated in this study. Children came from three different age groups, 5-6 years (*M* age = 5,7 years, *SD* = .47), 8-9 years (*M* age = 8,5 years, *SD* = .50), and 11-12 years (*M* age = 11,8 years, *SD* = .40). Children were in their first, fourth, and seventh year of school education, respectively. All children in a class participated (i.e., there were no exclusion criteria based on gender, race, or any other characteristic). The sample was collected at public and private elementary and secondary schools in the local area of Surrey, South East England. Students were of heterogeneous ethnic (mostly European) and socioeconomic (mostly middle-class) backgrounds. Six children missed at least one day of the one-week program; therefore, the statistical analysis is based on a sample of 184 participants.

In the first instance, a letter explaining the study in more detail was sent to the Head Teacher of each school. A template letter to schools is attached in Appendix 1. This was followed up by a telephone call. After receiving permission from the schools, a consent letter was sent to children's parents. A template consent letter is attached (see Appendix 2). Children were also asked for their consent to participate before the study began. They were told that the researcher was interested in how children understand and think about stories and socio-moral issues, and reminded that participation was voluntary and that they could withdraw from the study at any time. Debriefing for the participating children took the form of a brief presentation to the class discussing how children at different ages might think and feel about different issues, for example whether people should share with others or the reasons why lying is wrong. A more comprehensive debriefing was also given to teachers after the data collection had been completed.

4.2.2. Design

Participants were randomly assigned to control and experimental groups. Children in both groups engaged in pretest and posttest measures of argument generation on two topics (sharing and lying). Children in the experimental group engaged in three group discussions on different topics (friendship, stealing, and trusting). Children in the control group were not involved in group discussions. The study employed a mixed ANOVA design. There were two independent, between-groups variables: age group (5-6, 8-9, and 11-12 years), and condition (experimental and control groups). The independent within-subjects variable was test of argument skill (pretest and posttest). Dependent measures included measures of argument skill, which are detailed in the method section.

4.2.3. Procedure

Participants engaged in an one-week program that included a variety of tasks related to argument generation. The study included: (1) a pretest of assessment of argument skills, (2) group discussions of assessment of argumentative strategies, and (3) a posttest of assessment of argument skills. The procedure involved all children in a program which began on the first day of the school week (Monday) and finished on the final day of that week (Friday). These three phases of the procedure are detailed below.

Pretest of assessment of argument skill

On the first day, all children engaged in a pretest assessment of argument skill. The pretest consisted of an individual interview based on a discussion topic about *sharing.* Each participant was asked by the researcher to formulate arguments, counterarguments and rebuttals providing justifications for the key question: "Do you think that people should share their things with others or keep what they like for themselves?" The interviewer then asked the child to give reasons in support of their opinions: "Why? Try to say all reasons that explain your position". This question was followed by several probes, for example, "If you were trying to convince someone (or a child with the same age) that your view is right, what reasons could you say to convince the person that *people should ___ (e.g., share their things with others)*?"

In the next segment of the interview, each child was asked to generate an opposing position: "Imagine now that someone else disagreed with your opinion that *people should ___ (e.g., not share or keep their things for themselves)*" What opposing reasons could this person say to you to show that his or her view is the right one?" This question sometimes elicited a counterargument with respect to the child's initial argument, and sometimes an alternative argument related to the other side of the question. If the child produced an initial two-sided argument in response to the question, including pro and con reasons, the interviewer asked the child to talk further about the opposing reasons or generate new ones: "You mentioned some reasons why *people should ___ (e.g., not share things with others)*. Just to be sure I understand, can you explain a little bit more about these reasons, or think about other reasons to justify this alternative position?"

In the remaining part of the interview, the child was asked to generate a rebuttal, prompted by the question: "What could you say to convince this person that he or she is wrong?" If the child was unable to generate a counterargument, in response to the previous question, the interviewer proposed one and asked the child to rebut it. (The complete interview protocol is presented in Appendix 3).

The interview took approximately 3 to 4 minutes. All of the verbal dialogue data were recorded on audiotape and later transcribed for coding and analysis. The coding was based on a scheme that was developed by Means and Voss (1996) that assessed similar skills in adolescents and also on coding schemes developed by Kuhn (1991), and Kuhn and Udell (2003) that assessed argument skill in adults (the full scheme is detailed later in the method section).

Group discussions

Participants in the experimental condition (*N* = 115) participated in group discussions about three different stories. Children were in different groups each time. Group discussions took place over three consecutive days and no group had more than one discussion in the same day. Participants were assigned to small groups of five children of the same age and grade level. Groups consisted of roughly equal numbers of boys and girls. At the beginning of each session, the group was given instructions to engage in and listen to a recorded story: "Let's listen to a story about a man and a bear. Please try to pay attention, because after you listen to the story, we are going to talk about it". The stimuli stories are fully detailed in Appendix 4. The storytelling was immediately followed by a discussion of the story as a whole. Conversations were elicited by a key question related to the story. For example, for the first story ("The bear that spoke"), students were asked the following question: "Do you think there is any difference between helping a friend or a stranger?" Then the researcher gave the following instructions to the group: "Your task is to talk about friendship and helping others. You will need to discuss the reasons each of you have for your views and find out where you agree or disagree. If you disagree, try to determine why and try to reach an agreement if you can." If participants had difficulty maintaining the discussion during the prescribed time, or generating arguments, the researcher asked some questions to prompt further dialogue and also to generate counterarguments and rebuttals. The full protocol interview for group discussions is detailed in Appendix 5.

Discussions lasted an average of 8 minutes among 5-6 year old children, 13 minutes among 8-9 year old children, and 11 minutes among 11-12 year old children. All of the verbal dialogue data were recorded on videotape and later transcribed for coding and analysis (Analysis and coding of discussions are detailed on Study Two, Chapter Five).

The three stories selected for these tasks came from different countries and cultures including folktales from Europe, India, and North America. All three stories contained a theme for thought and discussion (e.g., stealing, friendship and helping others, and trust). Participants in the control condition (N = 75) also listened to the storytelling, but instead of discussing the topic with their peers, they were asked to engage individually in a written activity. The researcher asked the same questions presented in the experimental condition. Each participant received a blank sheet to write their answers. For example, related to the story "The black tulip", participants were asked the following questions: (1) "In the story, the thief said that thieves never prosper. Do you think that stealing is always wrong? Try to refer to all reasons that support your position"; (2) "Imagine that someone disagrees with your opinion. What would you reply to him or her to explain that your position is right?"; (3) "What could you say to show that your own view is the correct one?" These questions prompted the generation of arguments, counterarguments and rebuttals, respectively (see again Appendix 6). Five-year-old children, instead of writing arguments, were asked to think about the story and imagine, or think for themselves, what they would say if they had to answer the questions (see Appendix 6). The activity took no more than 10 minutes to complete.

Posttest assessment of argument skill

On the fifth and final day, children in both experimental and control conditions took part in a posttest assessment of argument generation skill. The posttest was identical to the pretest, except that children were asked to give their opinion about a different topic (lying). Each participant was asked to formulate arguments, counterarguments and rebuttals providing justifications for the key question: "Most people would say that lying is always wrong, except when there's a good reason for it. What do you think about this statement: is lying always wrong?" (see again Appendix 3 for more detail). The individual interview took no more than 3 to 4 minutes. All of the verbal dialogue data were recorded on audiotape and later transcribed for coding and analysis.

4.2.4. Coding of responses and justification categories

The coding of individual argument skills was based on a scheme that was developed by Means and Voss (1996) that assessed similar skills in adolescents and also on coding schemes developed by Kuhn (1991), and Kuhn and Udell (2003) that assessed argument skill in adolescents and adults (the full scheme is detailed later). Thus, responses to the key questions provided the basis for assessing children's argument skills and exploring the quality of arguments generated. Coding was based on the following criteria:

Generating arguments

According to Means and Voss (1996) it is important to distinguish if an individual states an argument or a simple assertion or a claim. By definition, an argument is an assertion followed by reasons that support it. Consider the following example: Student A is asked the question, "Do you think that lying is always wrong?" and the student says, "I think that lying is always wrong, and people shouldn't do it". In this case, the student gives an opinion, but does not produce a valid reason to justify that opinion. Alternatively, a student B when asked the same question replies, "I think that lying is wrong, because you can get into trouble if you do it". In this case, student B generates a full argument, that is, an opinion, "I think that lying is wrong" supported by a consequential reason "Because you can get into trouble".

In a given answer, a child could address one side of the question or consider both sides of the issue. Two-sided arguments were defined as a stronger type of argument, because frequently it provided the occasion to generate multiple arguments and also opposing arguments. Each measure, claim, one-sided argument, two-sided argument, were coded as {0, 1, 2} respectively.

Number and types of reasons

An argument was considered stronger depending on the number of acceptable reasons that an individual stated in order to support an opinion and the quality of those reasons. Classification of reasons was based on a coding scheme developed by Means and Voss (1996) that assessed similar skills in adolescents.

The number of different types of reasons that a child stated in order to support an opinion was counted. Most research based on the Toulmin's framework has considered an argument supported by several different reasons to be stronger than an argument supported by just one reason. A distinction was made between reasons included in the child's initial argument, and opposing reasons which were included in counterarguments. Table 4.1 presents some examples of these reasons.

Table 4.1. Examples of reasons given by children to justify their views

Reasons in favour of sharing
"Because when you share your feelings and fears, you feel better and less lonely"; "Because if people share things, like books, then they don't have to waste money buying new things all the time"
Reasons against sharing
"Because you have to protect your things"; "Because important and secret things are not meant to be shared"
Reasons in favour of lying
"Because you can lie when you think the truth will make someone sad"; "Because sometimes you want to keep a secret, and not telling a secret is not a bad lie"
Reasons against lying
"Because if people find out, they will never trust you again, even if you tell the truth"; "Because you might lose your friends"

In a study concerned with the quality of content of arguments produced by adolescents (Means & Voss, 1996), reasons presented were divided into six categories.

According to this classification, quality of reasons decreases over the following categories: *abstract* reasons, *consequential* reasons, *rule-based* reasons, *authority appeal* reasons, *personal* reasons, and *vague* reasons. *Rule-based, authority appeal*, and *personal* reasons are supposed to differ little in quality (Means & Voss, 1996). These coding categories were adapted and used to classify the content of children's arguments. Table 4.2 presents these categories and some examples of reasons given by children.

Table 4.2. Justification categories for children's responses

Category	*Description*	*Examples*
Abstract	An elaborate statement or a full argument.	"Because some people have lots of money and they don't need it all, or they don't actually spend it, so they could give it to people who might really need it. If everyone had the same, then the world would be fair" (posttest, girl, 11 years).
Consequential	A statement in which a direct consequence (positive or negative) is stated as an outcome of a particular reason	"Because if you lie really badly, like adopting a false identity, you can go to prison and really bad things come out of it" (posttest, girl, 11 years).
Rule-based	An accepted belief or a statement based on moral issues.	"Because sharing with people is kind" (pretest, girl, 5 years).
Authority appeal	A statement that involves appeal to an authority.	"Lying is wrong because the teacher might find out and be upset" (posttest, girl, 5 years).
Personal	A statement based on personal experience.	"Because I don't like when people lie to me" (posttest, girl, 5 years)
Vague	An imprecise statement.	"Because that would be the best thing to do" (pretest, boy, 5 years)

Generating an opposing claim *versus* a counterargument

Another criterion of argument structure evaluation is taking into account the generation of counterarguments. As Kuhn (1991) noted, "the ability to generate opposing arguments is an important indicator of the way subjects regard their own opinions" (p. 143). As with argument generation, it was distinguished whether a participant stated a simple opposing claim (e.g., "Other people might think that lying is good") or a full counterargument, that is, an opposing opinion supported by reasons. Table 4.3 provides examples of each of these outcomes. Counterarguments were coded as absent or present based on children's ability to offer reasons to support the opposite side of the question, by considering a hypothetical other's point of view.

Table 4.3. Illustration of possible outcomes of participant's attempts to generate counterarguments

Counterclaim	"Other people could say that you shouldn't share" (pretest, girl, 5 years).
Counterargument	"Some people could say that they don't want to share some things, like precious things, because other people may not return them" (pretest, boy, 8 years)

Rebuttals

A final criterion assessed was the ability to generate rebuttals, that is, to rebut the previous counterargument, either by criticising it, arguing that it was not as strong as the initial argument or advancing an alternative argument against it. A successful rebuttal was also coded when a participant advanced spontaneously a critique immediately after generating a counterargument. Table 4.4 provides an example of a rebuttal generated immediately after a counterargument. Children who did not generate a counterargument in the previous segment of the interview were also given the opportunity to generate a rebuttal. As with counterargument generation, rebuttals were coded as absent or present.

Table 4.4. Illustration of a counterargument followed by a rebuttal

Posttest, girl, 11 years	"People would probably say that lying is always wrong, because not telling the truth might be harmful to others/ but sometimes a small white lie can go for the benefit of others./ When people say that lying is wrong, they're not thinking through it completely, because they're only thinking about people making things up/ and hurting people./ However, a small lie, like keeping a secret or a promise,/ might be the right thing to do in order to help other people"

4.2.5. Reliability of argument skill measures

Coding children's responses in pretest and posttest assessments involved interpreting utterances in order to identify kinds of arguments and opposing arguments generated, and to classify different types of justifications. This coding scheme involved giving more than one code per turn.

To establish reliability of the coding, a second judge coded 40 interviews (about 20% of the total number of responses). The second judge was given a description and brief introduction to the scoring of categories but was blind to the scores of the first judge. The consistency between the ratings of judges was very good. The pretest Cohen's kappa result was .93; while the posttest Cohen's kappa result was .90.

4.3. Results

4.3.1. Design and analysis

A mixed design was employed in this study. The first factor was the within-subjects factor comparing pretest and posttest measures of argument skill and argument content. The second factor was the between-subjects factor of age group, with three levels (5-, 8- and 11- years), and the factor of condition, with two levels (experimental and control). There were three dichotomous variables and measures of argument skill: type of argument (one-sided and two-sided), counterargument (absent or present), and rebuttal (absent or present). There were also measures of quality of argument content: reasons and opposing reasons (number and type). Analysis examined children's mean use of these different types of reasons. Several parametric and non-parametric tests were used as appropriate.

The following analyses detail: (1) the effect of baseline age differences on argument skill; (2) the effect of the group discussion activity on the individual arguments given in pretest and posttest; and then (3) the results of the interaction between age and group (group discussion *versus* no discussion) on improvements of argument skills and argument quality.

Baseline age differences in argument type

The first hypothesis tested was that argument generation skill would improve with age. Specifically, it was predicted that 11-12 year-old children would be more skilled in constructing arguments compared with 8-9 year-olds who, in turn, would be more skilled than 5-6 year-old children. First, age differences in the ability to generate arguments at the initial assessment (topic about sharing) were explored. Results showed that *all* participants were able to provide full arguments. Figure 4.1 illustrates the percentages of children at different ages producing two types of argument.

There was a relationship between children's age and the type of arguments generated, χ2 (2, N = 189) = 61.64, p < .001, Cramer's V = .571. As shown in Figure 4.1, 5-year-old children offered only one-sided arguments. Both 8- and 11-year-old children generated two-sided arguments, but 11-year-old children were more skilled in constructing two-sided arguments than 8 year olds.

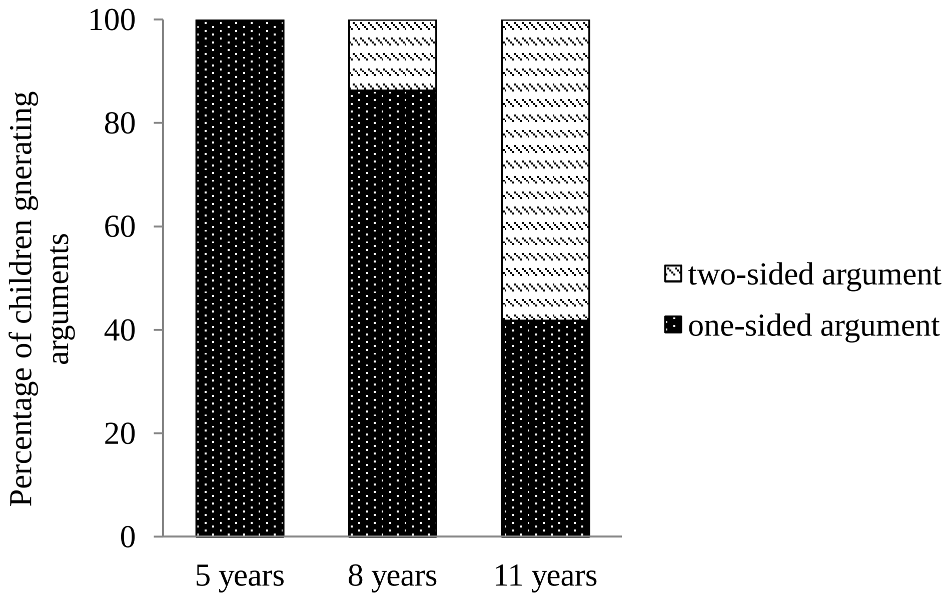


Figure 4.1. Percentage of children at different ages generating one-sided or two-sided arguments

Baseline age differences in counterarguments and rebuttals

Then children's ability in generating counterarguments and rebuttals was examined. The prediction here was that older children would be more skilled in generating successful counterarguments and rebuttals, when compared to younger children. The analysis confirmed this prediction; there was a relationship between children's age and the generation of successful counterarguments, χ^2 (2, N = 189) = 29.42, p < .001, Cramer's V = .395. Table 4.5 shows the percentages of children at different ages producing counterarguments.

Regarding generation of rebuttals, results also showed a relationship between children's age and the ability to rebut previous lines of argument, χ^2 (2, N = 189) = 23.84, p < .001, Cramer's V = .355. As in the case of generation of counterarguments, the older two groups were more skilled in generating rebuttals, when compared with the youngest group (5-year old children) (see again Table 4.5 below).

Table 4.5. Percentages of children generating counterarguments and rebuttals by age group

	5 years, *N*=61	8 years, *N*=73	11 years, *N*=55
Counterarguments	52.5 %	83.6 %	92.7 %
Rebuttals	44.3 %	72.6 %	85.5 %

Baseline age differences in number and type of reasons

Lastly, the quality of argument content, that is, the reasons children produced to justify their opinions was explored. Using a one-way between-subjects ANOVA, with age as a condition, age differences in the number and type of reasons (and opposing reasons) given by children were examined. Results indicated age differences in terms of number of reasons found in children's initial arguments, F (2,178) = 3.04, $p < .01$, partial $\eta^2 = .05$, with number of reasons increasing progressively with age. As shown in Table 4.6, Bonferroni post hoc tests revealed differences between 5-year olds and 11-year olds. It was expected that there would be differences in the kinds of reasons offered, with older children likely to give more high quality reasons (e.g., abstract and consequential), and fewer low quality reasons (e.g., personal and vague). Data and post hoc analyses ($p < .001$) reported in Table 4.6 show that older children (11 years) offer more abstract reasons than younger children (5 and 8 years), F (2,188) = 21.90, $p < .001$, partial $\eta^2 = .19$. There were also age differences in terms of authority-based reasons, F (2,188) = 4.19, $p < .01$, partial $\eta^2 = .43$. As Table 4.6 shows, authority-based reasons were only found on the arguments of 8- year olds. No age effects were found for other categories of reasons, including consequential, rule-based or moral, personal and vague reasons.

Age differences in terms of opposing reasons given by children in counterarguments were also explored. Similarly, it was predicted that older children would use an increased number of opposing reasons when compared to younger children. There was a significant effect of age for the number of opposing reasons, F (2,188) = 24.16 $p < .001$, partial $\eta^2 = .27$, with significant post hoc differences between 5-year-olds and 8-year-olds and between 5-year-olds and 11-year-olds, and between 11-

and 8-year-old children (see again Table 4.6). There was also a significant effect of age for consequential opposing reasons, F (2,188) = 7.78 p < .001, partial η^2 = .07. As can be seen in Table 4.6, tests revealed a significant difference between 5- year and older age groups (i.e., 8- years and 11- years). There was also a significant effect of age for rule-based or moral opposing reasons, F (2,188) = 20.86 p < .001, partial η^2 = .18. Post hoc tests indicate significant differences between 5-year-olds and 8-year-olds and between 5-year-olds and 11-year-olds, and between 11- and 8-year-old children (see again Table 4.6).

Table 4.6. Mean (and standard deviation) use of number and type of reasons and opposing reasons, relating to significant results for each age group

	5 years, *N*=60		8 years, *N*=71		11 years, *N*=53	
	M	*SD*	*M*	*SD*	*M*	*SD*
Number of reasons	1.36_a	.52	1.58_a	.71	1.73_b	.65
Abstract reasons	$.03_a$	.18	$.27_b$	.48	$.60_c$	.63
Authority based reasons	$.00_a$	.00	$.07_b$	.25	$.00_a$	.00
Number of opposing reasons	$.56_a$	.56	$.95_b$	.55	1.29_c	.59
Consequential opposing reasons	$.11_a$	.32	$.38_b$	.52	$.44_b$	.57
Rule-based opposing reasons	$.00_a$	.00	$.19_b$	.43	$.47_c$	.54

Note. Separate subscripts on each line indicate groups differing significantly (p<.05) using Bonferroni *post hoc* tests.

Pre- to posttest differences between control and experimental groups

The main focus of this analysis was the evaluation of changes in the quality of argument skills from pretest to posttest in the experimental and control groups. In particular, this analysis looked at how peer discussion affected individual arguments offered by children. The principal hypothesis was that arguments of children in the experimental group (i.e., those who engaged in group discussion) would improve between pre- and posttest compared with individuals in the control group (i.e., no group discussion). More specifically, concerning argument generation, it was predicted that the experimental group would use more sophisticated argument elements (such as two-sided arguments) after group discussion than the control group.

As predicted, there were positive changes in argument skill at posttest in the experimental group, in terms of generation of two-sided arguments. The McNemar-Bowker test showed a significant difference between the proportion of children generating two-sided arguments at pretest, and the proportion of children generating two-sided arguments at posttest (N = 112, exact $p < .001$) in the experimental group.

As seen in Figure 4.2, the proportion of children generating one-sided arguments, at pretest, is higher than the proportion of children generating two-sided arguments in both groups. At posttest, the proportion of children using two-sided arguments increased significantly only in the experimental group. Table 4.7 provides an illustration of change from one-sided to two-sided argument by an 8-year old child.

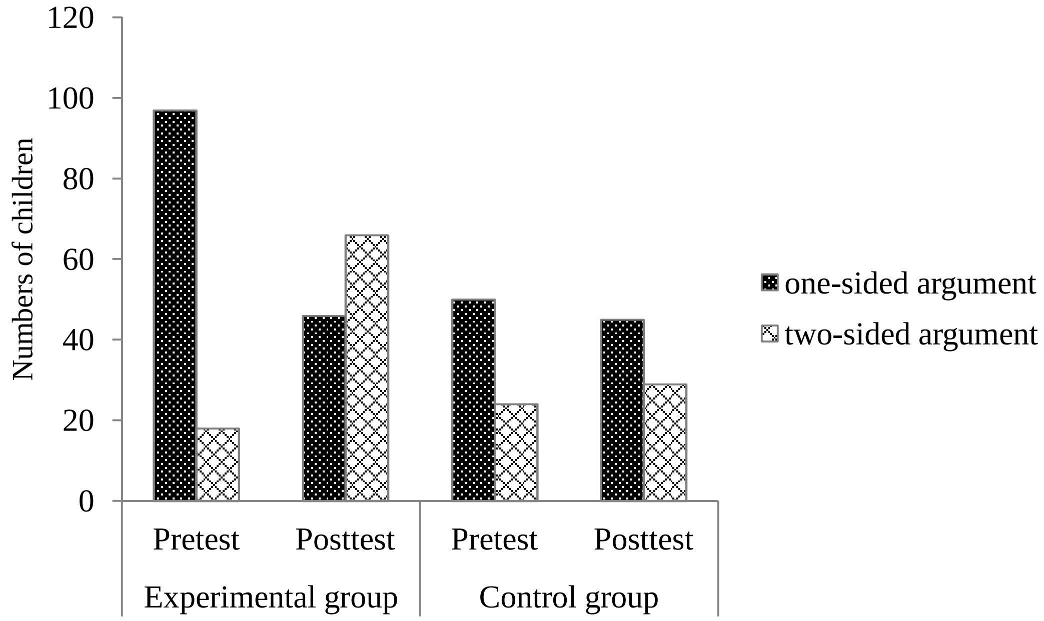


Figure 4.2. Pre- and posttest distributions of children in experimental and control groups by type of argument generated

Table 4.7. Illustration of change from a one-sided to a two-sided argument (girl, 8 years old)

Pretest	"I think people should share, because if they don't share they will not have any friends. And it's nice to share because someone may not have something and he asks you to borrow it and you could help him, so it's nice to share."
Posttest	"I think it is not always wrong to lie, because someone could tell you something that could hurt your friends and if you don't want to tell them, then you might lie and say something different to protect them from getting hurt. So, I don't think it is always wrong; but if someone says to you that they have something that they don't actually have, then they shouldn't lie - that's bad! And I think lying is wrong when you can tell the truth and you lie on purpose, but sometimes you have to lie. So, lying is wrong but sometimes it can be good."

There was also a significant difference in the proportion of children generating rebuttals at pretest compared with the proportion of children generating rebuttals at posttest in the experimental condition, using the McNemar test for binominal data (N = 112, exact $p < .001$) As Figure 4.3 shows, 66.2% of experimental participants and 67.8% control participants generated rebuttals at pretest. At posttest, the percentage of experimental participants who were successful at generating rebuttals increased to 85.7%, showing a positive change.

There was no significant effect of condition (experimental or control) on the within-subjects variable (pre- to posttest use) on measures of quality of argument content, including number and range of reasons offered, and the different types of reason used (abstract, consequential, rule-based, authority, personal and vague).

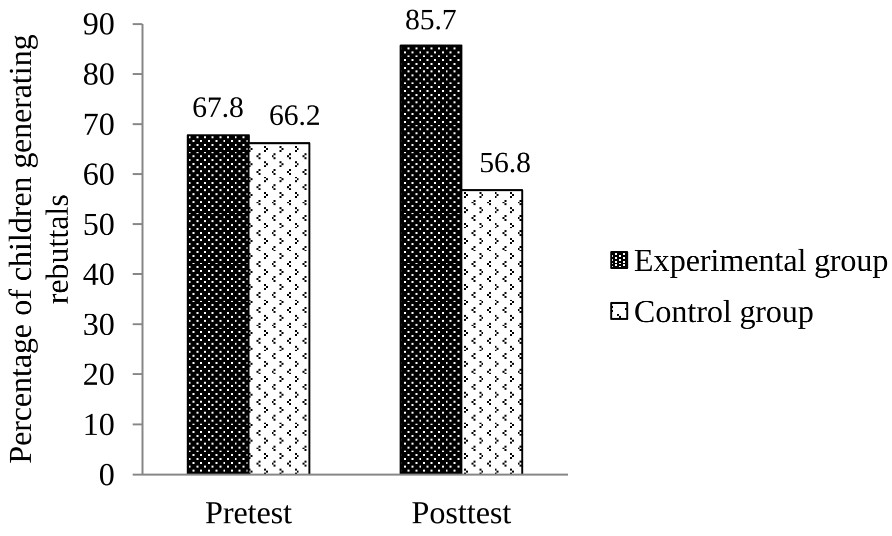


Figure 4.3. Pre- and posttest percentages of children in experimental and control groups generating rebuttals

Pre- to posttest age differences between control and experimental groups

The next analysis focused on how peer discussions, compared with no discussion, affected children's argument skills at different ages. Using the McNemar-Bowker test, with pre- and posttest repeated measures of argument skill, the relations among age group, condition (control versus experimental groups) and the proportion of children using different measures of argument skill were explored. There was a statistically significant difference in the use of two-sided arguments by 11-year old children comparing the two conditions (control *versus* experimental) ($N = 30$, exact $p = .001$) (see Table 4.8).

There was also a significant difference from pre- to posttest in terms of proportion of 8-year olds generating rebuttals, comparing the two conditions (control vs. experimental) ($N = 54$, exact $p = .004$). Eight-year-old children in the experimental group were more successfully in producing rebuttals at posttest than children in the control group. There were no statistically significant results using this test for the oldest age group, because *all* 11-year-old children used counterarguments and rebuttals.

There were no significant interactions between age and group in the number of reasons given by children and no significant interactions between age and group in the types of reasons generated.

Table 4.8. Pre- and posttest frequencies and percentages of children in experimental and control groups by type of argument generated

	Experimental group			Control group		
	5 years	8 years	11 years	5 years	8 years	11 years
Pretest						
One-sided	29 (100%)	55 (100%)	13 (42%)	32(100%)	8 (44%)	10 (42%)
Two-sided	0	0	18 (58%)	0	10 (56%)	8 (33%)
Posttest						
One-sided	16 (57%)	28 (52%)	2 (7%)	27 (84%)	10 (56%)	14 (58%)
Two-sided	12 (43%)	26 (48%)	28 (93%)	5 (16%)	8 (44%)	16 (67%)

4.4. Discussion

The present study examined developmental differences in children's ability to generate arguments related to social-moral questions. The main goal was to explore the types of arguments children use from 5 years old onwards. This study also explored the contribution of peer group discussions over a period of three days to improvement of individual arguments generated by children. Kuhn's approach (1991) of examining adults' reasoning on everyday issues as interiorised dialogic argument was adopted to analyse children's argumentative skills.

The findings reported in this chapter provide an insight into children's understanding and ability to construct arguments considering both their own perspective, and also the perspective of a hypothetical other. In this respect, the results are consistent with earlier findings that suggest that the ability to understand and produce basic arguments emerges relatively early in development (e.g., Anderson et al, 1997; Clark & Delia, 1976; Orsolini, 1993; Orsolini & Pontecorvo, 1992; Stein & Miller, 1993a, 1993b). This study shows that, by the age 5 years, children are able to produce the principal components of an argument, that is, they state an opinion supported by at least one reason.

Analysis of age differences in argument generation skills revealed that argumentative skills develop with age. Across the three age groups, there were significant changes in argument quality, demonstrated by the progression with age from one-sided to two-sided arguments. Most notably, compared with one-sided arguments, two-sided arguments are a more complete type of argument, and thus contribute to attainment of competence in argumentative reasoning (Kuhn, 1991; Kuhn, Shaw, & Felton, 1997). Results showed that 11-12 year old children were more skilled in constructing two-sided arguments than 8-9 year old children, who in turn performed better than 5-6 year old children.

As noted in cognitive and developmental literature, analysing counterarguments is also relevant. Counterargument is another type of argument that addresses an opposing position, and it is an important criterion of skilled argumentation (Kuhn, 1991; Kuhn, Shaw, & Felton, 1997). Even 5-year-olds were able to produce some counterarguments, although the average number was significantly lower compared with the average number of counterarguments produced by older children. However, there were no significant differences between the counterarguments used by children aged 8-9 and 11-12 years, suggesting that these become cemented as a feature of children's arguments from 8 years onwards. There was also a significant effect of age group in use of rebuttals, with significant differences again between the youngest and the older two age groups. As Kuhn (1991) explains, generating rebuttals requires that the participant integrates previous lines of argument. Thus, counterargument and rebuttal are markers of an awareness of others' perspectives in argumentative and, as such, have been characterised as more advanced argument skills (e.g. Kuhn, 1991).

For the younger children, comparative difficulty in generating counterarguments and rebuttals might be a result of a problem in coordinating own and other perspectives in an argumentative setting. Kuhn and Udell (2007) found that young adolescents are less able than adults to coordinate attention to favoured and opposing positions in an argument. Although adolescents prefer an argument strengthening the favoured position, they are able to attend to the other's point of view, and even generate an argument against it, when explicitly asked to do so. As Kuhn and Udell (2007) explain, young adolescents are able to execute the skill (of addressing the opposing position), but it seems that they do not recognise the need to do so. Based on these findings that report developmental differences between adolescents and adults, one might hypothesise that, similarly, younger children (5 and 6 years) did not consider the hypothetical other's position as relevant as compared with older children (8 to 12 years), therefore they did not find the need to challenge it by generating counterarguments.

The second hypothesis predicted that engaging in group discussions (compared with not engaging in such discussions) would have a beneficial effect on the individual children's argument skills in a subsequent posttest. This prediction was based upon previous research which has found that argument skills improve after a period of engaging in discussion with other children (e.g. Kuhn et al., 1997). However, broadly speaking, this second hypothesis was not confirmed in the present study. Generally, *all* children (i.e., both those who engaged in group discussion and those who did not) showed improvements in argument skills in the subsequent posttest. The broad finding here appears to be at odds with previous research and there are at least two possible explanations for the discrepancy. It may be that the present study simply did not involve sufficient opportunity for sustained interaction to make gains in argument skills visible in the posttest. A longer period of more and longer sessions of interaction might have led to differences between control and experimental groups.

Other studies (albeit with older participants) that have involved longer and more frequent opportunities for discussion have indicated that, although individual reflection has been found to be an important ingredient in the development of argument skills, it is particularly effective when combined with real group discussion (see again, Kuhn & Udell, 2003). Moreover, peer interaction appears to have benefits over and above individual reflection on other developmental tasks (Howe, McWilliam, & Cross, 2005).

Thus, the finding of no differences comparing group discussion with individual reflection, in terms of improvements in argument skills between pretest and posttest, should be treated with some caution in terms of its generalisability across age groups, conversation topics, and forms (type and frequency) of discussion. Moreover, while the present results are consistent with other studies that have documented the potential of argumentation and collaborative debate in promoting the development of argumentative skills (e.g., Felton & Kuhn, 2001; Nussbaum & Sinatra, 2003), they also suggest that many of these benefits may be attributable to the role of discussion as a stimulus for individual reflection.

However, not all findings of improvement in argument skills can be attributed to reflection alone. This analysis revealed an important, significant interaction between condition (group discussion vs. individual reflection) and age group in argument generation at pre- and posttest. Significant differences were found in the use of two-sided arguments between experimental and control conditions for children aged 5-6 and 11-12 years, but not for 8-9 year-olds. Specifically, in the youngest and oldest age groups use of two-sided arguments increased in both discussion and reflection (experimental and control) groups. However, in the 8- year old age group, while the discussion group used more two-sided arguments at posttest, the control group showed no similar advances. For each age group the posttest increases were from a high baseline, that is, although the youngest children used more two-sided arguments at posttest they generally used fewer two-sided arguments; 8 year olds used slightly more two-sided arguments overall; and 11-12 year olds used most both at pretest and at posttest.

This latter finding is important because it suggests that development in the use of two-sided arguments appears to be linked specifically to engaging in peer group discussion at 8 years. An obvious question is why this might be the case at this age group and not in the younger and older age groups. Part of the answer may lie in the analysis of age differences in other measures of argument skill. These, generally, show a smooth progression from less to more advanced or sophisticated forms of argument with age. In particular, while the use of two-sided arguments shows a progressive increase with age for each year group, the use of one-sided arguments only diminishes significantly in the oldest age group. It may be that 8-year-olds are in a transitional stage in terms of their orientation to argument and knowledge: Leman and Duveen (1996) have argued that while younger children (6-7 years) see argument and discussion as winning and losing, older children (11-12 years) view argument and discussion as a means of establishing the right or correct answer to a question. Correspondingly, younger children may view knowledge as being linked to the expression of a personal opinion or perspective, whereas older children view knowledge as more discursive or evidence-based.

If the 8-year-olds in the present study are between these two contrasting conceptual orientations to knowledge and argument, it may explain why they begin to use more two-sided arguments but not fewer one-sided arguments than the 5-year-olds. At this transitional stage, group discussion may act as a prompt or cue to consider others' perspectives. However, individual reflection on the task is not sufficient to shake children out of a focus on their own perspective. Older children are aware of the need to incorporate others' perspectives in making arguments, and so in the present study showed posttest increases in use of two-sided arguments in both reflection and discussion conditions. The posttest increases in two-sided arguments amongst younger (5 year old) children are more difficult to explain. A possible explanation is that these younger children treat each side of the argument as an interesting example, a sort of list of alternatives, rather than seeking to strategically deploy one set of arguments to support a position. Thus, in posttests, the increased use of two-sided arguments corresponds to an increase in ability to generate alternative arguments amongst the 5 year olds. Amongst the 11 year olds, however, it corresponds to an increased strategic deployment of these more sophisticated elements. The 8 year olds stand between these two differing phases.

Thus, there seems to be an important shift in how children address differences in perspectives, at around 8 years of age. Before around 7 years children appear to resolve differences in perspective or views exclusively as a matter of winning or losing. However, from approximately 9 years onwards, children see interaction as an opportunity to address and understand others' views and recognise that discussion offers a means of resolving these differences (Leman & Duveen, 1996; Leman & Oldham, 2005). The present results may, therefore, reflect children's changing orientations to interaction at an important transitional age. At 8 years children may not fully grasp the importance of considering that an argument may have two sides. However, discussion and conversation prompts children to consider this possibility.

4.4.1. Limitations

An obstacle in analysing the empirical evidence in this study was the lack of adequate coding schemes to assess and evaluate the quality of children's arguments and the cognitive skills entailed in children's argumentative reasoning. More reliable and sensitive evaluation systems are needed to determine whether children generate progressively better arguments with age. In particular, counterarguments were elicited by asking children to "Imagine that someone disagreed with his or her opinion", and to "Give opposing reasons that the hypothetical other could say to convince you that he or she is right". Given their limited skills in second-order perspective taking (Kuhn, 1999b), it is possible that children, particularly 5-year olds, struggled to consider the hypothetical situation in the interviews. Therefore, the younger children's performance may have been constrained by their understanding of the task itself.

A further methodological limitation was the fact that the topics discussed in the pre- and posttest sessions were not counterbalanced (the *sharing* topic was always in the pretest, and the *lying* topic always in the posttest). This limitation affected the interpretation of the results regarding the differences in performance across the two sessions. A possible reason why children generated more two-sided arguments in the posttest was that they found it easier to provide arguments about the *lying* topic. However, only the experimental group improved in this way, so the results were not exclusively attributable to this limitation of the design in the present study.

Another possible contributing factor to these findings is that argument skill is confounded with children's knowledge about the topics. It is possible that the older a child is, the more he or she would be able to think up counterarguments and rebuttals with respect to *sharing* and *lying* topics. If this was the case, then obtained age differences were not necessarily due to children's growing understanding and use of arguments, but perhaps due to their ability to come up with other views and arguments with respect to these topics.

These two methodological issues (i.e., randomisation processes and children's prior knowledge) were taken into account in the design of the subsequent studies. For instance, the third and fourth studies (both detailed in Chapter Six) employed various topics that were selected in a carefully planned pilot study to assess whether the youngest children were familiar with those topics. Moreover, presentation of topics and arguments was randomised.

Another potential criticism of this study was the fact that the sessions of interaction were short, and the posttest was conducted only three days after the initial assessment. As discussed earlier, the result that at 8 years of age group discussions were particularly beneficial in developing an appreciation of the relevance of others' perspectives was based on a single indicator (two-sided arguments) of the many used in this study. Given that no differences were found in the other indicators, for example in children's ability to generate counterarguments and in the quality of the justifications provided, it is difficult to draw conclusions about a possible interaction between age and benefits of engaging in argumentative discussions.

Furthermore, there were two potential limitations regarding the tasks assigned to control and experimental groups of children at different ages. First, the task of 5-year old children differed from the task required of children in other age groups. Instead of writing arguments, 5-year olds were asked to think about the story and imagine, or think for themselves, what they would say if they had to answer the questions. However, it is impossible to know whether children engaged indeed in thinking, making problematic the comparison between the 5-year olds in the control group and the corresponding experimental group. Second, in the intervention of the experimental group, the researcher asked occasionally some questions to prompt further dialogue and also to generate counterarguments. The support provided by the researcher in the experimental group could have been an extraneous variable, which makes it difficult to interpret differences between groups. Compared to the experimental group, the researcher did not have an equally active role in the control group and she did not provide assistance when participants had difficulty in writing counterarguments.

4.4.2. Implications

The purpose of this study was to gain a better understanding of how children at different ages generate arguments, and also evaluate the individual arguments produced by children before and after engaging in an argumentative discourse activity. This study is important, because it extends the limited literature on children's argument skills by examining the specific argumentative elements children generate at different ages. Results indicate that there are important developmental differences at a young age in argument skill; however, more research should be carried out to better understand the course of this development.

The question of whether peer-interaction promotes children's argument skills is an important one and has relevance for pedagogical classroom situations. Results suggest that at 8-years group discussions may be particularly beneficial in developing awareness of two-sided arguments and an appreciation of the relevance of others' perspectives in argument. Further research is required to establish how children's knowledge and use of arguments changes around 8 years, and how opportunities for discussion and individual reflection can be optimised to promote the development of argument skills. One of the educational implications of these findings is that encouraging children to think critically about everyday topics, and enabling them to share their opinions and arguments in the classroom, may help students to develop argument skills that will serve them well across a range of different situations. The study presented in the next chapter (Chapter Five) focuses on the mechanisms behind these effects. Specifically, some of the characteristics in children's discussions (discourse and strategic elements) that might promote the development of argumentative reasoning were explored.

Chapter Five - Study Two: Children's strategic arguments and social interaction

5.1. Introduction

While the first study focused on children's ability to articulate positions and reasons in an individual basis, this study focuses specifically on the nature of children's conversations and their ability to direct argumentative discourse with others. The central objective was to identify what argument skills children from three age groups (5-6, 8-9, and 11-12 years-old) possess and how they use them in group discussions with peers. There are two distinctive features in the present study. Analysis of children's discourse included identifying and counting the total number of utterance types they use while discussing a topic with the peer group. The second feature was to explore whether children exhibit goal-directed strategies while engaging in discussions. This latter question could reveal whether, even if children can use certain elements of argumentation, they choose to deploy these elements in discussion where social dynamics and consideration of different perspectives may be more active.

5.1.1. Integrating theoretical approaches to study argumentation

The main theoretical point of reference in understanding the role of social interaction in individuals' ability to argue is offered by normative theories of argument. These include Formal Dialectics (Krabbe, 1986, 1992, 2002), Communication Theory (Jacobs & Jackson, 1982); Informal Logic (Walton, 1989), Pragma-Dialectics (van Eemeren & Grootendorst, 2004). These theories are based on different assumptions, including the set of rules and definition of argumentation (see the literature review in Chapter Two). But there are also many similarities in the general assumptions of normative theories. These theories assume that argumentation can be broadly defined as a social activity in which people discuss claims. Thus, analyses of argumentation should focus on communication and interaction between two or more people. Also, these theories explain that argumentation arises from attempts to resolve *conflicts* or *differences of opinion*, and that people involved in a discussion may have different *sets of commitments*. Moreover, it is suggested that there is not a single principle to evaluate argumentation. On the contrary, evaluative criteria should be applied according to different kinds of argument. Normative theories offer a useful framework for analysing empirically how individuals construct argument in the interaction with others, and were the theoretical basis of this study.

Additionally, Activity Theory (Leont'ev, 1981) is of particular interest for this study, since it offers a theoretical framework for understanding the development of argumentative strategies in discussions. According to Leont'ev (1981), when people engage in a discussion, they develop *actions*, or behaviours to pursue goals, and these goal-directed behaviours become increasingly sophisticated during a discussion. Moreover, a discussion develops as individuals improve their strategies and achieve goals. Felton and Kuhn (2001) have argued that these two forms of development reinforce one another.

5.1.2. Age differences in arguing and winning arguments

Previous studies have laid the groundwork for investigating how children interact with their peers in collaborative discussions. The skills involved in argumentative discussions are complex. Children are required, not only to share their points of view, but also to understand and listen to another's arguments and form strong, coherent and persuasive arguments. Clark and Delia (1976) showed that taking the perspective of other is a fundamental social-cognitive ability to effective social communication amongst children and adolescents. That is, the ability to understand and to adapt to the perspective of other, which develops with age (e.g., Selman & Byrne, 1974), leads to a more effective communication of persuasive messages.

Results of the study conducted by Clark and Delia (1976) showed that ninth graders constructed more than three times the number of arguments second graders offered. The major differences in the use of arguments and persuasive strategies were found between second and third graders, between third and fourth graders, and between eighth and ninth graders. Leman and Duveen (1996) explored the dynamics of conversations of same-aged peers in a discussion of a simple perceptual task. Children from two age groups (6-7 and 11-12 years) were asked to judge whether two lines in an optical illusion were the same length. Some children (experimental condition) received training in a measurement algorithm using sticks placed over the lines. Children in the control condition did not receive training. Discussion pairs consisted of one child who had answered independently that the lines were the same length and one who responded that they were different. The children were asked to discuss it and arrive at an agreement.

The results from this study showed striking differences between the age groups, particularly the ways in which the “expertise knowledge” was used strategically in the discussions. Older children (11-12 years) showed a good grasp of the strategy of an argument, employed their expert knowledge appropriately, and tended to arrive at a conclusion by weighting the reasons of both sides. By contrast, younger children (6-7 years) were less centred in the arguments provided, and tended to rely on external features of the situation in justifying their beliefs. Their conversations were very conflictual, and this conflict was based on personalities or the strength of belief of each child, and also on gender differences. Leman and Duveen (1996) concluded that while older children understand better the interpersonal and communicative processes involved in knowledge acquisition, younger children have more difficulty in separating concepts of knowledge from concepts related to an individual’s social status. In another study, Leman and Oldham (2005) used a collaborative recall task to explore the nature and outcomes of children’s interaction with another child at the same age (two 7-years-olds or two 9-years-olds) or different age (7- and 9- year-old). Children were instructed to memorise word lists for recall. In the first condition, children recalled collaboratively: in a pair with the other child. In the second condition, recalled words independently.

Analyses included recall scores, contribution of each child of a dyad to the number of items collectively recalled, and measures of social dominance. The main results indicated that older children dominate social aspects of interaction and recall when paired with younger child. But with the same-age peer, younger children did not benefit from the collaboration. Leman and Oldham (2005) argued that younger children may lack full awareness of the potential of interaction to facilitate their performance in the task.

Anderson’s et al. (2001) study with fourth graders (9-10 year olds) showed that children also attempt to coordinate conversation with the goals of argumentation. Their results suggest that, when engaging in a discussion, children share and appropriate each other’s strategies. As a result, strategy use gradually “snowballs” within conversational partners. These strategies include attempts to make explicit claims, to articulate one’s position taking into account what other partners said, and to challenge opposing arguments with hypothetical scenarios and critiques.

Felton and Kuhn (2001) assessed more sophisticated strategies in dialogues of adolescents and adults. Their study reports the development of an analytical system for analysing multiple dialogues between peers on the topic of capital punishment.

Argumentative strategies include *corner sequence*, in which a speaker questions his partner for the purpose of finding a weakness in the partner's position, which the speaker is then able to criticise. Two strategies that represent defensive moves were *rebuttal*, defined as a sequence of counterarguments, and *block* that occurs when a partner counterargues the premise of a leading question posed by the partner, avoiding in this way being forced to undermine his or her position. A fourth strategy identified was *case sequence*, which represents an offensive move, in which a speaker questions the partner about a hypothetical scenario or case, with the goal of directing the partner's argument. Results showed that the use of these strategies, particularly corner sequence, rebuttal and block occurred more frequently in adult dialogues than in adolescent dialogues. Felton and Kuhn (2001) also compared the use of strategies in argumentation in agreeing and disagreeing dialogues. At the beginning of the study, participants identified their positions on capital punishment using an opinion scale adopted from Kuhn and Lao (1996). Participants were, then, assigned to agreeing, disagreeing, and neutral dyads. If the dyad members agreed with each other, they were asked to find all the reasons why they agreed. If they disagreed, they were asked to reach a consensus. Results show that agreeing discourse is as strategic as disagreeing discourse, although its goals differ. Felton and Kuhn (2001) also found that adolescents did not exhibit the strategic skill that adults did of adapting discourse to the requirements of particular contexts (agreeing vs. disagreeing dialogues).

5.1.3. Work on peer collaboration

An important function of a discussion about a topic is the exchange of different points of view (Howe, 2010). There is now a substantial body of work dedicated to the study of peer interaction on several subjects of the school curriculum. Results have confirmed the significance of contrasting views on literacy and the arts (e.g., Miell & Littleton, 2004), mathematics (e.g., Schwarz, Neuman, & Biezuner, 2000), and science (Howe, Rodgers, & Tolmie, 1990; Howe & Tolmie, 2003; Howe, Tolmie, Greer, & Mackenzie, 1995; Howe, Tolmie, & Rodgers, 1992; Tolmie, Howe, Mackenzie, & Greer, 1993). For the past 20 years, research focused on science conducted by Howe and her colleagues have provided enough evidence of the power of exchanges of opinion. In all of the studies, the children who worked in groups where initial ideas differed and/ or were observed to express differences during group work performed significantly better when individually given posttests a few weeks later than during the initial assessment. Their progress was also significantly more salient than the progress detected with children who worked in similar groups and/ or failed to express contrasting ideas. The most striking finding was that contrasting opinions triggered change despite the fact that their scientific quality was weak. In a recent study, Tolmie, Christie, Howe, Thurston, Topping, Donaldson et al. (2007) found that knowledge gains obtained after the implementation of a 3-weeks science program, involving group tasks for 10- to 12-year olds, were sustained after an 18-month interval.

5.1.4. The present study

Whilst there are documented age differences on adult performance in strategic skills in argumentative contexts (Felton, 2004; Felton & Kuhn, 2001), there is little evidence regarding children's and young adolescents' ability to develop strategies to direct an argumentative discourse with their peers. Thus, the focus of children's discussions in the current study constitutes a novel approach to study the development of argumentation skills. The coding scheme used was adopted from the study by Felton and Kuhn (2001) who assessed discourse and strategic argumentative skills in adults. The first question in the current study is whether children understand and use sophisticated arguments (e.g., counterarguments) and argumentative strategies (e.g., blocks, rebuttals) to argue with their peers. This study also focuses directly upon the question of whether the use of argumentative strategies reflecting higher levels of argument skill increases with children's age. More specifically, it was expected that older children (11-years old) would use a greater number of argumentative strategies than younger children (8- years), who in turn would behave more strategically than 5-year olds.

5.2. Method

The empirical data reported in the present chapter are based on transcriptions of a series of group discussions on three different socio-moral topics. The sample included children from three age groups (5-, 8-, and 11- years-of-age). Prior and subsequent to the series of discussions, participants were asked to indicate and justify their own individual opinion regarding two topics (*sharing* and *lying*). These pretest and posttest assessments and group discussions were conducted as part of the previous study (see Chapter Four). The series of discussions provided the data for the work presented in this chapter.

5.2.1. Participants

A total of one hundred and fifteen participants engaged in a series of group discussions. The sample included children in three different age groups; 5 years (M age = 5, 7 years, SD = .48), 8 years (M age = 8, 4 years, SD = .48), and 11 years (M age = 11, 9 years, SD = .34). Children were in their first, fourth, and seventh year of school education. Students were of heterogeneous ethnic and socioeconomic backgrounds, and they were drawn from public and private elementary and secondary schools in the local area of Surrey, South East England. In the first instance, a letter explaining the study in more detail was sent to the Head Teacher of each school. A template letter to schools is attached in Appendix 1. After receiving permission from the schools, a consent letter was sent to children's parents or guardians, who were required to give written consent for their child's participation in this study. A template consent letter is attached (see Appendix 2). Children were also asked for their consent to take part in the group discussions and it was made clear that they could withdraw from the study at any point if they wished.

5.2.2. Procedure

Participants were assigned randomly to groups of five children from the same age and class. Groups consisted of roughly equal numbers of boys and girls. These conversations took place over three consecutive days. No group was given more than one discussion in the same day.

At the beginning of each session, the group was given instructions to engage in and listen to a recorded story (e.g., "Let's listen to a story about two friends. Please try to pay attention, because after listen to the story, we are going to talk about it"). The storytelling was immediately followed by discussion of the story as a whole. Conversations were elicited by a key question related with the moral theme in the story.

At the start and during discussion, the interviewer asked a series of questions to initiate and maintain discussion. For example, related to the first story ("The bear that spoke"), students were asked the following question: "Is there any difference between helping a stranger or a friend?" Then the researcher gave the following instructions to the group: "Your task is to talk about the friendship and helping others, or whether is there any difference between helping a friend or a stranger. You will need to discuss the reasons each of you have for your views and find out where you agree or disagree. If you disagree, try to determine why and try to reach an agreement if you can". If participants had difficulty maintaining the discussion during the prescribed time, or generating arguments, the researcher asked some questions to prompt further dialogue and also to generate counterarguments and rebuttals (see Table 5.1).

Table 5.1. Illustration of prompt questions used in the discussion of the story "the bear that spoke"

Key question	Is there any difference between helping a stranger or a friend?
Prompt questions	1. Why? Try to refer to all reasons that explain your position. 1 a. (Probe, when subject completes initial response) Anything else? 2. Someone (child's name) seems to disagree with your opinion. What would you reply to him/ her to explain that your position is right? 2.a. (If not already indicated) What could you say to show that your own view is the right one?

In order to end the discussion, the researcher asked: "Do you think you can reach an agreement together?" If the majority of children said "yes", the researcher continued: "Thank you. It was very interesting to listen to your opinions about this topic. Did you like discussing this together?" If some children did not agree and continued discussing ideas, the researcher finalised the discussion saying: "We have to stop now, because we are running out of time and I have to call the next group. Thank you very much for participating in this activity. It was very interesting to listen to your opinions about this topic, and I hope you enjoyed it as well".

Discussions lasted an average of eight minutes among 5-6 year old children, 13 minutes among 8-9 year old children, and 11 minutes among 11-12 year old children.

All of the verbal dialogue data were recorded on videotape and later transcribed for coding and analysis.

Materials

Stimulus stories were selected from two books for children: "First stories for thinking" (Fisher, 1999), for children aged four upwards, and "Stories for thinking" (Fisher, 1996), for children aged nine upwards. The three stories selected for these tasks come from different countries and cultures including folktales from Europe, India and North America. All three stories contained a theme for thinking and discussion. "The black tulip" (Fisher, 1996) is a Dutch folktale about *stealing*; "The bear that spoke" (Fisher, 1996) is a Canadian folktale that talks about *friendship and helping others*, and "The ungrateful crocodile" (Fisher, 1999) is a story from India about *trust.* (Complete stories are presented in Appendix 4). All three stories were recorded by the researcher's supervisor. Children listened for approximately 2-3 minutes to a story and, immediately after storytelling, the researcher asked a key question related to the moral theme in the story (see illustration on Table 5.2). Prompt questions were also used for further discussions of each story (Appendix 5). All of the verbal dialogue data were recorded on videotape using a camera.

Table 5.2. Stories and key questions for discussions

Story	*Moral theme*	*Duration (min)*	*Key question*
The bear that spoke	Helping friends	2, 07	Is there any difference between helping a stranger or a friend?
The black tulip	Stealing	3, 43	In the story, the thief said that thieves never prosper. Do you think that stealing is always wrong?
The ungrateful crocodile	Trusting others	2, 22	In the story the man is kind and also trusting of others, but someone took advantage of it. If someone breaks a promise, should people trust this person again?

Coding

There were 12 discussions produced by 5-6 years old children (year 1), 28 discussions produced by 8-9 years old children (year 4), and 17 discussions produced by 11-12 years old children (year 7). Evaluation of argumentative discourse skills in these series of discussions was based on the assessment scheme developed by Felton and Kuhn (2001) that assessed similar skills in adolescents and adults. A summary of the coding scheme is provided in Table 5.3 below. A detailed description of this coding scheme is provided in the methodology chapter of this thesis (see Chapter Three).

Table 5.3. Summary of analytical scheme for argumentative discourse (Felton & Kuhn, 2001, p.141)

Transactive questions	
Agree-?	A question that asks whether the partner will accept or agree with the speaker's claim
Case-?	A request for the partner to take a position on a particular case or scenario
Clarify-?	A request for the partner to clarify his or her preceding utterance
Justify-?	A request for the partner to support his or her preceding utterance with evidence or further argument
Meta-?	A question regarding the dialogue itself (rather than its content)
Position-?	A request for the partner to state his or her position on an issue
Question-?	A simple informational question which does not refer back to the partner's preceding utterances
Respond-?	A request for the partner to react to the speaker's utterance
Transactive statements	
Add	An extension or elaboration of the partner's preceding utterance
Advance	An extension or elaboration that advances the partner's preceding argument
Agree	A statement of agreement with the partner's preceding utterance
Aside	A comment that does not extend or elaborate the partner's preceding utterance
Clarify	A clarification of speaker's own argument in response to the

Transactive questions	
	partner's preceding utterance
Coopt	An assertion at the partner's immediately preceding utterance that serves the speaker's opposing argument
Counter-A	A disagreement with the partner's preceding utterance, accompanied by an alternate argument
Counter-C	A disagreement with the partner's preceding utterance, accompanied by a critique
Disagree	A simple disagreement without further argument or elaboration
Dismiss	An assertion that the partner's immediately preceding utterance is irrelevant to the speaker's position
Interpret	A paraphrase of the partner's preceding utterance with or without further elaboration
Meta	An utterance regarding the dialogue itself (rather than its content)
Null	An unintelligible or off-task utterance
Refuse	An explicit refusal to respond to the partner's preceding question
Substantiate	An utterance offered in support of the partner's preceding utterance
Non-transactive statements	
Continue	A continuation or elaboration of the speaker's own last utterance which ignores the partner's immediately preceding utterance
Dismiss	An utterance having no apparent connection to the preceding utterances of either partner or speaker

This scheme categorises each utterance in a dialogue based on its function relative to the preceding utterance, rather than focusing on the content of conversations. The scheme includes three general categories: transactive questions, transactive statements, and non-transactive statements. According to Felton and Kuhn (2001), an utterance is defined as transactive if it connects directly to the partner's preceding utterance. Transactive questions request a response or a clarification from the partner, for example "What do you mean?" or "Why do you think that...?" or "What if…?" Transactive statements are utterances expressed in response to the partner. Non-transactive statements are utterances that do not connect to the partner's preceding utterance (they include utterances coded as 'Continue' and 'Unconnected'). In such cases, the speaker is breaking from the preceding conversation and introducing a new argument or idea.

In each discussion, each turn was segmented into utterances, and each utterance was given a code. Each conversational turn was assigned with one code (or sometimes with two codes). Coding conversational turns of five speakers can be challenging, as often a speaker responds to the first speaker, instead of addressing the argument of the last one. However, a code was given always according to the preceding speaker. Occasionally, children did not complete an argument or idea, because of interruptions from another child. Thus, conversational turns with incomplete utterances were not coded. Also, a code was not given when the preceding speaker was the researcher.

After coding individual utterances, all discussions were re-examined in search of *strategic sequences.* Felton and Kuhn (2001) defined strategic sequences as "patterns of utterances that might represent an attempt to advance an extended argumentative strategy" (p. 145). Based on this analytic system, four sequences of codes were identified and counted in the discussions produced by children in the three age groups:

1. Corner sequence, identified when the speaker asks the partner to clarify his position (Clarify-?), or when the speaker tries to interpret the other's response (Interpret), and then, challenges his or her view advancing a Counter-C;

*2. Case-? sequence***,** which is a variant of the corner sequence defined by Clarify-?, followed by a Counter-C. Instead of Clarify-?, the opening statement is a Case question;

3. Rebuttal is defined as presenting a counterargument that follows another counterargument (Counter-A or Counter- C) produced by the partner; and

4. Blocking occurs when the speaker presents a Counter-C, to reject or counter-argue the premise of a leading question (e.g., Case-?) posed by the preceding speaker.

Reliability of utterance and sequence types

To test reliability of the coding of argumentative discourse measures a second judge coded blind ten of the discussions, selected at random (about 15% of the total number of discussions). Agreement on coding for utterance and sequence categories was good: utterance types, Cohen's kappa = .88; sequence types, Cohen's kappa =.76.

5.3. Results

5.3.1. Design and analysis

A total of sixty seven group discussions were produced; fifty seven (out of 67 of these discussions) were produced by groups of five children, and ten (out of 67 of these discussions) were produced by groups of four or six children. Therefore, the analysis included only the group discussions composed by five children. The other ten were excluded from the analysis. More specifically, there were 12 discussions produced by 5-6 years old children (year 1), 28 discussions produced by 8-9 year old children (year 4), and 17 discussions produced by 11-12 years old children (year 7).

A one-way multivariate analysis of variance (MANOVA) was conducted to determine the effect of age on all measures of argumentative discourse: first the utterances used by groups in discussion; and second, the strategic sequences.

Age differences in utterance types

The first objective of this study was to identify differences in the argumentative discourse of children at different ages. For this purpose, the generation of different utterance types in group discussions by children in three age groups (5-6, 8-9, and 11-12 years-of-age) was explored.

Statistically significant multivariate differences between age groups appeared with respect to four utterance codes, Wilks' $\lambda = .05$, F (46, 64) = 4.82, $p < .001$. Table 5.4 presents the mean use of these utterance types in children's discussions in the three age groups. The three age groups differed significantly in terms of the use of *Clarify-?*, F (2, 54) = 3.22, p < .01, partial $\eta^2 = .11$, *Add*, F (2, 54) = 11.77, p < .001, partial $\eta^2 = .30$, of *Advance*, F (2, 54) = 51.97, p < .001, partial $\eta^2 = .66$, and use of *Counter-A*, F (2, 54) = 15.29, p < .001, partial $\eta^2 = .36$.

As can be seen from Table 5.4, post hoc tests indicated that the use of *Add* was found significantly more often in discourse of 8- year olds. The other three utterance codes were found significantly more often in discourse of the oldest children (11- year olds), compared with younger children (5 and 8 year olds). Use of *Advance* and

Counter-A increased progressively with age. However, although means indicate some changes, use of these two utterance types only differed significantly for 11-year-old compared with 5- and 8- year old children. Use of the question *Clarify-?* differed significantly between the oldest children (11 years) and the youngest children (5 years).

Table 5.4. Mean use (and standard deviations) of utterance types Clarify-?, Add, Advance and Counter-A and Rebuttal strategies in group discussions

	5 years		8 years		11 years	
Code	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*
Clarify-?	$.08_a$	.29	$.21_a$	.42	$.65_b$	1.06
Add	3.92_a	2.84	8.43_b	3.06	4.94_a	3.31
Advance	1.08_a	.90	1.50_a	1.14	7.59_b	3.50
Counter-A	$.75_a$	.75	1.89_a	1.75	3.94_b	1.78

Note: Subscript letters indicate groups that differ significantly using post-hoc Bonferroni tests (p<.05)

Use of Clarify-?

As Table 5.4 shows, the question *Clarify-?* was more prevalent in the oldest children group (11-12 years-of-age). Sometimes, this question does not reflect an argumentative strategy. A speaker might ask the partner to explain his or her preceding utterance, without argumentative goals in mind. However, in other situations, *Clarify-?* is used indirectly to address the partner's argument with the intent of weakening it. In the following example, regarding the topic of *stealing*, speaker B asks for a clarification on the argument given by the first speaker ("Are you saying that stealing a pencil is O.K.?"). This question has an argumentative goal: speaker B wants to elicit what he or she sees as a weak argument from the first speaker and is prepared to criticise it. Thus, as predicted, after speaker A gives an explanation, speaker B advances a *Counter-C* (see Table 5.5.).

Table 5.5. Example of the use of Clarify-? as an argumentative strategy by 11-year old children

Code	Speaker/ Utterance
Counter-C	Speaker A: That is not classified as stealing, but as just taking something. We don't say: "he stole my pencil!" We say: "he took my pencil!"
Clarify-?	Speaker B: Are you saying that stealing a pencil is O.K.?
Clarify	Speaker A: You're not stealing; you're just using a pencil.
Counter-C	Speaker B: If you don't usually do that, then it is O.K., but if you keep on doing it all the time, that's classified as wrong!

Use of *Add*

Results showed that children aged 8-9 years exceeded the other age groups in the mean use of the utterance *Add*. Add is defined as an extension or elaboration of the partner's preceding utterance. It is a weak strategic utterance, since it neither advances the speaker's position nor challenges the partner's argument. Table 5.6 presents examples of Add in a discussion between 8-9 years old children on the topic *helping friends and strangers.*

Table 5.6 Example of Add produced by 8-year old children discussing a story about helping friends and strangers

Code	Speaker/ Utterance
Continue	Speaker A: You can help strangers except in a dark alley.
Add	Speaker B: you can help strangers when there are lots of people around, so they can't hurt you.
Add	Speaker C: Don't help them at night or in graveyards!

Use of *Advance*

Along with the code *Add*, the utterance *Advance* is also directed to strengthen the other speaker's position. In this case, the speaker provides an extension or elaboration of the partner's preceding argument. Results showed that this utterance type was more prevalent in the discussion of 11-12 year-olds (see Table 5.7).

Table 5.7. Example of Advance an 11-year old child while discussing a story about stealing

Code	Speaker/ Utterance
Continue	Speaker A: So, stealing is wrong depending on the situation.
Advance	Speaker B: Most of the times stealing is wrong, and thieves either get caught or they will have to run away through the rest of their lives. They become paranoid about being caught. Stealing is breaking the law.

Use of Counter-Alternate (Counter-A)

The three age groups also differed in the mean use of the utterance type *Counter-A.* Counter-A is defined as a disagreement with the speaker's preceding utterance, accompanied by an alternative argument. This utterance type is intended to pursue argumentative ends, since it challenges the speaker's position with a different argument (see Table 5.8).

Table 5.8. Example of Counter-A produced by an 11-year old child while discussing a story about stealing

Code	Speaker/ Utterance
Clarify	Speaker A: Maybe people deserve a second opportunity.
Counter-A	Speaker B: I would trust someone again if this person breaks a promise once, but if they keep doing it again and again, then I would probably not trust this person again.

Age differences in the use of strategic sequences

Finally, the mean use of different strategic sequences by age group was examined. The three age groups differed only in terms of the use of *rebuttal*, F (2, 54) = 4.47, $p < .01$, partial $\eta^2 = .07$. *Post hoc* Bonferroni tests revealed that the use of *rebuttals* differed significantly only between 11 year olds and 5 and 8 year old children (see Table 5.9). As seen in Table 5.9, the other three strategic sequences identified (corner sequence, block, and case sequence) occurred infrequently in children's discussions in all age groups, and results show no statistical differences between them.

Rebuttal represents a defensive move, but it is still a very strong strategic sequence, since it demonstrates that the speaker is aware of the argumentative goals in a discussion (Felton & Kuhn, 2001). Table 5.10 presents an example of a rebuttal.

Table 5.9. Mean frequency (and standard deviation) of sequence types in group discussions

	5-6 years		8-9 years		11-12 years	
Code	Mean	SD	Mean	SD	Mean	SD
Corner sequence	.00	.00	.04	.19	.18	.53
Rebuttal	1.17_a	1.34	1.11_a	1.62	2.59_b	2.00
Block	.17	.39	.32	.82	.24	.56
Case-? sequence	.00	.00	.14	.45	.18	.39

Note: subscript letters indicate groups that differ significantly using post-hoc Bonferroni tests ($p < .05$)

Table 5.10. Example of a Rebuttal produced by 8- year old children while discussing a story about trust

Code	Speaker/ Utterance
Clarify	Speaker A: Well, forgiving means that you will talk to him, and not trusting means probably that you wouldn't borrow him things anymore.
Counter-C	Speaker B: I disagree, because trusting is the same as forgiving. For example, if you give something to other person, you allow him to have it and that's trusting.
Counter-C	Speaker A: No, trusting and forgiving are not the same, because trust is when you can rely on someone to do something, and forgiving is when someone says sorry and you say it is O.K. and you can agree not to fight about it.

5.4. Discussion

The present study explored age differences in children's use of discourse and argumentation skills in peer group discussions. Children aged 5-6, 8-9, and 11-12 years discussed three different topics of a socio-moral theme in response to a stimulus story.

Conversations were analysed in terms of utterance and sequence types (i.e., argument strategies), based on the analytical coding scheme designed by Felton and Kuhn (2001).

The results showed that children in all age groups, even as young as 5 year old, were able to argue about a topic, express their opinions, and communicate with their peers. The use of unconnected or null utterances was practically inexistent. However, results also suggested that while the youngest children (5-6 years old) seem more preoccupied in expressing their own opinions, older children (11-12 years old) appeared to behave more strategically, producing more critiques (Counter-C), alternative arguments (Counter-A) and sequences of counterarguments (Rebuttals). These data suggest that at 11-12 years children have acquired many important argument skills and deploy them when exploring and evaluating the reasons for one's own and other's positions or perspectives in a discussion. Older children improve their strategy use as they adjust the goals they seek to achieve in discourse. Skilled arguers understand that the goal of effective argumentation is not only advancing sophisticated arguments, but to direct the arguments to gain advantage over the others (Leont'ev, 1981).

Results pointed to a key shift between 8-9 and 11-12 year old in terms of the mastery of many important argument skills. Particularly noteworthy regarding the use of utterance types were the changes in the use of *Add* statements in discourse. These show an inverted U-shaped developmental trajectory, increasing between 5-6 and 8-9 years, but then dropping between 8-9 and 11-12 years. Add statements extend or elaborate a speaker's preceding utterance. Adding is a poor strategy to the goals of argumentation, since it only elaborates the other speaker's statement, without either advancing the argument, or offering an opposing view. These differ from Advance statements in which children extend or elaborate a speaker's preceding argument. The oldest children (11-12 years) showed a decline in the use of *Add*, and an increase in the use of *Advance*, showing a more sophisticated form of argument. Another fundamental advance in argumentation skills was the use of the question *Clarify-?*, which was more prevalent in the oldest group (11-12 years). By asking the other to clarify his or her position, children demonstrated an appreciation for the other's perspective. A clarification question could have also been used as a first step to advance a *corner-sequence* strategy.

This suggests that at 8-9 years children are beginning to take others' perspectives on board but have difficulty recognising the ways in which positions and arguments (reasons that support these positions) inter-relate in a conversation. In this respect, 8-9 year old children may spend more time in discussions adding to their co-discussants' statements because they are starting to recognise that another's perspective is a relevant concern (Leman & Duveen, 1996; Leman & Oldham, 2005). Yet, they may still lack adequate awareness to coordinate this information in a strategic way to conduct effective argumentation. This result is also consistent with the theory and data on the relationship between perspective-taking and effective argumentation (Clark & Delia, 1976) and helps explain the present findings.

Moreover, the age differences observed in children's use of rebuttals in the interviews analysed in the previous study (Chapter Four) suggest that, while 8-year old children appear to have a good grasp of counterargument, they do not use significantly more of these skills in peer discussion. The oldest age group employed significantly more rebuttal strategies in the discussions than the younger children. Counterargument and rebuttal are markers of an awareness of others' perspectives in conversation and discussion and, as such, have been characterised as more advanced argument skills (e.g. Felton & Kuhn, 2001). The present results point to the possibility that the deployment of argument skills in peer discussion lags behind children's ability to use these skills.

5.4.1. Limitations

The results of this study with respect to the use of strategic sequences in children's discussions remain tentative because all age groups produced argumentative strategies (e.g., *corner-sequence*, *block* and *case-based sequence*) rather infrequently. This was probably due to the nature of the task. Each discussion lasted for about ten minutes (including listening to the stimuli story and task instructions), which probably was not enough time for children, in groups of five peers, to express their points of view and discuss in depth the positions and arguments of the other speakers.

A potential criticism of this task design was that assignment to groups was not based on any particular criterion. Children were then asked to discuss their reasons, and if they disagreed, to determine why and reach a possible agreement. Because the emphasis was on discovery and exploration, the researcher gave children the freedom to determine the content of their discussions and used a flexible approach to create a productive group dynamic. The researcher exercised direct control over the discussion only in rare occasions, such as, when a child was dominating the entire discussion and not letting other children participate. In most cases, members of the group held different positions on a topic and were led to engage in a debate with their peers and reach an agreement. In a few occasions, it was difficult for children to maintain a discussion during the prescribed time or generating arguments, particularly with 5-year olds. In this case, the researcher asked some questions to prompt further dialogue and also to generate counterarguments. Nevertheless, the composition of the group (of whether the group was composed of members who shared the same opinion or who had opposing views) may have led to differences in the quality and quantity of argument and argumentative strategies produced. On one hand, this variable should have been controlled or examined; on the other hand, it would have been impractical to do it with such a large sample and with the time restrictions of schools.

Another limitation regarding the methodology of this study was that the measure used to assess the components of argumentative reasoning was originally developed to measure argument dyads (either individuals or teams) where individuals have opportunity to directly respond to the previous utterance of the other interlocutor. In the present study, there were five interlocutors speaking and, therefore, the coding scheme was adapted to fit the characteristics of the group discussions. For instance, from time to time, the investigator asked a child to clarify his or her position in relation to the last speaker's utterance (e.g., "So, do you disagree with what [child's name] said?"). In such situations, and every time participants responded to the investigator's prompt questions, participants' utterances were assigned a Null code. Most of the times, the decision to give codes was similar to the ground rules of the original coding scheme. Through the course of a discussion, it is expected that participants address the utterance of the last speaker (Felton, 2000). This was observed in practice.

Given the potential difficulties in measuring or rating utterances in a group, and the lack of research on how adults fair at it, it may seem premature to look at how young children perform at this task. However, as stressed in the methodology chapter (Chapter Three), this study was mainly exploratory and served as a means to devise new quantitative measures for subsequent studies. It was, thus, the first attempt to test a dyadic measurement of argumentative skills in a different context.

A further limitation is that the design of this research did not enable to draw conclusions regarding possible differences between the two contexts: dyadic and group discussions. It is, thus, clear that further research is needed to device appropriate measurements to determine whether the skills involved in dyadic argumentation *versus* argumentation with multiple individuals are similar. For instance, establishing how children's knowledge and use of arguments change with age, and also how opportunities for discussion can be optimised to promote the development of argument skills can have important theoretical and practical implications.

5.4.2. Implications

These findings highlight the importance of understanding and incorporating others' perspectives in discussion (see again Leman & Duveen, 1996). A study focused on the argumentative skills of young children is particularly relevant in terms of its implications on education and classroom learning. As Mercer (2009) argues, one of the most important aims of education is to develop children's abilities in argumentation. In his view, education is conceived as a dialogic process in which the dialogue between teachers and learners and the dialogue amongst learners contributes to the development of their individual intellectual abilities. It is through the use of language that children develop their skills in reasoning and argumentation. The work of Stein and her colleagues (e.g., Stein & Albro, 2001; Stein & Miller, 1993a, 1993b) has shown that children first learn to argue through conflictual talk with their parents about everyday situations. In these interactions, children learn how to use language effectively as a means of pursuing interests and developing shared understanding. In school, teachers also use discursive strategies, such as questioning, recapping, reformulating, and elaborating to engage students in learning activities. As well as learning from guidance, and example of adults, children also learn the skills of thinking by interacting and communicating with each other (Mercer, 2009). Any account of the development of reasoning and argumentation based only on the study of conversations between older and younger participants (e.g., parent-child interactions) would be insufficient. Children also learn how to communicate and argue better when interacting, playing, and talking with their peers.

While Study One (Chapter Four) focused on the argument skills that children exhibit in a formal interview with the researcher, the present study explored these skills when children engage in a more informal group activity with their peers. This study extends the limited literature on children's argument skills by examining the specific argumentative discourse elements that children generate at different ages. Results revealed significant differences between younger children and 11-year olds in terms of children's discourse strategies during group discussions, with the older children showing more instances of asking for clarifications and building on the utterances of their interactive partners. Nevertheless, children at all ages did use rebuttals (a sequence of counterarguments) in discussions. Although rebuttal represents a defensive move in part of the speaker, it is still a very strong strategic sequence, since it demonstrates that the speaker is aware of the argumentative goals in a discussion (Felton & Kuhn, 2001).

This result suggests that, from a young age, children understand the goals of discourse and the role speakers play in an argumentative discussion. This recognition or awareness seems to develop with age. A question one may ask is whether giving instructions regarding the definition and use of strategic arguments can promote the development of these strategies. These implications are further discussed in the final discussion chapter (Chapter Eight).

Chapter Six - Children's evaluation of argument strength (Study Three) and argument effectiveness (Study Four)

6.1. Introduction

The previous two studies have addressed how children at different ages generate arguments, both individually (Study One) and in peer collaborations (Study Two). Results showed that older children (11-12 years old) generate more complex forms of arguments compared to younger children (5-6 and 8-9 years old). For example, in face-to-face interviews (Study One), older children produced arguments that contained more justifications, and arguments that addressed both sides of the question (two-sided arguments). Moreover, the oldest age group (11- year olds) intervened more in group discussions, not only in constructing their own arguments, but also in challenging and critiquing opposing arguments generated by the other speakers. Increasing construction of stronger types of arguments suggests that older children were more aware of others' perspectives and arguments.

The tasks of constructing, evaluating, and responding to arguments are closely connected (Govier, 2005). For instance, when we decide that someone else has offered a weak argument, and we give an appraisal of the argument to show that the reasons in support of the claim or the conclusion are not acceptable, we are actually offering an argument ourselves. Moreover, when we evaluate arguments in a text or speech, we always end up constructing our own arguments, because we will be giving reasons to our own conclusion as to whether the argument is strong or not. When we offer our own arguments, we need to explore all the reasons that support our claims, and also to evaluate whether they are acceptable and relevant. Therefore, there are two sides to the practice of argument. There is the matter of evaluating other people's arguments, and there is the matter of constructing strong arguments (Govier, 2005). While the focus of the previous two studies was on argument generation, the studies described in this chapter address argument evaluation. Although generation and evaluation skills in argumentation are interconnected, some researchers on argumentation have investigated these two components of argumentation in separate studies (e.g., Goldstein, Crowell, & Kuhn, 2009; Leitão, 2003).

The present chapter describes a series of empirical studies designed to explore children's ability to appreciate and evaluate arguments. The study of evaluation skills, also referred as meta-level skills by Kuhn and colleagues (e.g., Goldstein, Crowell, & Kuhn, 2009; Kuhn, 1991) is highly practical for education and in everyday life.

Children are required to express their ideas and produce arguments in many situations in daily life, for example in family conflicts and peer interactions. In these argumentative interactions, children need to understand and carefully examine the views and arguments proposed, in order to argue and counter-argue effectively. In school, students are also required to critically evaluate the relevance of claims and arguments provided in textbooks and other sources, such as the Internet (Glassner, Weinstock, & Neuman, 2005). Evaluating information from the Internet is a particularly relevant topic for parents and teachers concerned with students' increased use of Internet materials for personal and academic research. The Internet exposes students to information that ranges widely in its reliability. To guard effectively against misinformation and fraud, and use information effectively, students need to critically evaluate what they read on Internet websites. As highlighted in the literature review chapter (see Chapter Two), building students' critical thinking lies partially in teaching them argument evaluation skills.

6.1.1. Understanding an argument and taking sides

In order to evaluate an argument, we first have to know what an argument is. In practice, this means finding claims and justifications in written and spoken material. Children, and even adults, find this matter difficult. Brem, Russell and Weems (2001), found that students often performed poorly in analysing scientific information on an Internet website, because they did not evaluate the information sufficiently. Some characteristics of websites made argument evaluation challenging (for example, multiple layers of argument, missing evidence or insufficient detail), but students' weaknesses exacerbated these difficulties. According to the authors, these weaknesses stemmed from (1) students' overreliance on surface features rather than systematic analysis, for example, relying on credentials as a marker of credibility, and also (2) students' failure to understand the nature of science and publishing, for example, focusing on the scientific argument, thus paying less attention to the reporting. Moreover, a recurrent theme was the lack of meta-cognitive reflection. Many students showed an "absolutist" orientation, that is, a belief that, given enough time and information, one can arrive at a "right answer" with complete certainty (Kuhn, 1991).

They also trusted common sense when assessing reasonableness, even though the goal was to produce the opposite response. These results indicated that students reacted to information on websites without reflecting on why they responded in a particular way. This is consistent with other findings suggesting a lack of reflection in argument exhibited by young adults (Kuhn, 1991; Kuhn & Felton, 2000).

Other studies have suggested that people tend to rely too heavily on explanations rather than evidence when they evaluate arguments (e.g., Brem & Rips, 2000; Kuhn, 1991). Kuhn (1991) suggested that these errors arise from an inability to distinguish between explanations and evidence. Specifically, people's weaknesses in argument evaluation result, not only because explanations influence their search for and interpretation of evidence, but also because people believe that their explanation *is* evidence. Brem and Rips (2000), on the other hand, advanced an alternative account that many people do distinguish between explanations and evidence, but rely more heavily on unsupported explanations when evidence is weak or absent. Although evidence availability influences performance, the authors considered that factor not necessarily a weakness. When no evidence is available, participants, who have nothing but an explanation to go on, give that story some weight, even if it is weak. In these cases, they are substituting explanations for unavailable as a useful strategy to argue under uncertainty.

Evaluating an argument involves, not only describing an argument, but also having sufficient knowledge about the argument's topic to make appropriate judgements (Voss & van Dyke, 2001). Brem (2000) analysed how adolescents' prior knowledge regarding the purpose of science influences their evaluations of science accounts on the Internet. First, using a survey instrument including Likert scale items and open-ended questions, Brem (2000) assessed students' concept of science. Participant were girls, aged 14 to 16 years (from 9th and 10th grades), and results showed that their concept of science was focused on practical and life-enhancing goals, such as improving life or helping people. For example, of some presented uses of science, the strongest link found was that "Science helps staying safe and healthy"; over half stated that they used science for this purpose at least once a month, and 78% agreed that science could be useful for his purpose. "Solving everyday problems" was the second most popular purpose. As the set of items moved to less traditional pedagogical notions of science, students saw less connection to science. Fewer reported using science to "Understand people", and only 50% thought this was potentially useful. Additionally, very few students reported that science could be useful for "Taking a stand in political issues" and "Test experts' credibility". When presented with specific reasons for wanting to learn science, students again showed an interest in practical and caretaking functions (such as "Making decisions about personal health", or "Want a job that uses science"), though enjoyment of science was their number one reason.

In the second part of the study, Brem (2000) developed a web-based task which consisted of an introductory section about critical evaluation, and an evaluation section. The program allowed students to visit third-party websites for information, while remaining within a framework that provided instructions in assessing arguments, note-taking capabilities, and graphical argumentation tools. Eighty-one girls, aged 14 to 18 years, from grades 9, 10, and 12 (including the students who participated in the survey described above) participated in this study. Results showed that students' prior conceptions of science influenced how they evaluated accounts of science provided on the Internet. For instance, assessing source credibility was a real challenge to students with little knowledge about a particular scientific area (e.g., the role of a biochemist in cloning research). Instead of determining whether a source was knowledgeable and trustworthy, or examining their credentials and experience, students relied on the appearance of the credibility when they could not establish the importance of information, assuming that affiliations were relevant and reputable.

Moreover, students' views of "real" scientists were very similar to those that emerged from the survey. According to the student model, credible scientists are "Unprejudiced and interested only in advancing science", or "Engaged in activities with a clear purpose, often humanitarian in nature". According to this view, scientists do not possess ulterior motives, such as financial gain, or motivation by career goals and prestige. As Brem (2000) discusses, believing that scientists have no motive beyond helping and discovery may lead to an unwarranted level of trust. Moreover, if students do not know much about a scientific area and they do not recognise the purpose of a study, they may dismiss it prematurely. As this study shows, students' prior knowledge about a topic plays a crucial role in how they address and evaluate arguments related to that topic.

As highlighted in the literature review chapter (Chapter Two), research on argument generation has also demonstrated that arguers tend to ignore the opponent's argument and focus mainly on their own arguments (e.g., Felton & Kuhn 2001; Kuhn & Udell, 2007). For example, Kuhn and Udell (2007) conducted a study on preference for favoured or opposing arguments between adolescents and adults. Results of this study showed that adolescents tend to pay less attention to the opposing position, compared with adults. However, adolescents are still able to address the opposing position when explicitly asked to do so. As Kuhn and Udell (2007) suggest, it might be that adolescents do not recognise the need to address the opposing arguments, because they do not understand the goals and potential benefits of addressing and challenging counterarguments. This evidence indicates that, although cognitive and linguistic demands of argumentation can explain in part developmental differences in argument skill, the development of epistemological understanding is also crucial for appreciating the relevance of counterarguments. The work of Stein and her colleagues on children's generation of arguments in family conflicts has also showed that children are more aware of arguments in favour of their own positions than the claims and reasons of the opposing side (e.g., Stein, Bernas, & Calicchia, 1997; Stein & Miller, 1990).

Arguments can involve personal, socio-moral, ethical, political, or scientific issues. In most arguments, especially those in socio-moral domain, reasons given to justify a position are closely linked to personal preferences, values, and beliefs about the benefits and costs of supporting that position (Stein & Miller, 1990, 1993a). When arguers support one side *versus* the other they have decided that the values and socio-moral principles that underlie their favoured position are more important than those of their opponent's position (Stein & Miller, 1993a, 1993b). Further, arguers (regardless of their age) begin a discussion with support for their position to convince or persuade the other person about the greater legitimacy of their position. Persuasion is carried forward by providing support for the favoured position and criticisms of the opposing position. In family or peer conflicts, even preschool age children give reasons for supporting their side of the issue (Stein & Liwag, 1997) and for opposing their opponent (Albro & Stein, 2000).

The question that may arise is: do arguers have equal amounts of knowledge about their own and their opponent's position? Stein and Miller (1993a) attempted to answer this question by asking primary school children and adults to talk about four different types of argument knowledge: 1) reasons for supporting a favoured position, 2) reasons for opposing a favoured position, 3) reasons for supporting an opponent's position, and 4) reasons for opposing an opponent's position. Results from this study revealed that participants at different ages (ranging from 7 to 21 years) could generate supporting reasons for their own position and at least one reason in favour of their opponent's position. While participants easily generated problems with their opponent's position, they had greater difficulty generating reasons that would weaken or dismiss their own position. They also do not generate the more fundamental principles that motivate their opponents' claims. Stein and Miller (1993b) also concluded that an individual's knowledge about an issue is critical in determining the choice of supporting one side over another. The greater the number of supporting reasons for one side, the more likely an arguer would be to support that side (Stein & Miller, 1993b). Thus, the content and structure of argument knowledge across the position is asymmetrical (Stein & Miller, 1993a, 1993b).

6.1.2. The communicative goals of argumentative discourse

The research reported in this chapter seeks to explore whether there are developmental differences in children's evaluation skills of written arguments. In the first instance, analyses of arguments focused on its formal structure. These involved verifying the presence or absence of individual components regarded as necessary to sound arguments. This analysis is important because it could reveal which particular type or structure of argument children, at different ages, regard as "good" or strong. The framework adopted was drawn from Toulmin's (1958) analysis of the components of argument. As noted by Clark, Sampson, Weinberg, and Erkens (2007), in their review of approaches, most researchers have adopted Toulmin's model to analyse arguments. Some researchers have also made adaptations to the model to improve clarity and reliability of analysis (e.g., Erduran, Simon, & Osborne, 2004; Kuhn, 1991; Means & Voss, 1996). Regardless of the adaptations, stronger arguments are thought to contain more of the different components (e.g., inclusion of sound reasons to back up claims, inclusion of counterarguments) than weaker arguments. A further objective of the present research was to explore whether children's views on the topics influenced their evaluation of the strength of particular types of argument.

In the second instance, the present research investigated how children evaluate arguments in an interpersonal or dialogic context. In particular, the second study focused on children's evaluative skills with respect to the pragmatic function of argumentation. Analyses of children's arguments focused on the goal arguers pursue in argumentation - that of influencing others' points of view. This interest stemmed from recent studies that have shown that discourse goals are important mediators of the way children understand and evaluate arguments (Leitão, 2000, 2003).

For instance, Leitão (2003) analysed how children, aged 8-, 11- and 14- years, evaluate and select arguments and counterarguments for inclusion in a text aiming at convincing possible readers about the position defended. Participants were given one of two cards containing the following statements: *Children themselves should select the programs they watch on TV* or *Parents should select the programs children watch on TV*. Participants were presented with three reasons in favour of their views and three reasons in favour of the opposite view (i.e., counterarguments), and were then asked to decide whether those reasons should be included in the text. Additionally, children were asked to give reasons for each decision made. Results showed that the number of counterarguments selected for inclusion in the text was significantly lower than the number of arguments (for all age groups). Nevertheless, an unexpected percentage of counterarguments (40%) were selected by 8-, 11-, and 14- year old children to be incorporated into the text. As Leitão (2003) suggests, this result challenges the widely accepted view that children do not generate counterarguments in oral or written tasks because they cannot take alternative views into account. The result indicates that, when selecting content for inclusion in a text, children may consider views and counterarguments that may never be incorporated into the text. Analysis of reasons children invoked to justify their decisions revealed that they decided whether to include a statement in the text based on three criteria: (a) agreement or disagreement with the content of the target statement, (b) understanding that even though the content of a statement is partially acceptable, its scope should be restricted or modulated, and (c) assessment of the impact of an idea on the text goal, that is, the perception that the presence of a statement would or would not enhance the probability of the text viewpoint's being accepted. According to Leitão (2003), these criteria reflect the arguer's compliance with two constraints. The first is the *content constraint*, which leads the writer to focuses on the content (the first two criteria above). The second is the *rhetorical constraint*, or the writer's perception of the potential effect of an idea on the acceptability of the text's viewpoint (third criterion).

In a second study, Leitão (2003) looked in particular at children's awareness of the rhetorical value of counterarguments for persuading a reader. Participants were 8-, 11- year old children and first year college students (age 18-19), and they were asked to evaluate texts that varied in the inclusion of different argumentative elements (e.g., supporting element, counterargument, and reply). The essay topic concerned the extension of playtime in school. Results indicated that almost none of the participants regarded the texts, in which a counterargument was included, as capable of achieving the text goal. When asked to evaluate text versions that included counterarguments, 92% of 8- year olds and 69% of 11-year olds saw the inclusion of counterargument as something that would run against text purposes. Even among college students, 56% thought the presence of counterarguments might not be "good enough" to achieve the text's goal.

Similar results were obtained in educational studies. For instance, in a review of empirical studies on argumentative writing, Santos and Santos (1999) advanced the idea that writing to persuade, in contrast to simply expressing an opinion, might inhibit the production of alternative views and counterarguments because the failure to rebut them undermines the essay's persuasiveness. Recent studies on argumentative writing have provided evidence for this explanation.

For example, in an experiment conducted by Nussbaum and Kardash (2005), college students were asked to write an essay to persuade an audience or to simply express an opinion (no persuasion) about a controversial topic ("Does watching television causes children to become more violent?"). The authors also wanted to explore whether the provision of a short text, outlining arguments on both sides of the issue, would improve essay quality. Results showed that, compared to the no persuasion goal, the persuasion goal reduced the quality of the essay, when students wrote without the support of the text. Nussbaum and Kardash (2005) concluded that persuasion goals might discourage students to take into account alternative views.

Another set of studies conducted by Ferretti and colleagues compared the effects of a general goal to persuade and an elaborated goal that contained specific sub-goals on the argumentative writing of fourth- and sixth-grade students with and without learning disabilities (Ferretti, Lewis, Andrews-Weckerly, 2009; Ferretti, MacArthur, Dowdy, 2000). Both studies showed that the elaborated goal induced students to include more alternative views and arguments, and therefore to produce more persuasive essays than the general goal of persuasion.

In sum, previous research has shown that the ability to evaluate and construct arguments is influenced by several personal and situational dimensions. These include: background knowledge of a topic, ability to understand and display argumentative strategies, arguers' attitudes and beliefs toward a topic, discourse goals, and type of audience that arguers address. However, very few studies have looked particularly at the relationship between goals and processes in argumentation from a developmental perspective. For instance, while Leitão (2003) addressed this question in the studies described above, the results of her studies showed no differences between young children's and teenagers' performances in the argument selection tasks.

6.1.3. The present research

The research reported in this chapter comprises two related studies on argument evaluative skills of 8- year old and 11-year old children. Study Three investigates developmental differences in children's evaluation of arguments in terms of its strength. Study Four explores developmental differences in children's evaluation of arguments in terms of its effectiveness, that is, the extent to which an argument is seen to be persuasive enough to change the audience's points of view.

Study Three assessed how 8- year olds and 11- year olds appreciate different statements (e.g., children should get pocket money) and how they evaluate the quality or strength of different types of arguments. Arguments varied in content (reasons) and structure (number of reasons; inclusion of an alternative position). Based on the assessment criteria of quality of arguments delineated in the previous studies, three types of argument were analysed: *single argument* (the simplest form of argument, in which a claim is supported by one reason); *multiple argument* (an argument that states a claim supported by two reasons); and *counterargument* (an argument that includes a reason in favour of the claim, and another reason in favour of the alternative position).

Two specific hypotheses were formulated regarding age differences in children's evaluation of the strength of different argument structures. First, it was predicted that multiple arguments supporting any particular position would be perceived as stronger than a single argument, because they contain more reasons. This prediction was developed on the basis of previous research on argument generation (e.g., Kuhn, 1991; Means & Voss, 1996). For instance, Kuhn's research (e.g., Kuhn, 1991; Kuhn, Shaw, & Felton, 1997) has shown that skilled arguers generate more reasons to support their claims. The second hypothesis predicted that older children (11-12 years) would rate counterarguments as stronger than arguments, whereas younger children (8-9 years) would perceive fewer differences between the two. Again, this prediction is in line with previous research on counterargumentation (e.g., Kuhn, Felton, & Shaw, 1997) and also previous findings reported in this thesis. For instance, Study One (Chapter Four) showed that children generate progressively more complex forms of argument as they get older. For example, 11-year old children produce arguments that address both sides of an issue and, thus, they advance more reasons and opposing reasons to justify their views, compared with younger children. The research question posed in the present study was whether children would show corresponding developmental change in the appreciation of stronger *versus* weaker arguments. Increasing use of stronger arguments implies such awareness, nevertheless, this question is worthy of an empirical test.

Children engaged in a computer task and were asked to think about several controversial statements. These claims were related to everyday issues that most children are familiar with, such as wearing school uniforms, or receiving pocket money. Children were asked to state their position on each issue and then to rate how weak or strong an argument was, independently of their views on the topic. A further objective of this study was to explore whether children's views on the topics influenced their preference for particular types of argument. In light with previous findings, it was predicted that children with a favourable opinion regarding a target statement would consider arguments in favour of that statement as stronger (Kardash & Nussbaum, 2005; Leitão, 2003).

Study Four was conducted to address the question posed earlier as to how the goal of persuasion affects children's evaluation of arguments: Are the arguments previously evaluated as strong also perceived as the most persuasive? In a similar computer based task, children were asked to select arguments to influence a character's point of view. The general hypothesis formulated in this study was that younger children (8-9 years) will show a preference for arguments over counterarguments for persuading arguers to change their points of view.

Prior to conducting these two studies, a small-scale, focus group study was carried out to gather information about the sorts of arguments children typically use on various topics.

6.2. Pilot study

A small scale focus-group study was carried out to gather information prior to the larger studies. Children were asked about discussion topics listed in Table 6.1. The objectives of the pilot study were: (1) assessing whether children were familiar with the topics selected; (2) gathering information on the sort of reasons children give to justify their points of view; (3) selecting the most suitable topics to be incorporated in the main studies, based on children's level of knowledge and the arguments they generate; and (4) creating a list of arguments to incorporate in the design of the main studies. As already discussed in the methodology chapter (see Chapter Three), piloting is a crucial stage of the design of research tasks for children. Results could be compromised if children did not have enough knowledge regarding the topics, or did not understand the wording in the questions.

6.2.1. Participants

Twelve children (6 boys, 6 girls) were assigned to two focus-group sessions. Each group had an equal number of boys and girls. Children were 8-9 years old (M = 8,3 years, SD = .49), and were in the fourth year of school education. Only the youngest group participated in the pilot study, and this group served as a point of reference for assessing the appropriate level of difficulty of the task. Children were drawn from a primary school in the local area of Surrey, SE England. The class teacher helped in the selection of participants, which was based on children's competence. A letter explaining the study in more detail was sent to the school's Head Teacher (see Appendix 7). This was followed by up by a telephone call. After receiving permission from the school, a consent letter was sent to children's parents (see Appendix 8).

6.2.2. Materials

An audio-recorder was used to record children's discussions during focus-group sessions. A paper-and-pencil questionnaire in Likert format was used to evaluate children's self-reported knowledge on ten different topics (see Appendix 10).

6.2.3. Tasks and Procedure

Children participated in group discussions, designed to collect their opinions on several social issues (e.g., children wearing school uniforms). Each group discussion lasted approximately 40 minutes. Children were asked to discuss, spontaneously, their opinions and to generate reasons in response of ten different statements (see Table 6.1).

Table 6.1. Topics and statements used in the pilot study

Topics	Statements
School uniforms	Students should wear school uniforms.
Zoos	Animals should be kept in the zoo.
Technology	The Internet brings people of the world closer together.
Machines	In the future, machines will replace people at work.
Television	Children should be able to have TVs in their bedrooms.
Laws	If laws did not exist, everyone would commit crimes.
School time	School days should be two hours shorter than they are now.
Famous people	Famous people are treated unfairly by the media.
Pocket money	Children should get pocket money.
Naughty children	Some children are naughtier than others.

The focus-group session was relatively unstructured, and all children had the opportunity to express their ideas about all statements. The researcher facilitated the discussion, to ensure that all group members contributed to the discussion and to avoid letting one child's ideas dominate. At the beginning of the discussion, children were given the following instructions: "The purpose of this study is to help me understand what children think about everyday issues. I am going to give you a statement, and then ask your opinion about that statement and the reasons why you agree or disagree with it". The major part of the session consisted of eliciting and probing children's reasoning regarding the topics. Broadly focused questions included presenting a statement and asking children's points of view on the topic, for example, "Some people think that in the future machines will replace people. Try to determine whether you agree or disagree with this statement and give me at least one reason to justify your position"; and also proposing a new reason and asking children to comment or discuss it, for example: "Some people think that school uniforms are very expensive. Do you agree with this idea, and why?" The initial instructions included a request to listen to "a wide range of different points of view". During the discussion, the researcher reinforced these initial instructions with probes and follow-up questions, such as: "Who else has some thoughts about this; maybe something a little different?", "You have been discussing several different ideas; what hasn't been said yet?", "Remember, I want to listen to all your opinions"; "Who has something else?" Additional information regarding the instructions given in focus group sessions is provided in Appendix 9. A more structured framework for the focus group discussion would be inappropriate given the nature and purposes of the present study.

Group discussions were audio-recorded. Additionally, the researcher took notes during the sessions and wrote up notes afterwards. Permission was obtained from children to be recorded prior to the start of the focus-group sessions. Brief notes were taken during the discussions to remind the researcher of points of interest and areas requiring further clarification within that discussion. Notes made immediately after the researcher had left the school were used to record important information to assist with data analysis.

At the end of focus group the session, children were asked to respond individually to a simple questionnaire about their personal knowledge regarding the topics, in response to the question: "How much would you say you know about the topic [e.g., school uniforms]?" Self-reported knowledge regarding the topics was rated on a 3-point scale, where 1 was marked "I know nothing", 2 "I know a little" and 3 "I know a lot" (see again Appendix 10).

6.2.4 Analysis

Group discussions were audio-recorded, and then analysed. In addition, notes taken by the researcher during the discussions and afterwards were also analysed. The aim was to generate a list of different reasons that could be used in the main studies. The self-reported knowledge questionnaire was also analysed to assess children's level of knowledge of the topics presented.

Argument generation

For the argument generation task there was no need to collect individual participant-level data. A total of twelve children (two groups of six children each) advanced reasons in favour and against all statements. A list of reasons given by children to support their views is detailed in Table 6.2.

Table 6.2. Reasons in favour and against several different statements given by children

Statement: **Children should wear school uniforms**

Reasons in favour

- Uniforms represent the school
- Children in the morning would not have to make up their minds on what to wear
- Uniforms are easy to wear
- It is easier to identify children who belong in the school and those who do not
- It is cheaper to buy uniforms than lots of different clothes

Reasons against

- Uniforms are dull
- Children cannot play games or sports with uniforms, because they would not have clothes to wear the next day
- Uniforms are expensive
- Uniforms stop children being creative
- Everyone looks the same

Statement: **Animals should be kept in the zoo**

Reasons in favour

- Zoos provide a safe home for animals
- Zoos protect animals
- Zoos provide regular meals for animals
- Children can learn about animals when they visit zoos

Reasons against

- Animals in zoos live in cages
- Animals in zoos do not have a big area to run or to hunt their food
- Animals in zoos suffer a lot because they live alone

Statement: **The Internet brings people of the world closer together**

Reasons in favour

- People from different countries can communicate with each other
- People talk with each other more frequently through email
- People can make new friends in chat rooms

Reasons against

- People do not know what the person they are emailing look like or is like personally
- People who use Internet a lot do not have time to meet friends and do other things

Statement: **In the future, machines will replace people at work**

Reasons in favour

- Machines are not lazy
- Machines work quicker
- Machines do not make mistakes

Reasons against

- Machines cannot be creative like people
- Machines cannot interact with people
- Machines do not have feelings

Statement: **Children should be able to have TVs in their bedrooms**

Reasons in favour

- Everyone in the family can do their own thing
- Watching TV after doing homework is a good reward
- Children can learn things
- Children would be more responsible with their own TV
- Children can watch their favourite shows in their rooms

Reasons against

- Children would watch stuff that parents do not allow
- Children would spend less time with their family
- Children who watch too much TV often do not make many friends
- TV is addictive
- Some TV shows are violent
- Children would not study hard or do their homework

Statement: **If laws did not exist, everyone would commit crimes**

Reasons in favour

- Without laws, there would be nothing protecting the human rights

Reasons against

- Crimes exist even with laws
- People would be more responsible for their own actions

Statement: **School days should be two hours shorter than they are now**

Reasons in favour

- Children could sleep more in the morning
- Children would concentrate better at school in the afternoon
- Children would have more time to play
- Children would have more time to do their homework the night before
- Children would learn more

Reasons against

- Parents who work in the morning would not be able to take their children to school
- Changes would require a lot of money
- Children would have to do more homework to catch up
- Children would learn fewer things
- Children would have to work two hours later at school in the afternoon

Statement: **Famous people are treated badly by the media**

Reasons in favour

- Famous people cannot go anywhere without bodyguards
- Magazines and TV invent lies about people's lives

- Famous people are photographed even when they do not want to be.

Reasons against

- Famous people use the media to gain fame
- The media pays famous people to have photographs taken

Statement: **Children should get pocket money**

Reasons in favour

- Children could save money to buy a special item
- Children would learn the value of money
- Children would learn about savings
- Children would be more independent
- Children would be more responsible
- Children could learn to understand the cost of things

Reasons against

- Children are too young to manage money
- Children might sometimes receive money without doing anything to deserve it
- Children might not appreciate the value of money as they get older
- It is dangerous for children to carry money with them
- Children would spend all their money on sweets

Statement: **Why are some children naughtier than others?**

Reasons in favour

- Children are raised in different families and some parents are naughtier than others

Reasons against

- All children behave badly from time to time

Self-reported knowledge on topics

Differences in self-reported knowledge were examined to determine the most suitable topics regarding the degree of knowledge an 8-year old child was likely to have. Direct measures of knowledge were not undertaken. The topics related to school uniforms, television, school time, and pocket money were the ones for which children's reported knowledge was the greatest (see Table 6.3). Few children, in contrast, reported to have knowledge regarding machines, laws, and famous people. For topics related to zoos, technology, and why some children are naughty, subjects reported to have intermediate knowledge (see again Table 6.3).

Table 6.3. Frequency distribution of children's reported knowledge on selected topics

Topics	*I know nothing*	*I know a little*	*I know a lot*
School uniforms	0	2	10
Zoos	6	4	2
Technology	3	8	1
Machines	10	2	0
Television	0	3	9
Laws	9	3	0
School time	0	6	6
Famous people	9	2	1
Pocket money	0	1	11
Naughty children	4	6	2

The focus-group sample (N = 12) was quite small and unrepresentative of the characteristics of the population from which the sample was selected. No statistical tests were performed to analyse whether there were statistically significant differences for scores of children's reported knowledge for all topics. This was appropriate because the objective of this part of the pilot study was merely exploratory. More specifically, it was carried out to refine the results obtained in the focus groups and to help select only four out of ten topics to be displayed in the main studies.

The following topics listed below were chosen as ones children were able to think and talk about in the focus-group sessions. They were also chosen as ones which a group of 8-year old children reported knowing more about.

1. Children should wear school uniforms.
2. Children should be able to have TVs in their bedrooms.
3. School days should be two hours shorter than they are now.
4. Children should get pocket money.

Participants were very familiar with topics related to school, for example regarding wearing school uniforms. They were also interested in school policies, in particular concerning the amount of time students spend in school. The topics related with having television set in children's bedrooms and getting pocket money were also relevant, because most children who participated in the focus groups reported having discussed these issues at least once with teachers or parents. These topics continue to be relevant as children get older. For instance, the topic about television has been highly debated in news and Internet forums, by parents, teachers, and professionals of health care concerned with children's school performance. Therefore, it was predicted that most 8- year olds, and also 11- year olds (the other age group to be included in the main studies) would have heard of or discussed these topics in school or at home.

6.3. Study Three: Age differences in children's evaluation of the strength of arguments

The objective of this study was to explore which particular argument type or structure children regard to be strong. Arguments varied, not only in structure (number of reasons, inclusion of an alternative position), but also in content (reasons). These arguments were selected from the pilot study conducted earlier.

6.3.1. Method

Participants

One hundred and forty-two children (76 boys and 66 girls) participated in the study. Children came from two different age groups; 8-9 years (*M* = 8,4 years, *SD* = .49), and 11-12 years (*M* = 11,9 years, *SD* = .32). Children were in their fourth and seventh year of school education, respectively. They were not from the same population reported in the pilot study. The reason for choosing these two age groups (8-year olds and 11-year olds) was the interest in studying children for whom the handling of opposing positions and counterarguments seems to be critical, as shown in the previous studies and other literature (e.g., Golder & Coirier, 1994, 1996; Leitão, 2003).

The sample was collected at primary and secondary schools in the local area of Surrey, South East England. Students were of heterogeneous ethnic (mostly European) and socioeconomic (mostly middle class) backgrounds. All children in a class were invited to participate (i.e., there were no exclusion criteria based on gender, race, or any other characteristic). Consent was established by means of a consent letter that was sent schools (see Appendix 11) and to children's parents (see Appendix 12). Children were also asked for their consent to participate before the study began. Children, teachers and parents were fully debriefed and told of the study aims after the data collection had been completed.

Materials

Children completed a test individually in a computer room available at their school. The computer program used was written in a web language called Active Server Pages (ASP). ASP is a web application framework, developed by Microsoft, which allows creating interactive web pages or web-based applications that are easy to modify. The web page is connected to a database that holds the questions and also records the data for the participants.

The program structure consisted of 25 page screens, including information sheet, instructions for each task and tasks presentation. Topics were presented in the same order; first about school uniforms, then about TVs in bedrooms, followed by the topics about school time, and finally about pocket money. Order of appearance of the arguments was counterbalanced across topics. The test also included a measurement of participants' time reactions. Time reactions were analysed as a check for outliers.

The syntax of programming language consisted of the various language elements, and operators used to write the instructions. In order to produce different structures of argument, we first had to create a list of reasons for the arguments. For each of the four topics, there were four reasons in favour (pro- condition), and one reason against (anti- condition) the statement (see Table 6.4).

Table 6.4. List of reasons in favour and against for four different topics as displayed in the computer program script

Topic	*Reason*	*Condition*
School uniforms	• Uniforms represent the school	pro
	• Uniforms are easy to wear	pro
	• Uniforms can save parents money	pro
	• Uniforms mean personality is more important than how much money someone has	pro
	• Uniforms are dull	anti
TV in bedrooms	• Having a TV allows children to have time for themselves	pro
	• Watching TV is a good reward for children	pro
	• Children can learn to be more responsible with their own TV	pro
	• Some TV shows are educational	pro
	• Children would watch shows that parents don't allow	anti
School time	• Children would concentrate better for the time they are in school	pro
	• Children would have more time to play	pro
	• Children would be happier	pro
	• Teachers would have more time to prepare classes	pro
	• Children would learn less	anti
Pocket money	• An allowance could teach children about savings	pro
	• Children could learn to understand the cost of things	pro
	• An allowance gives children a little independence	pro
	• Children could save money to buy something special	pro
	• Children might spend all of their money on sweets	anti

Three types of argument were created; single argument, multiple argument, and counterargument. Different argument structures were created with the help of indicator words. These are certain words that often indicate the presence of a particular element of an argument. For example, a simple argument includes a statement (e.g., children should get pocket money), followed by the word "because" and then reason(s) to support it. The use of "because" is a common word indicator for reasons, which helps in their identification.

Single arguments were constructed by combining a statement with one reason in favour of the statement, chosen randomly from a list of four reasons. (e.g., children should get pocket money, because children could understand the cost of things).

Multiple arguments were created by combining a statement with two reasons separated by the word "and", an indicator of enumerating reasons. (e.g., children should get pocket money, because an allowance could teach children about savings and children could save money to buy something special).

Counterarguments include reason(s) that count against the author's conclusion rather than for it. Usually, they can be given away by phrases like "some might argue that", "it has been suggested that", or the use of word indicators like "but" and "however" before introducing the criticism or the alternative position. However, for the purposes of this study, the alternative position was mentioned at the beginning of the sentence. If used the other way round, it would not make sense to ask children to rate the extent to which an argument, ending in a disfavoured position, strengthens a favourable statement. Therefore, counterarguments were created by presenting the statement, then the word "although" followed by one reason against the statement, next a comma sign, and then one reason in favour of the statement (e.g., children should get pocket money, because although children might spend all their money on sweets**,** an allowance gives children a little independence).

The order of selection of reasons was randomised, and once a reason had been selected to create the first argument, it was excluded from the list of reasons available to integrate the next arguments. The program database included two separate databases, one with participant's personal data, and another with participant's responses to the test. Test results on each child were recorded separately from the personal information they provided by using an anonymous identifying number only. Reaction times of the subjects were also recorded in the test response spreadsheet.

Tasks and procedure

Each child was assigned to a desk with a computer. Testing took place during an *Information and Communication Technologies* (ICT) class. ICT classes are implemented in the curriculum in primary education; therefore, all children in year four were skilled at using a computer. The researcher provided the internet link to assess the test. Children worked individually at a computer for approximately 10 minutes, but the researcher provided assistance when needed. The topics and arguments presented were based on the responses children provided in the pilot study.

In the first page screen, children were asked to complete a simple personal information sheet, with name, date of birth, and gender. General instructions about the test were included at the bottom of the first page screen: "This test is about several different topics: wearing school uniforms, having TVs in the bedroom, school time, and children's pocket money. Please read the next instructions carefully before giving your answers! [press continue button when you are ready]".

The next segment included instructions about the opinion rating task: "Thank you! You will now be shown a statement. Please say how strongly you agree or disagree with this statement [press continue button when you are ready]". Then, the first statement was presented (e.g., Students should wear school uniforms) and children were required to respond using a 5-point scale that ranged from strongly disagree "1" to strongly agree "5" (See Figure 6.1).

The next page screen included instructions for the argument rating task: "That's great! Now you will see on the screen three short sentences. You need to decide how strong the arguments are. This task is NOT about your personal opinion! Rather than deciding which argument you agree with, you have to evaluate whether the argument is weak or strong [press continue button when you are ready]". Here, children were asked to rate the strength of different arguments, using a 1 to 5 scale, where 1 is marked "very weak" and 5 "very strong".

In all rating tasks, visual cues (figures of thumbs up and down) were added to facilitate children's understanding of the task. Moreover, questions were carefully written to avoid ambiguities and difficult words that children could not understand. Particular attention was also given to layout, so younger children were never in doubt as to how or where a response should be placed.

Order of appearance of the arguments (single argument, multiple argument, and counterargument) was counterbalanced across topics. However, topics appeared in the same order. The following figures are illustrative. The remaining three topics and respective arguments were identical in form.

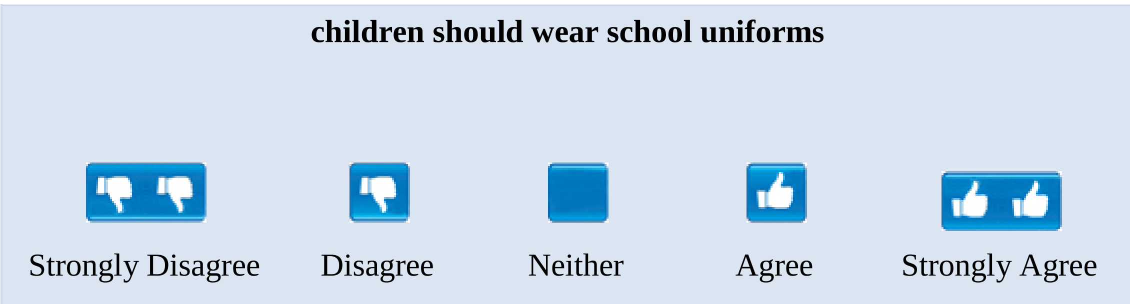


Figure 6.1. Opinion rating screen

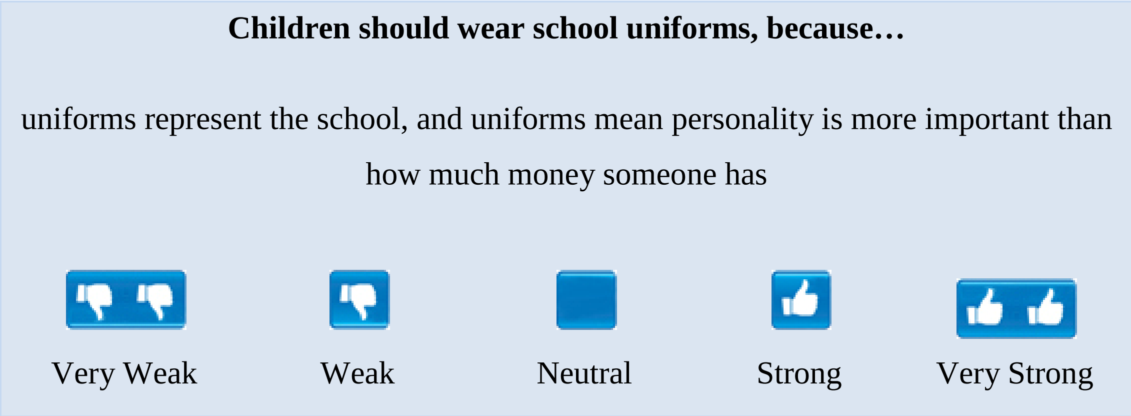


Figure 6.2. Multiple argument rating screen

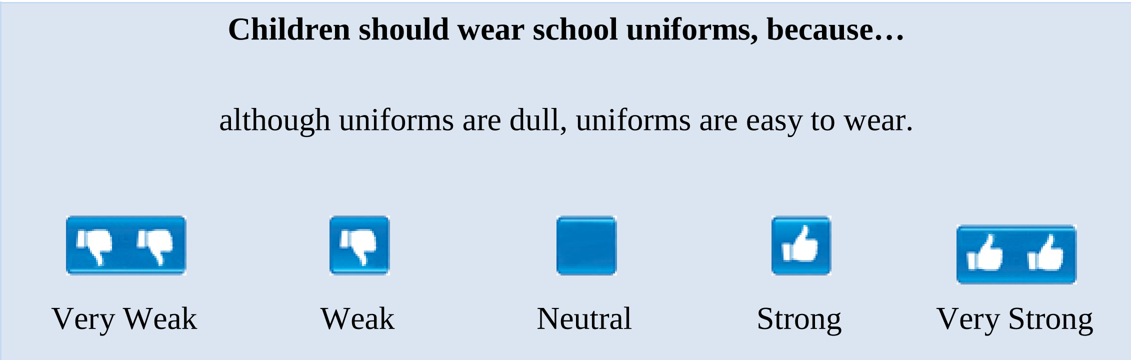


Figure 6.3. Counterargument rating screen

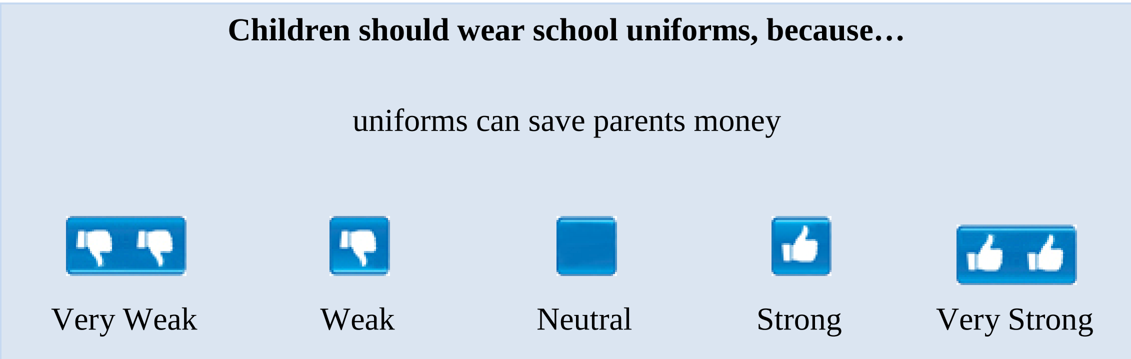


Figure 6.4. Single argument rating screen

Measures

Children's responses were examined to establish levels of agreement for each topic, and strength of different types of argument. Level of agreement was rated in a 5-point scale, with a score 1 corresponding to the lowest level of agreement ("strongly disagree"), and a score of 5 corresponding to the highest level of agreement ("strongly agree"). Similarly, level of argument strength was rated in a 5-point scale, with a score 1 corresponding to the lowest level of strength ("very weak"), and a score of 5 corresponding to the highest level of strength ("very strong").

6.3.2. Results

Design

The design involved a mixed model comparing *between groups* effects related to children's age group (i.e., 8- years, 11- years). *Within groups* effects compared ratings of different types of argument (i.e., single argument, multiple argument, and counterargument). Dependent variables were opinion rating for the statements, and ratings of the strength of arguments.

Missing data

Two 8-year old children were not able to complete the test. The teacher reported that both children had severe reading difficulties. They were still invited to take part of the study and the researcher "worked through" the test with them, by reading the statements aloud. However, it was decided not to include these data in the analysis.

Initial analysis of the data revealed a small number of outliers in terms of time taken to complete the tasks. Specifically, three 8-year old children took less than two seconds to respond to each question, gave the same rating score to all questions, and completed the test in less than two minutes. In these three cases, children did not focus on the task at hand at all. Therefore, it was decided not to include data from these participants in the subsequent analyses.

Statistical procedures

Tests of normality were calculated for each dependent variable using the Shapiro-Wilks statistic. Results showed a p value $< .001$ for all variables; therefore the null hypothesis, which stated that the data were normally distributed, was rejected. Skewness and kurtosis, which describe departures from normality in the distributions of variables, were also estimated. Estimates of skewness and kurtosis were calculated by dividing the statistic value by its standard error to obtain a z test of the null hypothesis. Skew and kurtosis values in the range +2 to -2 would be expected for a normal distribution (Davis & Smith, 2005). However, the dependent variables tested failed the test of normality, because either one of skew or kurtosis values were outside this range.

Given the fact that the data were not normally distributed and were collected using nominal or ordinal scales, nonparametric tests were chosen to test the hypotheses in this study. These included correlation tests using Spearman’s value, Mann Whitney test of differences for independent samples, and Wilcoxon test of differences for related samples. Data descriptive statistics included median as a measure of central tendency and range as a measure of dispersion. The disadvantage of nonparametric tests is that they are less powerful than their parametric equivalents (Brace, Kemp, & Snelgar, 2006). Therefore, as a check and to guarantee greater statistical power, parametric tests were also run, including analysis of variance (ANOVA). In addition, data descriptive reports below also include values of mean as a measure of central tendency and values of standard deviation as a measure of dispersion (see Table 6.5).

Analyses performed, using parametric and non-parametric, revealed the same significant effects and interactions; therefore, in subsequent analysis, statistical tests reported are non-parametric.

Do children of different ages have different points of view on the topics?

Both 8- and 11-year old children had favourable opinions regarding most topics. Table 6.5 provides the median and range values of opinion rating by age (in addition, mean and standard deviation are also reported). Opinions diverged between 8-year-old and 11-year- old children regarding the topic about students wearing school uniforms. As seen in Figure 6.5, frequencies of unfavourable ratings (disagree and strongly disagree) are higher for older children (11 years) compared with 8-year-old children, who in turn, seem to agree more with the target statement.

Table 6.5. Descriptive values (median, range, mean and standard deviation) of position ratings for each age group

	8 years, *N=67*				11 years, *N=70*			
	Median	*Range*	*Mean*	*Std.dev*	*Median*	*Range*	*Mean*	*Std.dev*
"Students should wear school uniforms"	4	4	3.55	1.34	2	4	2.59	1.29
"Children should have TVs in their rooms"	4	4	4.04	1.24	5	4	4.40	.88
"School days should be two hours shorter than they are now"	4	3	3.66	1.49	4	4	3.73	1.31
"Children should get pocket money"	5	4	4.49	.98	5	4	4.39	.95

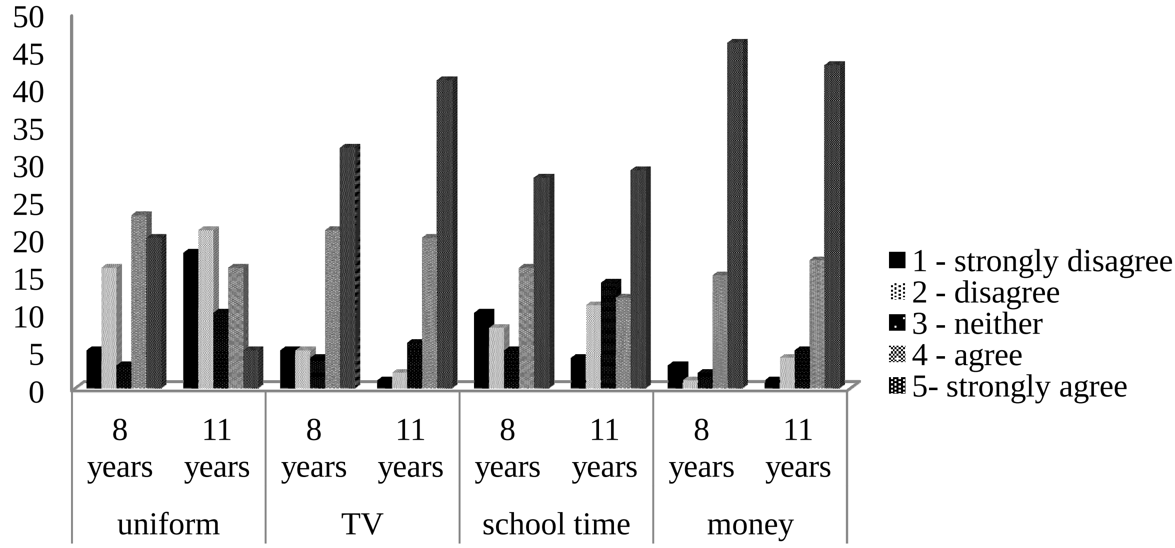


Figure 6.5. Frequency of position ratings for each age group across topics

Effects of children's points of view on argument evaluation

The first hypothesis predicted that arguments that are in agreement with children's own positions would be perceived as stronger than arguments which concur with an alternative position. The design employed was correlational, with several variables each measured on a 5 point scale. A nonparametric measure of correlation, Spearman's $r_{s,}$ was chosen for this test, because the variables did not meet the assumptions for parametric data and also given the relatively small sample size used in this study. It was expected that there would be a positive relationship between opinion rating and ratings of the three types of argument proposed (single arguments, multiple arguments, and counterarguments) across topics. Thus, children who held strong favourable views on a topic, will rate arguments and counterarguments in favour of that position as stronger.

Results revealed significant positive correlations for the relationship between positions children hold and how they rate all types of arguments presented. More specifically, for the topic concerning school uniforms, there was a significant positive correlation between children's point of view and the ratings of all types of arguments, including single arguments (r = .41, N = 137, p < .001, one-tailed), multiple arguments, (r = .57, N = 137, p < .001, one-tailed), and also counterarguments, (r = .24, N = 137, p

< .01, one-tailed). For the topic related with children having TV in their bedrooms, there was also a fairly strong correlation between children's opinions and how they rate single arguments (r = .33, N = 137, p < .001, one-tailed), multiple arguments (r = .47, N = 137, p < .001, one-tailed), and counterarguments (r = .44, N = 137, p < .001, one-tailed). There were also significant correlations between children's opinion on school hours and all types of argument, including single arguments (r = .47, N = 137, p < .001, one-tailed), multiple arguments, (r = .52, N = 137, p < .001, one-tailed), and also counterarguments, (r = .48, N = 137, p < .01, one-tailed). For the last topic, related to children's pocket money, there were significant positive correlations between opinion rating and strength rating for all types of arguments; single arguments (r = .37, N = 137, p < .001, one-tailed), multiple arguments, (r = .27, N = 137, p < .001, one-tailed), and also counterarguments, (r = .36, N = 137, p < .001, one-tailed). A parametric measure of correlation, Pearson's r, was also performed and yielded the same significant results. These correlations varied from weak to moderate. As predicted, these results confirm that the way children rate arguments is related to their personal points of view on an issue.

Children's ratings of single *versus* multiple arguments

The prediction here was that children would rate multiple arguments supporting a particular position as stronger than single arguments. To test this hypothesis, a Wilcoxon Signed Ranks test was performed. A significant difference was found between ratings of multiple and single arguments about *school uniforms*, based on positive ranks, z = 1.68, N – Ties = 105, p < .01, one-tailed. There were more high ranks for the positive differences, that is, children's ratings for multiple arguments were superior to the ratings for single arguments.

There were no significant differences between the conditions for the remaining topics, that is, there were a fairly equal spread of ranks of strength ratings for single and multiple arguments for these topics.

Age differences in children's evaluation of arguments and counterarguments

A Mann-Whitney test was used to assess whether there was a statistically significant difference between the mean ranks of argument strength ratings by 8-year olds (N = 67) and 11-year olds (N = 70). First, age differences in ratings of single and multiple arguments were explored. These two types of argument only differed in the number of reasons. It was expected that older children (11- years) would give higher scores of strength to multiple arguments than single arguments. Secondly, age differences in the evaluation of counterarguments were analysed. A hypothesis formulated here was that 11-year old children would rate counterarguments as a stronger than arguments, whereas younger children (8- year olds) would not evaluate counterarguments as a stronger type of argument.

For the first topic, related to children wearing school uniforms, there was a statistically significant difference on how children at different ages rated single arguments (U = 1604, N_1 = 67, N_2 = 70, p < .001, two-tailed), and also multiple arguments (U = 1899, N_1 = 67, N_2 = 70, p < .01, two-tailed). For single arguments (i.e., arguments including one reason), the average rank rating of strength by 8-year old children was significantly higher (80.06) than the average rank rating of strength by 11-year old children (58.41), and so single arguments had a higher mean rating score by 8-year olds. The average rank rating of strength for multiple arguments by younger children (8- years) was also significantly higher (75.66) compared with the average rank rating of argument strength by 11-year old children (62.63).

For the topic related to having TVs in bedrooms, there was a statistically significant difference between the two age groups in terms of ratings of multiple arguments (U = 1779.5, N_1 = 67, N_2 = 70, p < .01, two-tailed), and also counterarguments (U = 1576, N_1 = 67, N_2 = 70, p < .001, two-tailed). For this topic, the mean rank of strength of multiple arguments for younger children was significantly lower (60.56) than the mean rank of strength of multiple arguments for 11-year old children (77.08) Similarly, the mean rank of strength of counterarguments for younger children was significantly lower (57.52) than the mean rank of strength of counterarguments for 11-year old children (79.99).

For the topic related to school days, there were statistically significant age differences only in the ratings of counterarguments, U = 1693, N_1 = 67, N_2 = 70, p < .01, two-tailed. The average rank of strength of counterarguments for younger children was significantly lower (59.27) than the average rank of strength of counterarguments for 11-year old children (78.31).

For the last topic, related to children's pocket money, there were also age differences again in the ratings of counterarguments, U = 1482, N_1 = 67, N_2 = 70, p < .001, two-tailed. The mean rank of strength of counterarguments for younger children was significantly lower (56.12) than the mean rank of strength of counterarguments for 11-year old children (81.33).

As predicted, older children (11- years) evaluated counterarguments as a predominately stronger type of argument across most topics. By comparison, fewer 8-year olds evaluated counterarguments as a strong type of argument (see Figure 6.6).

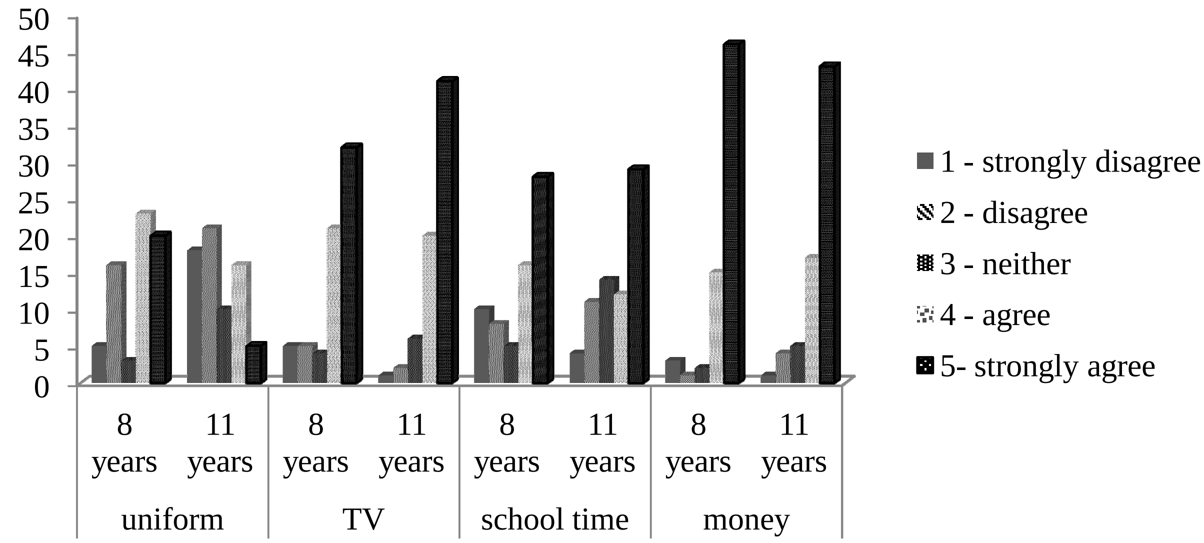


Figure 6.6. Evaluation of counterarguments by age group across topics

Effect of argument content on children's ratings

In addition, a content analysis was carried out to assess in more detail if children's evaluation of the strength of arguments depended on the content of those arguments rather than its structure. Single arguments included one of four possible reasons, and they were generated in a randomised order. The relationship between reasons stated in single arguments and how children evaluated those arguments was examined using chi- square tests. Results showed that children's ratings of strength of arguments depended on the content of arguments for two topics: school uniforms and pocket money.

For the school uniforms topic, there was a significant association between the two variables, χ^2 (12, N = 137) = 24.48, p < .005 (Pearson's chi-square). As seen in Table 6.6, twelve out of thirty-three children rated "Uniforms represent the school" as a very strong reason. Most children also rated arguments including the reason "Uniforms mean personality is more important than how much money someone has" as a strong or a very strong argument. In contrast, fewer children rated "Uniforms are easy to wear" and "Uniforms can save parents money" with high scores on the scale.

For the topic related to pocket money, there was a significant association between the reasons presented and how children rated those reasons, χ^2 (9, N = 137) = 35.33, p < .001 (Pearson's chi-square). In this case, almost all reasons were rated positively. However, more children rated the reason "Children could save money to buy something special" as a very strong reason (see Table 6.7). There was no association between the two variables for the remaining topics: TV in rooms and school time.

Table 6.6. Distribution of children's ratings of argument strength related to different reasons in favour of school uniforms

	Ratings					Total
	very weak	*weak*	*neutral*	*strong*	*very strong*	
Uniforms represent the school	5	4	6	6	12	33
Uniforms are easy to wear	7	11	8	7	3	36
Uniforms can save parents money	7	11	8	13	3	42
Uniforms mean personality is more important than how much money someone has	1	5	2	12	6	26
Total	20	31	24	38	24	137

Table 6.7. Distribution of children's ratings of argument strength related to different reasons in favour of pocket money

	Ratings					Total
	very weak	*weak*	*neutral*	*strong*	*very strong*	
An allowance could teach children about savings	0	1	4	18	9	32
Children could learn to understand the cost of things	0	3	10	8	12	33
An allowance gives children a little independence	0	1	2	9	17	29
Children could save money to buy something special	0	1	3	5	34	43
Total	0	6	19	40	72	137

6.3.3. Discussion of results for Study Three

This study examined how 8-year old and 11-year old children rated the strength of different arguments. Arguments were presented randomly and they varied in content (different reasons) and structure (number of reasons; inclusion of alternative views).

The first hypothesis made predictions about how children's personal views on a topic would affect the evaluation of argument strength. The prediction that children with a favourable position on an issue would evaluate arguments in favour of that statement as stronger was confirmed. For example, if a child strongly agreed that school days should be shorter, then he or she would classify "School days should be two hours shorter than they are now, because children would have more time to play" as a strong argument. Children with strong favourable views on a topic also evaluated counterarguments (arguments that address the alternative view at the beginning, but states a reason that favours the initial position at the end) as a strong type of argument. Previous research has demonstrated that individuals' points of view influence their reasoning on a topic, so the result is not surprising. For example, Nussbaum and Kardash (2005) found that students with extreme attitudes about a controversial issue generated fewer alternative ideas about the issue than those with less extreme attitudes.

The second hypothesis predicted that children would rate multiple arguments (a claim supported by two reasons) as a stronger type of argument, because they are longer and include more reasons than single arguments (supported by only one reason). However, the findings of the present study indicate that children do not necessarily regard arguments with a greater number of reasons as stronger. With the exception of the results related to the topic about school uniforms, which revealed a marginally significant preference for multiple arguments, both single and multiple arguments for the remaining topics were rated as equally strong.

There are at least two possible explanations for this result. It may be that children's responses were an artefact of the research design, as children were asked to rate different types of arguments one at the time. That is, single arguments, multiple arguments and counterarguments were presented in a randomised order, and no clues were given related to what arguments would appear next on the screen. Thus, children may have been forced to give similar ratings to arguments, making it difficult to differentiate stronger *versus* weaker arguments. In order to find out whether children had preference for a particular kind of argument (for example, a multiple argument over a single argument), it would have been more appropriate to use a comparative measure, in which children would be given the opportunity to choose between two types of argument. This procedure (paired-comparison rating task) was the chosen measure to be employed in the next study described in this chapter.

Another possible explanation is that the content of arguments may have also influenced the way children evaluated the strength of different argument structures. Results of the content analysis revealed that children's ratings of argument strength depended on the content of arguments presented for some topics. For a start, this finding indicates that children are responding to the task at hand in a thoughtful way, that is, they are carefully examining the elements (reasons) that constitute an argument before making a judgement. For instance, for the topic related to whether children should receive pocket money, there were reasons children favoured more than others. It is possible that children evaluated a single argument containing a favourite reason (e.g., "Children could save money to buy something special") as a stronger argument than a multiple argument containing a reason they did not agree with. It is also possible that the presence of a reason regarded as weak was enough to diminish the strength of an argument. Consequently, children did not regard most multiple arguments as a stronger type compared to simpler forms of argument.

The content of arguments for the topic concerning school uniforms also had an effect on children's ratings of the strength of arguments, even though the presentation of reasons was randomised. More specifically, twelve out of thirty-three children rated "Uniforms represent the school" as a very strong reason. Most children also rated arguments including the reason "Uniforms mean personality is more important than how much money someone has" as a strong or a very strong argument. In contrast, fewer children rated "Uniforms are easy to wear" and "Uniforms can save parents money" with high scores on the scale. For the remaining two topics, children's ratings of arguments containing several different reasons yielded no statistical significant.

Why did the content of arguments influence children's ratings of strength for some topics (pocket money and school uniforms) but not for others (TV in bedrooms and school days)? It could be children have regarded the first two topics (pocket money and school uniforms) as more controversial and agreed less with some of the reasons presented in favour of those statements. Although posttest measures of children's justifications for their ratings were not undertaken in this study, the results may be interpreted in light of previous qualitative analyses.

For instance, Leitão (2003) analysed the reasons children, aged 8-, 11- and 14-years, invoked to justify their selection of arguments to be included in a text. Results showed that children in all age groups selected or rejected ideas based on their agreement with the content of an argument, and also the restriction or modulation of its scope (which implies partial acceptance of the content). Similarly, the present results are indicative that the *content of arguments* is an important mediator of children’s evaluation of argument strength. This is an important finding, because it defies some of the premises in which research based on Toulmin’s framework is conducted. According to researchers who use a framework focused on formal argumentation structure, the accuracy or relevance of the statements within an argument is less important than the number of components an argument has in terms of evaluating its strength (Goldstein, Crowell, & Kuhn, 2009).

The next set of hypotheses made predictions about age differences in children’s evaluation of arguments and counterarguments. First, it was predicted that older children (11- years) would rate multiple arguments as a stronger type than single arguments. Although in argumentation, *more* does not necessarily mean *better* (Means & Voss, 1996), most researchers have regarded arguments with a greater number of reasons to be stronger (e.g., Kuhn, 1991). This hypothesis was confirmed in relation to only one topic (*Children should have a TV in their bedrooms*).

In contrast, for the topic related to school uniforms, younger children (8- years) rated multiple arguments more favourably than 11- year old children, contrary to what was expected. There were no age differences in how children rated the two types of argument for the remaining two topics. These results are not completely at odds with previous research. In fact, the first study presented in this thesis, regarding age differences in argument generation (see Chapter Four) supports these findings. Results from Study One outlined in this thesis showed that the ability to generate a greater number of reasons increased progressively with age, from 5 years to 12 years. However, no statistical significant differences were found between 8-year-olds and 11-year olds.

The second hypothesis concerned age differences in children’s evaluation of counterarguments. It was predicted that older children (11- years) would regard counterarguments as a particularly strong type of argument. Counterarguments were *constructed* in order to address both positions, but to emphasise the favoured position (e.g., Although children might spend all their money on sweets, children could understand the cost of things). As predicted, 11- year old children gave higher scores to counterarguments than 8- year old children across most topics (TV in bedrooms, school days, and pocket money). No statistically significant age differences were found in the evaluation of counterarguments for the topic about students wearing school uniforms.

Overall, examination of the two age groups revealed both similarities and differences. The hypothesis concerning age differences in the evaluation of counterarguments is a particularly interesting one and has the potential of adding understanding to previous research on argumentation. The present findings reflect the close parallels between argument generation skills and argument evaluative skills among 8- year-olds and 11- year olds. Compared to older children (11- years), fewer 8-year old children evaluated counterarguments as a strong type of argument. This result suggests that younger children showed less appreciation for alternative arguments, an age-related pattern that parallels one found in discourse.

6.4. Study Four: Age differences in children's evaluation of the effectiveness of arguments

Using a similar computer-based task and the same topics, this second study investigated how children evaluated arguments and counterarguments when the task goal was to persuade a hypothetical arguer to adopt a different position. This study was, in contrast to the previous one, focused on the pragmatic function of arguments, that is, their effectiveness.

6.4.1. Method

Participants

One hundred and fourteen children (57 boys and 57 girls) participated in the study. Children came from two different age groups; 8-9 years (*M* = 8,5 years, *SD* = .50), and 11-12 years (*M* = 11,2 years, *SD* = .37). Children were in their fourth and seventh year of school education, respectively. This sample corresponds to two classes from each year group that were in attendance in the class during data collection and that had given consent to participate in the study. Children were not from the same population reported in the previous study (Study Three). The sample was collected from a school situated in the local area of Slough, in South East England. Students were of heterogeneous ethnic (primarily European and South Asian) and socioeconomic (mostly low-middle class) backgrounds. Consent was obtained through letters sent to schools (see Appendix 13) and children's parents (see Appendix 14).

Materials

Materials used in this test were similar to the ones developed for the previous study. The computer test consisted of opinion rating and argument selection tasks. Stimuli (topics and arguments) were generated and evaluated in the pilot assessment of the previous study (Study Three). However, only three out of four topics were selected to be displayed in this study; otherwise the task would be too long and harder for children. The topic about school days was chosen to be taken out from this study, because in the pilot study conducted prior to these two main studies, children reported knowing less about the topic *school days* than the other three topics, and also said they were less interested in talking about the topic *school days* in the focus group sessions compared with the other topics, for example about *school uniforms* or *pocket money*.

In order to produce different structures of argument, a list of reasons was created. This list was identical to the one used in the computer program script of the previous study, but three new reasons against each topic were added. In total, four reasons in favour (pro- condition), and four reasons against (anti- condition) for each of the three statements (see Table 6.8).

Table 6.8. List of reasons in favour and against three different statements as displayed in the computer program script

Topic	Reason	Condition
School uniforms	• Uniforms represent the school	pro
	• Uniforms are easy to wear	pro
	• Uniforms can save parents money	pro
	• Uniforms mean personality is more important than how much money someone has	pro
	• Uniforms are dull	anti
	• Uniforms can be expensive	anti
	• Uniforms have no use outside school	anti
	• Uniforms stop children being creative	anti
TV in bedrooms	• Having a TV allows children to have time for themselves	pro
	• Watching TV is a good reward for children	pro
	• Children can learn to be more responsible with their own TV	pro
	• Some TV shows are educational	pro
	• Children would watch shows that parents do not allow	anti
	• Children would spend less time with their family	anti
	• Children wouldn't read a book if they could just switch on the TV	anti
	• TV is addictive	anti
Pocket money	• An allowance could teach children about savings	pro
	• Children could learn to understand the cost of things	pro
	• An allowance gives children a little independence	pro
	• Children could save money to buy something special	pro
	• Children might spend all of their money on sweets	anti
	• children are too young to manage money	anti
	• Children might not appreciate the value of money as they get older	anti
	• It could be dangerous if children carry money around	anti

Tasks and procedure

Children completed a computer task individually during an ICT class. All children in the class were invited to participate and they were able to complete the test simultaneously in a quiet computer room at their school. The task took approximately 10 minutes to complete.

In the first page screen, children were asked to complete a simple personal information sheet, with name, date of birth, and gender. General instructions about the test were included at the bottom of the first page screen: "We are interested in knowing what you think about everyday topics, such as wearing school uniforms. We are going to ask your opinion about this and other topics and you have to say how strongly you agree or disagree [press continue button when you are ready]".

The next segment included instructions about the opinion rating task: "Thank you! You will now be shown a statement. Please say how strongly you agree or disagree with this statement [press continue button when you are ready]". Then, the first statement was presented (e.g., Children should wear school uniforms) and children were required to respond using a 5-point scale that ranged from strongly disagree "1" to strongly agree "5". In the opinion rating task, visual cues (figures of thumbs up and down) were added to facilitate children's understanding of the task.

The next page screen included instructions for the argument selection task based on the persuasion goal proposed: "That's great! We also have a more challenging task for you! We are going to introduce you six friends: Thomas, Maria, Jamaal, Emma, Laura, and Omar. They all have opinions about the topics, your task is to choose the best arguments to convince or persuade them to change their mind [press continue button when you are ready]". Here, children were asked to choose one of two arguments. Order of appearance of types of argument (single argument, multiple argument, and counterargument) was counterbalanced across topics. However, topics and characters appeared in the same order. The following figures are illustrative. The remaining two topics and related arguments were identical in form.

I am Thomas. I think children SHOULD wear school uniforms.

Which one of these arguments is most likely to persuade Thomas that children should NOT wear uniforms?

uniforms stop children being creative

uniforms are dull, and uniforms can be expensive

Figure 6.7. Example of an argument selection screen: presentation of a single argument versus a multiple arguments.

I am Maria. I think children should NOT wear school uniforms.

Which one of these arguments is most likely to persuade Maria that children SHOULD wear school uniforms?

uniforms make it easy to identify children who belong in the school

although uniforms are dull, uniforms are easy to wear

Figure 6.8. Example of an argument selection screen: presentation of a single argument versus a counterargument

6.4.2. Results

Design and measures

The design employed had two factors; the between-subjects factor of age group (i.e., 8-years, 11-years) and the within-subjects factor of condition (single vs. multiple arguments, single argument vs. counterargument, and multiple argument vs. counterargument). There were two dependent variables: (1) opinion rating for the statements was measured on an ordinal scale and was operationalised as the response on a 5 point scale, where point 1 was "strongly disagree" and point 5 "completely agree"; and (2) preference for a specific type of argument was measured on a nominal scale and was operationalised as the response chosen from two possible responses (e.g., single vs. multiple arguments).

Missing data

Four 8-year old children with severe learning disabilities were not able to complete the test. They were still invited to take part in the study and the researcher administered the test in a one-on-one verbal interview, with frequent comprehension checks and rest breaks. Although children were able to provide answers and complete the task with the researcher's help, it was decided not to include these data in the analysis. There were no outliers in terms of time reactions taken to complete the task.

Children's points of view on the topics

Children's views on the topics did not differ from the views given by children on the same topics in the previous study (Study Three). Again, 8- year old children had favourable views regarding all topics. In contrast, most 11- year old children reported having unfavourable or neutral views about students wearing school uniforms (see Table 6.9).

Table 6.9. Descriptive values (median, range, mean and standard deviation) of position ratings by age

	8 years, *N=55*				11 years, *N=55*			
	Median	*Range*	*Mean*	*Std. dev.*	*Median*	*Range*	*Mean*	*Std dev.*
Uniforms	4	4	3.55	1.45	3	4	2.69	1.14
TV	4	4	3.95	1.29	4	3	3.67	1.25
Pocket money	5	4	4.24	1.14	5	2	4.40	.76

Children's preference for types of arguments across topics

A Binomial test was used to determine the proportion of children who selected a particular argument in a set of two possibilities. The Binomial test was chosen because the data were in two discrete categories and the design was of one-sample type (Sidney & Castellan, 1988). There were three different sets of arguments and children were asked to select one of the two: (1) single vs. multiple arguments; (2) single argument vs. counterargument; and (3) multiple argument vs. counterargument. The task included two goals: to persuade a character to agree with position (e.g., "Children should have TV in their rooms"), or to persuade the character to disagree with a position (e.g., "Children should NOT have TV in their rooms"). Arguments were provided according to the task instructions.

The Binominal test assessed whether the proportion of preferred types of arguments differed significantly from 50% chance (i.e., from .5). The prediction was that there would be a difference between the frequencies of chosen arguments, that is, the proportion of children choosing complex arguments, such as multiple arguments and counterarguments, would be greater than the proportion of children choosing single arguments. More specifically, for the *pair single versus argument*, it was expected that children would choose a multiple argument as the most persuasive, because it contains more reasons. For the *pair single argument versus counterargument*, it was predicted that children would select a counterargument to persuade the character, because it is a more sophisticated form of argumentation. For the last paired condition, *multiple argument versus counterargument*, no predictions were made related to children's preference for one these types, because both can be regarded as strong. Furthermore, no predictions were made related to preferences for a particular type of argument in these two conditions: (a) when the task goal was to persuade the character to agree with a statement, and (b) when the task goal was to persuade the character to disagree with a statement. The results showed statistically significant differences in some conditions across topics. Table 6.10 shows data for all topics. Sixty eight out of 110 children preferred single arguments rather than counterarguments to persuade the character to adopt a favoured position for wearing school uniforms. A binomial test revealed a significant preference for single arguments, $p < .05$. In the condition single vs. multiple arguments supporting an opposite position, sixty six out of 110 children preferred multiple arguments, $p < .05$.

For the topic related to TV in bedrooms, results showed a significant preference for multiple arguments rather than single arguments supporting an opposite position (see Table 6.10). Seventy one out of 110 children chose multiple arguments and this preference was statistically significant, $p < .05$. In the condition single argument vs. counterargument in favour of the position, sixty seven out of 110 children preferred single arguments, $p < .05$. Moreover, in the condition counterargument vs. multiple argument, seventy three out of 110 children chose multiple argument to support the favoured position, $p < .05$.

For the topic about whether children should receive pocket money, results showed no statistically significant differences on preference for a particular type/ structure of argument in all conditions (see again Table 6.10).

Overall, these results indicated that the prediction that stated that counterarguments would be a preferred argument over simpler types of argument was not confirmed.

Table 6.10. Frequency of children selecting an argument in three paired conditions in favour and against each topic (N = 110)

	single vs. multiple		single vs. counter		counter vs. multiple	
	single	multi	single	counter	counter	multi
In favour of students wearing school uniforms	57	53	68	42	45	65
Against students wearing school uniforms	44	66	47	63	57	53
In favour of children having TV in their bed rooms	53	57	67	43	37	73
Against children having TV in their bedrooms	39	71	52	58	50	60
In favour of children receiving pocket money	55	55	64	46	47	63
Against children receiving pocket money	52	58	53	57	65	45

Age differences in preference for types of arguments across topics

First, a Binomial test was performed separately for each age group, to explore the proportion of arguments chosen by 8-year old and 11-year old children, in different conditions across topics.

For the topic about *TV in bedrooms*, results showed that the oldest age group ($N = 55$) chose multiple arguments in favour the statement as more persuasive than counterarguments, $p < .05$. In the condition in which the arguments were against having TV in bedrooms, 11- year old children also preferred multiple arguments over single arguments, $p < .05$, and counterarguments, $p < .05$. Similarly, for the topic about *pocket money*, there was a statistically significant difference for the preference for multiple arguments over single arguments in favour of the statement, $p < .05$, with thirty seven out of 55 children choosing multiple arguments as the most persuasive. A significant difference was also found for preference for multiple arguments over counterarguments $p < .05$, with forty out of 55 children considering multiple arguments in favour of pocket money the most persuasive.

In contrast, 8- year old children ($N = 55$) did not show a preference for any particular type of argument across conditions and topics. The only statistically significant result found was a preference for single arguments over multiple arguments in favour of the topic of *pocket money*, $p < .05$, with thirty seven out of 55 children choosing single arguments as the most persuasive type of argument.

To explore these results further, a series of binomial logistic regression analyses were performed with age as a predictor variable, and argument preferences across different conditions as dependent variables. There were 18 binary response variables in total. These included three different conditions of argument type (single vs. multiple arguments; single argument vs. counterargument; and multiple argument vs. counterargument) for each topic, and two sides of argument (positive or negative), that is, they could be in favour or against the statement.

A total of 110 cases were analysed and children's age significantly predicted preference for multiple arguments over counterarguments in favour of the topic *pocket money* (omnibus chi-square = 8.79, df = 1, $p < .005$). According to the model, 65.5% of overall predictions were accurate. The values of the coefficients revealed that an increase of age was associated with an increase of the odds of children selecting multiple arguments as the most persuasive type of argument, by a factor of 1.52 (95%

CI 1.14-2.03). Children’s age also predicted their preference for multiple arguments over single arguments in favour of the topic *pocket money* (omnibus chi-square = 12.94, df = 1, p < .005). According to the model, 67.3% of overall predictions were accurate. The values of the coefficients revealed that an increase of age was associated with an increase of the odds of children selecting multiple arguments as the most persuasive type of argument, by a factor of 1.67 (95% CI 1.25-2.23).

Similarly, for the topic about *TV in bedrooms*, the factor of age predicted preference for multiple arguments rather counterarguments, only when these arguments were against the statement. Overall, 59.1% predictions of the model were accurate. The values of the coefficients revealed that an increase of age was associated with an increase of the odds of children selecting multiple arguments as the most persuasive type of argument, by a factor of 1.41 (95% CI 1.07-1.86).

6.4.3. Discussion of results for Study Four

Children’s views on the topics did not differ from the views given by children on the same topics in the previous study (Study Three). Again, 8- year old children had favourable views regarding all topics. In contrast, most 11- year old children, in both studies, reported having unfavourable or neutral views about students wearing school uniforms. This discussion topic is particularly relevant for children in the U.K., as most schools require students to wear school uniforms. While it has been argued that school uniforms provide a positive sense of unity among students, they can also imply the sacrifice of individuality and self-expression. A possible interpretation for the shift in attitudes towards school uniforms evidenced in these studies is that, as children become more independent and develop a sense of their personal identity (Catherwood & Gillibrand, 2004), they realise that the disadvantage of losing their individuality associated with wearing school uniforms far outweighs its benefits.

This study further explored developmental differences in children’s selection or preference for a particular type of argument (single argument, multiple argument, or counterargument) when the task goal was to persuade hypothetical arguers to change their views. The general hypothesis formulated in this study was that younger children (8-9 years) would show a preference for arguments over counterarguments for persuading arguers to change their points of view. As expected, 8- year olds selected either single or multiple arguments over counterarguments (which addressed the alternative view) to change the characters' views, consistently across all three topics.

The most striking finding was that older children (11-12 years) also did not regard counterarguments to be persuasive comparing to other types of argument. Although 11-year olds may regard counterarguments as a strong type of argument when standing alone (as found in Study Three), they seem to adopt different evaluation criteria when the task involves a communicative goal. That is, both 8- year olds and 11-year olds do not regard arguments that contain opposing elements as a valuable resource for making a position more acceptable and persuading arguers to change their views.

As noted in the previous study (Study Three), a counterargument was defined in this study as an argument containing a reason that addresses the character's point of view and also a reason that strengthens the alternative position (e.g., "Although an allowance gives children a little independence, it could be dangerous to carry money around"). In this example, the first line of reasoning strengths the character's position ("Children should get pocket money") and the second part presents a challenge to the character's view ("But it could be dangerous if children carry money around").

The present result suggests that children at both ages did not choose counterarguments to pursue the pragmatic goal, because these included a reason in favour of the character's position. Instead, children focused on the arguments that addressed a single view (opposite to the character's view). The finding that counterarguments are not regarded as persuasive is consistent with research on argumentative writing (Coirier, 1996; Ferretti, Lewis, Andrews-Weckerly, 2009; Ferretti, MacArthur, Dowdy, 2000; Leitão 2000, 2003; Nussbaum & Kardash, 2005).

Coirier (1996) identified two processes fundamental for writing elaborated argumentative texts. The first process is the ability to state arguments, which requires the use of writing skills, including cognitive and linguistic tools. The second process is *negotiation* which refers to the ability to take the audience into account. This process involves not only the use of linguistic devices, but also the use of sophisticated argumentative and rhetorical strategies to persuade an audience. Coirier's approach emphasises that the writing process is influenced by factors such as the writer's perception of his or her interaction with the audience (polemic or cooperative) and his or her ultimate goal with regard to the audience (persuading or compromising).

More recently, other studies provided further evidence that text goals are important mediators of the way children understand and evaluate arguments. For instance, Leitão (2003) showed that when a text goal involved making a viewpoint more acceptable and persuasive (to convince a potential reader), 8- year olds, 11- year olds and college students did not choose texts that incorporated opposing elements. Moreover, when asked to explain their decisions, the majority of young children and even college students viewed counterargumentation as “negative”. Half of the college students thought that the inclusion of a counterargument in a text would reduce the probability of its viewpoint being accepted, unless the writer was able to preserve the strength of his or her own position by replying to it. Accordingly, other researchers advanced the idea that writing to persuade, in contrast to simply expressing an opinion, might inhibit the production of alternative views and counterarguments because the failure to rebut them undermines the text’s persuasiveness (Nussbaum & Kardash, 2005; Santos & Santos, 1999).

Another important finding in the present study was that older children (11-years) selected arguments containing two reasons (multiple arguments) as the most persuasive type of argument, consistently across topics. Whereas in the previous study (Study Three), 11- year olds rated single and multiple arguments as equally strong, results in this study showed that older children regarded number of reasons as an important criterion for defining a persuasive argument. Younger children (8- years), on the other hand, did not show a preference for single or multiple arguments, and regarded both types as equally persuasive.

6.5. General discussion

These two studies focused on children’s meta-level or evaluative skills with respect to individual arguments. These studies addressed a number of questions. For instance, what constitutes strong arguments for children? And, does this change developmentally? Furthermore, do children regard strong arguments as the most persuasive? Or do criteria for evaluating arguments change accordingly to the communicative goals of a task?

Study Three examined how children at different ages appreciate and evaluate arguments in terms of their strength. A further objective was to explore whether children’s prior opinions on a topic influence subsequent evaluation of arguments. Although this is not a new research question, it was included in this study because it has the potential of adding some understanding of the processes underlying children’s evaluation of arguments. Results showed that both 8- year olds and 11- year olds evaluated arguments based on their agreement with the statements, that is, when children had a favourable position on an issue, they evaluated arguments in favour of that statement as stronger.

Moreover, both age groups did not regard arguments with greater number of reasons to be stronger, contrary to what expected. In three out of four topics, both 8- year olds and 11- year olds rated multiple and single arguments as equally strong. As suggested in previous literature (e.g., Leitão 2000, 2003; Nussbaum & Kardash, 2005), it is likely that children may have agreed with some reasons but not others and, thus, they have accepted only part of the content of arguments. Consequently, single and multiple arguments were evaluated as equally strong. Indeed, the content analysis revealed that children favoured some reasons more than others for the topic related to whether children should receive pocket money and the topic about children wearing school uniforms.

The results discussed so far may seem somewhat trivial. Few people would argue that individuals' evaluation of arguments on controversial topics is not, to some extent, subjective. However, most studies in argumentation have neglected the subjective dimension of argumentation processes, focusing merely on individuals' cognitive abilities to reason or argue well. This study is important because it offers a comprehensive understanding of how children appreciate and evaluate of arguments, by taking into account their perspective and exploring how their personal views affect their judgments of argument strength. Moreover, in order to establish the evaluative criteria of what constitute good arguments and teach students to argue better, one has first to assess what meaning children give to "goodness" or "strength" of an argument.

As hypothesised, results regarding age differences revealed that 11-year-old children gave higher scores to counterarguments than 8- year old children across most topics. This finding suggests that younger children showed less appreciation for alternative arguments, an age-related pattern that parallels one found in the discourse of 8- year olds examined in Study Two (Chapter Five).

Having identified how 8-year-olds and 11-year-olds evaluate the strength of arguments in a simple evaluation task, a second study was devised to explore whether children's evaluative criteria change when the task involves a different goal. Specifically, using a similar computer-based task, children in the same age groups were asked to select arguments to persuade hypothetical characters to change their views.

This study differed from the previous one in two ways. First, the focus was on the pragmatic function of arguments, or their effectiveness, rather than on argument strength. Second, children were asked to select arguments given two possible choices, rather than rate each argument individually.

As expected, results indicated that 8- year olds selected either single or multiple arguments over counterarguments (which addressed the alternative view) to change the characters' views, consistently across all three topics. Interestingly, older children (11-12 years) also did not regard counterarguments to be persuasive comparing to other types of argument. Even though 11- year olds may regard counterarguments as a strong type of argument when standing alone (as found in Study Three), they seem to adopt different evaluation criteria when the task involves a discourse or communicative goal. That is, both 8- year olds and 11- year olds do not regard arguments containing opposing elements as a valuable resource for achieving the persuasion goal. As mentioned earlier, this finding can be interpreted in light of previous research on argumentative writing (Coirier, 1996; Ferretti, Lewis, Andrews-Weckerly, 2009; Ferretti, MacArthur, Dowdy, 2000; Leitão 2000, 2003; Nussbaum & Kardash, 2005), that has documented that students do not include alternative views and counterarguments when writing argumentative essays to persuade an audience to accept a point of view.

This study also revealed that 11- year old children, but not younger children, regard arguments with greater number of reasons as the most persuasive type of argument, consistently across topics. However, the results obtained in these two studies cannot be evaluated without considering the limitations associated with the methods used in both studies. The strengths of these studies and the potential implications for future research are also addressed in the next sections.

6.5.1. Limitations

The assessment tasks used in these two studies might have not been sensitive enough to explore the complexity of children's skill in evaluating claims and arguments. One way to better understand the nature of children's responses and interpret the results obtained in these two studies would have been to conduct follow-up interviews with a number of children to gain insight into the thinking underlying their choices. This would have revealed, for example, whether children chose an argument based only on their agreement with the content of that argument. Moreover, it could provide some understanding about children's cognitive processing of choices of one argument over the other in Study Four.

Another problem in pursuing these research questions using a restrictive set of tasks is that argumentation processes cannot be fully understood when isolated from the discourse contexts and goals. For instance, in Study Four, children were asked to engage in a hypothetical situation and persuade a character to change his or her point of view. A problem of designing tasks, with hypothetical social scenarios like these, is that they may have no compelling motivational value for children (e.g., Bearison & Gass, 1979). Moreover, in a study examining developmental differences between hypothetical and practical social reasoning, Cox (1975) found that children's ability to understand on other's perspective appeared to be developmentally more advanced when the target was an actual person compared with a doll representing a person. These issues raise the relevant question of whether children's responses to hypothetical social scenarios are transferable to naturally occurring social situations. On the other hand, as discussed in the methodology chapter (Chapter Three), these computer-based tasks mirror much of children's daily life and school activities, and have the potential of being used as an educational tool.

Another potential criticism of these two studies is that the quantitative measures used in these studies did not allow drawing inferences about the psychological processes underlying children's evaluation and selection of arguments. For instance, after completing the questionnaire, it would have been interesting to interview a number of participants to gain insight into the thinking underlying their choices. Future research should consider these methodological limitations in order to devise better tasks to document children's developmental advances in argument evaluative skills.

6.5.2. Implications

The resulting simplicity of the tasks, while sacrificing examination of the many nuances and processes involved in argumentation, had the practical advantage of making it feasible to assess children's evaluation of claims and reasons across multiple kinds of arguments and content. In addition, its simplicity made it more appropriate for children than a long interview or paper-pencil test formats in which oral and written argumentative skills have been typically assessed. Specifically, these studies overcome the major challenges resulting from methods used in research on generation of oral or written arguments, including the difficulty some children have producing arguments or writing argumentative essays on complex academic topics. These two studies were self-completion computer tasks, with instructions and questions appearing on the screen.

As discussed in the methodology chapter (Chapter Three), using computers to devise and conduct research tasks has increased in popularity in recent years, because of the many advantages they present (Stangor, 2007). For instance, in terms of presenting information, computers can randomly select stimuli from lists, allowing counterbalancing across research participants. Moreover, information can be presented in many formats, including text, pictures and hyperlinks, which make the task more fun and interesting for children. A further strength of these studies was that a pilot study was conducted prior to the design of the tasks to guarantee that the tasks were adequate for children's content knowledge.

Overall, this work offered a clear empirical way to document how children evaluate arguments on several social topics, and to establish a link between argumentation and persuasive goals. In this respect, the fourth study is particularly relevant as it emphasises the importance of understanding the goals individuals pursue in argumentation (e.g., influencing the audience's point of view). The importance of the study of argumentation, and in particular its pragmatic function, or persuasion, is a persistent theme in this thesis.

The literature review chapter has highlighted that the study of argument is integral to many areas including education (see Chapter Two for more detail). For instance, the computer tasks devised for these studies could be used in school classes to teach children how to identify strong arguments and how to critically evaluate them. In fact, most teachers who had collaborated in the data collection, expressed interest in using these materials in class. And so, after data have been collected, teachers used some of the topics (e.g., children receiving pocket money or having a television in their bedrooms) in Assembly and debate classes to elicit argumentative discussions among students.

Chapter Seven - Study Five: Children's evaluation of argument strategy in debates

7.1. Introduction

The present study is the last one in a series of five interconnected studies that examined age differences in children's argumentation skills in different tasks and contexts. The first set of studies focused on generation of arguments, both individually (Study One) and in group interactions with peers (Study Two). The next studies focused on how children evaluate arguments. The ability to understand and carefully examine the views and arguments is essential to argue and counter-argue effectively. Two studies investigated children's understanding and evaluation of arguments using simple computer-based tasks. In Study Three, results indicated that younger children (8-9 years old) perceive fewer differences between weak and strong arguments than older children (11-12 years old). Older children showed a good grasp of the strength of arguments, rating for example counterarguments as stronger than single arguments. Study Four explored arguments' effectiveness or persuasiveness, using the same stimuli generated in the previous study. The interest here was to examine what kinds of arguments children find persuasive and whether there is a correlation between ratings of the strength of arguments and effectiveness, that is, the extent to which an argument is persuasive. Results revealed developmental differences in preference for different types of arguments, and that children regarded some types of arguments as more persuasive than others, for example arguments with more reasons.

The great advantage of using these empirical tasks is that it made it possible to manipulate different hypothetical conditions and explore how children evaluate arguments across these conditions. However, as outlined in Chapter Six, there are some limitations associated with these methods; for example, exploring argumentation processes outside social contexts makes it more difficult to generalise the results to children's interactions in everyday situations.

The present study complements the previous set of studies (see Chapter Six) by focusing on argument evaluation skills in real social interactions. More specifically, this study focused on children's ability to understand and evaluate goal-directed arguments and strategies employed in video-recorded argumentative dialogues. These videos were recorded by 9-10 year olds and they attempted to simulate, as accurately as possible, real dialogues between children.

This study is important because it could reveal which kinds of strategic arguments persuade children, and also, whether children can be persuaded by these arguments. The focus on persuasion as a goal of argumentation constitutes a novel approach to study the development of children's argumentative skills. For the most part, past research in children's argumentation has focused on the kinds of arguments they produce in family interactions (e.g., Stein, Bernas, Calicchia, & Wright, 1995; Stein & Miller, 1993a, 1993b) and school tasks (e.g., Marttunen, Laurinen, Litosseliti, & Lund, 2005; Means & Voss, 1996). Fewer researchers have looked specifically at the effectiveness of argumentation, that is, the extent to which arguments can influence or persuade children to maintain or change a position. Moreover, the task employed in this study is more representative of the sort of activities children normally engage in at school or in real-life situations (e.g., watching TV/ media), rather than the previous tasks in which children were asked to respond individually to a questionnaire at the computer.

7.1.1. The dynamics of arguing and persuading

Both Chapter One and a review of the literature (Chapter Two) highlighted the importance of understanding the course of development of discourse strategies to use arguments competitively in social contexts. Some studies have attempted to look directly at the strategies used in peer discourse and track their development (e.g., Anderson, Nguyen-Jahiel, McNurlen, Archodidou, Kim, Reznitskaya, Tillmanns, & Gilbert, 2001; Clark & Delia, 1976; Felton, 2004; Felton & Kuhn, 2001).

For instance, Anderson and colleagues (2001) examined the early development of argumentative strategies among 9-10 year old children. Children's discussions were transcribed and analysed to determine patterns of occurrence of different *argument stratagems*. These included attempts to make explicit claims, to articulate one's position relative to conversational partners, and to challenge others' arguments with hypothetical scenarios and critiques. The major finding was that the use of argument stratagems "snowballs" in discourse groups. That is, once a stratagem has been used successfully by a child, it tends to spread to other children and appear again during a discussion (Anderson et al., 2001).

Although it is unclear whether young children use these strategies to direct discourse to pursue argumentative goals, they do represent an attempt to coordinate conversation with their peers (Felton, 2004). Clark and Delia (1976) have found developmental differences in the discourse goals exhibited by children and adolescents. Their data suggest that, while children often make appeals without thinking about how they will impact others, adolescents use strategies reflecting progressively greater ability to understand and adapt to the perspective of others. In others words, adolescents are more aware of the goals and the competitive nature of argumentation than are children. Once adolescents recognise the goals that argumentative discourse entails, they are then ready to develop strategies to pursue these goals (Clark & Delia, 1976; Felton & Kuhn, 2001).

Felton and Kuhn (2001) have developed a system for categorising the strategies that adolescents and adults deploy in argumentative dialogues. They compared discourse of adolescents and those of adults in discussions about capital punishment. Results showed that adolescents were less preoccupied with producing the dialogue and less able to adapt effective strategies to meet the goals of argumentation. In contrast, adults adapted discourse to the requirement of different argumentative contexts (agreeing *versus* disagreeing dialogues). When they met with agreeing partners, adults engaged in a qualitatively different discourse than when they met with disagreeing partners.

Discourse strategies produced by adults were characterised by three features: (a) eliciting and critiquing partner's arguments, (b) directing partner's reasoning, and (c) blocking or rebutting attempts by the partner to critique arguments. The researchers identified nine strategies of argumentative discourse on which adults and adolescents differed: adding, using case-based questions, interpreting, counter-arguing, using case-based cornering sequences, interpretation-based cornering sequences, rebutting and blocking. The first three of these strategies occurred more frequently among adolescents and characterises less effective discourse. The remaining six were more frequent among adults and represent more advanced argumentative discourse. This coding scheme is fully described in the methodology chapter of this thesis (Chapter Three). However, a summary of the scheme and the theoretical framework in which this coding scheme was based are provided in the next section.

7.1.2. Arguers' goals and strategies

According to Walton (1989), when engaged in argumentative discourse, speakers have two goals: (1) to secure commitments from the opponent that can be used to support one's own argument; and (2) to undermine the opponent's position by identifying and challenging weaknesses in his or her argument. Drawing on Walton's analysis, Felton and Kuhn (2001) proposed that effective argumentation progresses as speakers are able to understand the discourse goals, and apply effective strategies to pursue these goals. When analysing the adolescents' and adults' dialogues about capital punishment, Felton and Kuhn (2001) identified four argumentative strategies.

1. *Rebutting:* is a basic element of argumentative discourse. It is a sequence in which a speaker presents a counterargument that follows the counterarguments produced by the partner. Thus, it represents an attempt by the speaker to remove the strength of a critique advanced by the partner. Ideally, a speaker should rebut every critique to his or her argument. Otherwise, the partner has successfully undermined the speaker's position. Although it is a defensive move, it is one that demonstrates awareness of the goals of argumentative discourse.

2. *Blocking:* occurs when a speaker rejects or counter-argues the premise of a leading question posed by the partner. In so doing, a speaker avoids being forced to undermine his or her position. Like rebuttals, blocks represent a defensive move on the part of the speaker.

3. *Case-cornering:* occurs when a speaker asks the partner to clarify his or her position, or when a speaker tries to interpret the other's response, and then, challenges his or her view advancing a counterargument. Thus, the speaker corners the partner in a weak position, and then is able to criticise his or her argument. This strategy reflects an offensive attempt to direct the partner's argument.

4. *Formulating a case:* is a variant of the corner sequence. However, instead of a clarifying question, the opening statement is a case question (i.e., the speaker starts an argument by proposing a hypothetical case or scenario). Once the partner takes a position, the opponent advances a counterargument. Like case-

cornering, case-based sequences reflect offensive attempts to direct the partner's argument.

In their study, Felton and Kuhn (2001) found that corner, rebuttal, and block occurred more frequently in adult dialogues, and case-based sequence was identified in both adolescent and adult dialogues. According to Felton and Kuhn (2001), case-based sequences lack strategic power compared with other strategies, such as corner sequences. This is because case-based sequences focus mainly on the partner's position, instead of addressing a speaker's own arguments.

Study Two in this thesis (Chapter Five) explored the use of these elements of discourse in younger populations (children were 5-6, 8-9, and 11-12 years-old). The objective of this previous study was mainly exploratory and the results remain tentative, because children produced discourse strategies rather infrequently. There were only significant statistical differences between the three age groups for the use of rebuttal, which appeared more frequently in the discourse of year 7 children (11-12 years).

Nonetheless, these data suggest that awareness of goals in argumentation may develop before late adolescence and adulthood. This view has been supported by the combined work of Stein and her colleagues (e.g., Stein & Liwag, 1999; Stein & Miller, 1990, 1993a). Their theoretical position has been that argumentation skill emerges early in development (around 3-5 years of age) and that neither children nor adults have cognitive difficulties understanding the basic components of an argument and the goals entailed in argumentative discourse. This contrasts with the position of other theorists, who argue that development of argument skills occurs late in childhood, during the beginning of adolescence.

For instance, Kuhn (2007b) is one of the investigators who have claimed that even adults have difficulty mastering the skills needed to become good arguers. Other researchers (e.g., Coirier, 1996; Coirier et al., 1999; Golder and Coirier, 1994; Knudson, 1992) have also focused on the difficulties that adolescents and adults experience in writing coherent and strong arguments. Gilbert (1997) adopts partially this position, except that he suggests that inadequacies of argument skills should be accepted so that we can teach people how to be more proficient in constructing arguments.

In light of the previous findings in this thesis (Chapters Four to Six), and in accordance with Stein's *early emergence hypothesis*, the present study further explores age differences in children's ability to recognise and evaluate argumentative goals presented in a series of video-recorded dialogues.

7.1.3. Engaging in argumentation and changing views

As noted in the literature review chapter (Chapter Two) and in previous study chapters, cognitive and developmental psychologists have been increasingly interested in understanding how new sources of information interact with existing beliefs and opinions in ways that lead children to change their views (Asterhan & Schwarz, 2009; Brem, Russel, & Weems, 2001; Chambers, 1995; Vosniadou, 2007). These studies fall under a heading of what has been termed "conceptual change". Vosniadou (2007), defines conceptual change as "the outcome of a complex cognitive as well as a social process thereby which an initial framework theory is restructured" (p. 2). Studies of conceptual change have focused mainly on how children learn science (Howe, Rodgers, & Tolmie, 1990; Howe & Tolmie, 2003; Howe, Tolmie, & Mackenzie, 1995; Stathopoulou & Vosniadou, 2007; Vosniadou, 2002; Vosniadou & Brewer, 1994; Vosniadou, Skopeliti, & Ikospentaki, 2004), but also mathematics (Damon & Phelps, 1988; Schwarz, Neuman, & Biezuner, 2000) and history (Pontecorvo & Girardet, 1993). These studies have all shown that conceptual change is the result of a slow and gradual process often accompanied by knowledge biases and lack of critical thinking.

Within social psychology, and particularly in the studies of persuasion, the assessment of attitudes and attitude change has a long history. Social psychologists have been concerned with both the cognitive and affective dimensions entailed in attitudes. The result has been the development of many dual process models to explain the affective (emotion) and cognitive processing and interpretations of persuasive messages. These include the *elaboration likelihood model*, the *heuristic-systematic model*, and the *extended parallel process model.*

In the Elaboration Likelihood Model, or ELM, (Petty & Cacioppo, 1986), cognitive processing is the central route, and affective or emotion processing is associated with the peripheral route. While central route processes involve cognitive processing of the content message, the peripheral route relies on the environmental cues of the message, such as the perceived credibility of the communicator, the attractiveness of the communicator, or the way the communicator conveys the message (Petty & Cacioppo, 1986). The ELM suggests that effective attitude change happens only through the central processing route that incorporates both cognitive and affective components, as opposed to the more heuristics-based peripheral route. This suggests that motivation through emotion alone does not result in attitude change (O'Keefe, 2008). Petty and Cacioppo also speculated that young children are only able to engage in peripheral processing. If so, then children's processing of a peer's presentation of evidence or a dialogue may be based more on the child's evaluation than on a careful consideration of the peer's arguments. Further, Petty and Cacioppo (1986) proposed that young children's inability to engage in elaborative processing may be due to limited prior knowledge.

Similar to the ELM, the Heuristic-Systematic Model, or HSM, (Chaiken, Liberman, & Eagly, 1989) states that information is either processed in a systematic way through comprehensive and analytical cognitive processing of the content message, or information is processed through shortcuts known as heuristics. Emotions (affect heuristics, feelings and gut-feeling reactions) are often used as shortcuts. According to this model, individuals are more apt to minimise their use of cognitive resources, thus, affecting the intake and processing of messages.

The Extended Parallel Process Model, or EPPM, includes both cognition and emotion in combination with threat and fear appeals (Witte, 1992). EPPM suggests that persuasive fear appeals are most effective when an individual has high involvement and efficacy. In other words, fear appeals are more effective when people care about the issue or situation, and when people perceive they possess the agency to deal with that issue or situation.

Research on attitudes has interested both social and cognitive psychologists. A particular phenomenon that has received a great deal of attention in recent years is *attitude polarization.* Attitude or belief polarization is a phenomenon in which a disagreement becomes more extreme as people evaluate mixed evidence on an issue (Fine, 2007). It is one of the effects of confirmation bias: the tendency to search and interpret information in such a way that it strengthens a person's initial view (Fine, 2007).

A pioneering study on attitude polarization, that continues to be widely cited nowadays, was conducted in 1979 by Lord, Ross, and Lepper. In this study, two groups of subjects were selected; one was strongly in favour of capital punishment, and the other was strongly against it. The researchers began by measuring the strength of participants' positions on the death penalty. Later, both groups of participants (pro- and anti-capital punishment) were put into small groups and were shown one of two cards. One card contained a statement about the results of a research project that favoured the death penalty, for example: "Kroner and Phillips (1977) compared murder rates for the year before and the year after adoption of capital punishment in 14 states. In 11 of the 14 states, murder rates were lower after adoption of the death penalty. This research supports the deterrent effect of the death penalty" (Lord, Ross, & Lepper, 1979, p. 2100). The other card had a statement about the results of a research project that opposed to the death penalty, for example: "Palmer and Crandall (1977) compared murder rates in 10 pairs of neighbouring states with different capital punishment laws. In 8 of the 10 pairs, murder rates were higher in the state with capital punishment. This research opposes the deterrent effect of the death penalty" (Lord, Ross, & Lepper, 1979, p. 2100).

Participants were then asked again about the strength of their beliefs regarding the effects of the death penalty, and also asked about the effect that the research had on their attitudes. In the final stage, participants were given the card that supported the opposite position to that they had initially read. Again, participants' degree of commitment to their original positions was re-measured, and participants were asked about the quality of the research and the effect that the research information had on their beliefs.

Lord, Ross and Lepper (1979) found that participants tended to hold that research which agreed with their initial views had been better conducted and was more convincing than research that conflicted with their original beliefs. Whichever position participants held initially, they tended to hold that position more strongly after reading about research that supported their position. In addition, after they had read the research that supported their current views as well as the research that conflicted with their views, they tended to hold their original attitudes more strongly than before they had received that information.

More recently, Kuhn and Lao (1996) conducted a study to probe the existence and frequency of the polarization phenomenon using some of the materials employed in the original Lord et al. study. Kuhn and Lao (1996) compared an evidence evaluation condition with several comparison conditions in which subjects were engaged with the topic but did not examine evidence. They found that polarization is a real but infrequent outcome of exposure to mixed evidence. In addition, their data suggest that it is simply cognitive engagement, rather than exposure to new evidence, that produces the polarization effect. Subsequent research conducted by Kuhn and her colleagues supports this view and provided new evidence that cognitive engagement with peers in discussion of a topic enhances thinking about that topic (Kuhn, Shaw, & Felton, 1997; Kuhn & Udell, 2003), and also facilitates attitude development (Lao & Kuhn, 2002). As Lao and Kuhn (2002) are careful to note, attitude development and attitude change are distinct constructs, in that, an attitude toward something may change from positive to negative without any change in the quality of the thinking supporting it. Conversely, the quality of thinking supporting an attitude may improve while the attitude itself remains unchanged.

7.1.4. The present study

The first aim of this study was to explore age differences in children's ability to recognise the role that different argumentative strategies play in discourse and to understand the dynamics between arguers in pursuing the goals of argumentation. Children participating in the study were presented with video clips in which two children were debating a scientific invention. In these videos, the supporters' goal was to convince participants that their ideas and arguments were strong. The opponents' goal was to challenge the supporters' ideas by diminishing the strength of their arguments. The strategic sequences presented were drawn from Felton and Kuhn's coding scheme of argumentative strategies (2001), but were adapted to a new topic to fit children's level of knowledge and understanding.

In Study Two (Chapter Five), this coding scheme was also applied to explore whether children, at different ages, were able to generate these strategies in discussion with their peers. Results showed that children's discourse at all ages was more *expository* than strategic, because they produced these strategies infrequently. Age differences were only found in the use of rebuttals, which was used more frequently by older children (11- year olds). The question posed here was whether these results reflect children's difficulty in constructing effective argumentative strategies, or children's lack of understanding of the goals of argumentative discourse. If children do not understand the arguer's goals and intentions that argumentation implies, then they may find it unnecessary to behave strategically. Thus, the present study complements the previous one by looking specifically at children's evaluative skills in discourse.

The first hypothesis formulated here was that there would be age differences in children's ability to recognise different strategic goals. If these skills are developmental, as the results from previous studies seem to indicate (Chapter Four to Six), then it is predicted that older children (11-12 years) would be better at recognising the impact that different strategies play in argumentative discourse than would younger children (8-9 years). More specifically, older children will show a preference for the supporter's arguments and evaluate his or her performance as strong in the rebutting and blocking scenarios. This is because *rebutting* and *blocking* represent defensive moves by an arguer to avoid being forced to undermine the initial position. In these scenarios, the supporter gains advantage by defending with success his or her initial position with counterarguments. Conversely, in scenarios with corner and case sequences, 11- year olds will evaluate the supporter's performance as weak and prefer the opponent's arguments. This is because corner sequence and case sequence reflect offensive attempts by the opponent to direct the partner's argument, thus leaving him or her in a weaker position. On the other hand, younger children (8- years) will have more difficulty in differentiating the supporters' and opponents' goals and intentions in the four strategic sequences.

The second hypothesis was that there would be age differences in the preference for a particular strategy, in terms of its effectiveness, when comparing six different paired combinations (corner sequence vs. rebuttal, case-based sequence vs. block, rebuttal vs. case-based sequence, block vs. rebuttal, corner sequence vs. block, case-based sequence vs. corner sequence). However, because this hypothesis is being investigated for the first time, no specific predictions relating to age differences were made here.

A further objective of the present study was to examine whether children can be persuaded to change their initial positions after listening to the strategic arguments of a particular communicator. The research question posed here is whether the presentation of evidence in a passive condition (video-recorded dialogues) is an effective means of attitude change, and also whether there are age-related differences in this respect.

However, the focus is not on the study of attitudes *per se*, but rather to examine children's thinking about novel ideas (original inventions) related to important social issues, such as protecting the environment, and improving people's lifestyle. In light of the finding by Staudinger and Baltes (1996) that implicit (imagined) interaction can be as effective as real social interaction in enhancing adults' thinking about everyday ill-structured dilemmas, it was predicted that children would be influenced to revaluate their positions after exposure to arguments. Again, predictions relating to age differences were not formulated because these are being investigated for the first time.

7.2. Pilot study

A pilot study was undertaken two weeks prior to the main study. The aim of the pilot survey was to gather information about the sorts of arguments adults (undergraduate students) consider strong. This assessment provided the basis of the stimuli to be deployed in the main study. Undergraduate students were told that the researcher was interested in how adults evaluate the strength of arguments and that this assessment would provide information to devise materials for a study with young children.

7.2.1. Participants in the pilot survey

Participants were 75 undergraduate students (65 female, 10 male) attending the first year of the Psychology degree in the university where the researcher studies. Students were 18-25 years old (*M* = 19, 1 years, *S.D.* = 1.52). They were recruited through the department's Research Participation Scheme. This is an online scheme accessible to first-year students via the departmental website. Through this scheme, students can sign up to take part in Psychology research studies, schedule appointments and receive course credits for their participation. The pilot study was advertised in the website for three weeks. Several timeslots were created to allow students to choose a convenient time to participate in the study.

A sample of student volunteers was chosen to be part of this pilot assessment for several reasons. First, the subjects were accessible and readily available. This allowed the process of data collection to be fast, inexpensive and easy. Another advantage of using adults in the pilot study was because they would be able to understand and cope with the large amount of information provided in the questionnaire. Moreover, designing questionnaires for children would be time consuming because they would have to be relatively short in length and contain language accessible to their level of comprehension. However, an obvious criticism of using a convenience sample was sampling bias and that the sample was not representative of the population of interest (Stangor, 2007).

7.2.2. Questionnaire survey

A paper-and-pencil questionnaire was designed specifically for the purpose of this pilot study. The instrument consisted of a five-point scale for measuring the strength of arguments, with a score of 1 corresponding to the lowest level of strength ("very weak"), and a score of 5 corresponding to the highest level of strength ("very strong"). The instrument consisted of four pages. Arguments listed in the scale were related to different scientific inventions (e.g., a recycling robot, a flying car, etc). The scale included a short description of an invention and a list of five reasons in favour and five reasons against each invention (i.e., the advantages and disadvantages of an invention). The following instructions appeared in the first page: "These inventions were created by 10-year-old children and they are related to the topic [e.g., protecting the environment]. Below you will find several arguments in favour and against these innovative ideas. Please evaluate the strength of each argument, using a 1 to 5 scale". Figure 7.1 provides an illustration of the arguments given in favour and against the recycling robot invention.

In total, items listed in the scale included four topics (Environment, Technology, Lifestyle, and Health), eight inventions (recycling robot, rain converter, translation telephone, flying car, clever hat, locator for lost things, healthy ice-cream, and spray for safe food), and eighty arguments (40 advantages, 40 disadvantages). An illustration of a part of the questionnaire is provided below (see Figure 7.1). The complete questionnaire is available in Appendix 15.

Invention 1: City recycling robot. It is a small robot that will go around a city and pick up any trash. It is able to identify and separate garbage using special-made sensors to look for recyclable materials. Material that can be recycled would be put into appropriate sections inside the robot	
Advantages of a city recycling robot	
Cheap to build	(1) very weak (2) weak (3) neutral (4) strong (5) very strong
Cities would be cleaner	(1) very weak (2) weak (3) neutral (4) strong (5) very strong
Some people do not care about recycling, but the robot would do it automatically	(1) very weak (2) weak (3) neutral (4) strong (5) very strong
Recycling avoids pollution	(1) very weak (2) weak (3) neutral (4) strong (5) very strong
Recycling avoids deforestation	(1) very weak (2) weak (3) neutral (4) strong (5) very strong
Disadvantages of a city recycling robot	
The robot picks up the trash, but it is incapable to recycle materials	(1) very weak (2) weak (3) neutral (4) strong (5) very strong
Expensive to put into practice in cities	(1) very weak (2) weak (3) neutral (4) strong (5) very strong
Does not solve the problem of factories that do not recycle materials	(1) very weak (2) weak (3) neutral (4) strong (5) very strong
Robots would consume fuel	(1) very weak (2) weak (3) neutral (4) strong (5) very strong
Robots would pollute the environment	(1) very weak (2) weak (3) neutral (4) strong (5) very strong
Invention 2: Rain converter. It is a mobile water unit that can transform rain into drinkable water and supply homes. The unit is displayed in the roof of a house where it captures the rain.	
Advantages of a rain converter	
Prevents the world of running short of fresh water	(1) very weak (2) weak (3) neutral (4) strong (5) very strong
Reduces the harm done to the environment by the water industry	(1) very weak (2) weak (3) neutral (4) strong (5) very strong
Cheap alternative source of water	(1) very weak (2) weak (3) neutral (4) strong (5) very strong
Reduces flooding	(1) very weak (2) weak (3) neutral (4) strong (5) very strong
Water storage could be used for fire prevention	(1) very weak (2) weak (3) neutral (4) strong (5) very strong
Disadvantages of a rain converter	
It would not work in places where it does not rain often	(1) very weak (2) weak (3) neutral (4) strong (5) very strong
If people capture all rain, rivers would run dry.	(1) very weak (2) weak (3) neutral (4) strong (5) very strong
Quality of filtered rainwater might be not very good	(1) very weak (2) weak (3) neutral (4) strong (5) very strong
It does not rain during the Summer	(1) very weak (2) weak (3) neutral (4) strong (5) very strong
A small device cannot filter rainwater	(1) very weak (2) weak (3) neutral (4) strong (5) very strong

Figure 7.1. Illustration of a part of the questionnaire for evaluating the strength of arguments for inventions for protecting the environment

7.2.3. Procedure

Students completed the questionnaire individually in a quiet room at the university. Participants received an information sheet explaining the purpose of the assessment. The following introduction appeared first: “You are invited to take part in a research study. I am interested in gathering information about the sorts of arguments adults consider strong. Your task is to respond to a simple questionnaire designed to evaluate your preference for different arguments related to scientific inventions created by children. The information you provide will be used to help me design a study about children’s understanding of persuasive arguments”. Participants were given the opportunity to ask questions before signing the consent form (see again Appendix 15). Participants took less than 10 minutes to complete the questionnaire.

7.2.4. Missing data

Examination of frequencies suggested missing data to be random. Thus, in accordance with Brace et al. (2006), respondents who missed at least one of the items in the questionnaire were excluded from the analysis, leaving a total of 63 participants.

7.2.5. Statistical note and results

Students’ evaluations of the strength of arguments were examined. The data were ordinal in nature; therefore median and range values are reported (see Table 7.1). In addition, the mean and standard deviation values are also reported (see again Table 7.1). By reporting the mean value and treating the Likert-scale as an interval scale, one is not assuming that the differences between the responses are equal in distance. In this example, it shows that students with higher-numbered responses are in more agreement with a particular argument than those with lower-numbered responses. For instance, related to the advantages of the recycling robot, students seem to agree more that the reason “Robots would keep cities clean” (M = 4.03) is stronger than other reasons like “Robots would be cheap to build” (M = 2.35), and “Robots are more efficient than people” (M = 3.68). Arguments with the highest ratings for each category were selected. More specifically, the advantage and the disadvantage rated as the strongest for each invention were selected to be displayed in the stimuli. These arguments are displayed in Table 7.2. No statistical tests were performed to analyse whether there were statistically significant differences for scores of arguments. Most researchers, particularly in the developmental field, agree that there is no need to apply statistical models to pilot data (Wilson, 2005). Instead, it is typical to calculate simple descriptive statistics to get an estimate of the evaluation of each item (McCartney, Burchinal, & Bub, 2006).

Table 7.1. Descriptive statistics for the pilot study

	Median	*Range*	*Mean*	*Std dev.*
Advantages of a city recycling robot				
Cheap to build	2	3	2.35	1.24
Cities would be cleaner	4	4	4.03	.84
More efficient than people	4	4	3.68	1.06
Recycling avoids pollution	4	4	3.83	1.11
Recycling avoids deforestation	4	4	3.73	1.11
Disadvantages of a city recycling robot				
Does not recycle materials	3	4	3.03	1.22
Expensive to put into practice in cities	4	3	4.07	.88
Does not solve the problem of factories that do not recycle materials	4	4	3.76	1.12
Robots would consume fuel	4	3	3.75	.98
Robots would pollute the environment	4	4	3.29	1.18
Advantages of a rain converter				
Prevents the world of running short of fresh water	4	4	3.56	1.12
Reduces the harm done to the environment by the water industry	4	4	3.57	.96
Cheap alternative source of water	4	4	3.81	.98
Reduces flooding	4	4	3.05	1.08
Water storage could be used for fire prevention	4	4	3.31	1.11
Disadvantages of a rain converter				
It would not work in places where it does not rain often	4	3	4.09	.93
If people capture all rain, rivers would run dry	2	4	2.73	1.33
Quality of filtered water might not be very good	4	4	3.41	.96

	Median	*Range*	*Mean*	*Std dev.*
It does not rain during the Summer	3	4	2.53	1.11
A small device cannot filter rainwater	3	4	2.79	1.00
Advantages of a translation telephone				
Improves communication in multiple languages	4	3	4.29	.69
Makes friends from other cultures	4	4	3.64	.97
Delivers information in multiples languages	4	3	4.03	.77
Cheaper than human translation	3	4	3.40	1.05
Quicker than human translation	4	4	3.57	1.07
Disadvantages of a translation telephone				
Machines would not be able to translate ambiguous words and sentences	4	3	4.24	.69
Translators would be unemployed	4	3	3.45	1.14
Calls would be expensive	4	4	3.93	.91
People would not be interested in learning new languages	4	4	3.40	1.33
Machines are not reliable	4	4	3.68	.96
Advantages of a flying car				
Cheaper than aeroplanes	4	4	3.31	1.19
Quick to go to a distant place	4	4	3.83	.89
People would not have to drive	3	4	3.05	1.20
There would not be traffic jams	3	4	3.09	1.25
Flying cars would be good as ambulances	4	4	3.68	1.18
Disadvantages of a flying car				
It is not a safe method of transport	4	4	3.61	1.15
It would be costly to build	5	4	4.33	.91
It would consume a lot of fuel	5	4	4.31	.90
There would be a lot of air crashes	4	4	3.88	1.08
It would not be practical	3	4	3.09	1.09
Advantages of a clever hat				
It would be fun to wear	3	4	2.73	1.35
It would be practical	4	4	3.33	1.12

	Median	*Range*	*Mean*	*Std dev.*
It would protect the eyes from the sunlight	4	4	3.49	.92
Good for bold people	3	4	2.51	1.20
People could ride a bicycle in the rain without carrying an umbrella in one hand	4	4	3.53	1.11
Disadvantages of a clever hat				
It would not be feasible	4	4	3.63	.98
It is not an important invention	4	4	3.55	1.11
It would make hair dry and puffy	2	4	2.36	1.15
It is better to have different varieties of hats	2	4	2.47	1.08
It would be too heavy for people's head and neck	4	3	3.85	.97
Advantages of a locator for lost things				
Finds misplaced or lost things quickly	4	3	4.28	.79
Reduces people's stress	4	3	3.92	.88
People would not be late for work	3	4	2.87	1.12
Cheap to build	3	4	3.09	1.15
People could also used it to locate a lost dog or cat	4	4	3.32	1.14
Disadvantages of a locator for lost things				
People would forget to use it	3	4	2.84	1.11
It is not very practical	3	4	2.59	1.08
People would need lots of locators for using it on different things	4	4	4.00	1.03
It is not an original idea	3	4	3.07	1.11
People already use too many electronic devices	3	4	2.94	1.28
Advantages of a healthy ice-cream				
Good for people who are picky eaters	4	4	3.43	1.12
Meals would be fun for children	4	3	3.77	.89
Prevents obesity	4	4	3.35	1.19
Parents would not have a problem convincing their children to eat healthy food	4	4	3.61	1.11
Cheaper than real food	3	4	2.65	.97

	Median	*Range*	*Mean*	*Std dev.*
Disadvantages of a healthy ice-cream				
A vegetable ice-cream would not taste as good as a chocolate ice-cream	4	4	3.95	1.08
Real fruit and vegetables are healthier	5	3	4.55	.58
It would not be popular amongst adults	4	4	3.57	1.08
Restaurants would be empty	2	4	2.43	1.23
It would be boring to eat ice creams every day	4	4	3.93	1.18
Advantages of a spray for safe food				
People would not have to peel fruit	3	4	3.00	1.12
Easy to use	4	4	3.89	.80
More efficient in killing germs than using water	4	4	4.00	.81
Prevent diseases provoked by toxins and pesticides	4	4	4.09	.81
More hygienic	4	3	3.89	.97
Disadvantages of a spray for safe food				
Difficult to create a safe spray	4	3	3.00	.72
No use in some fruits and vegetables that need to be peeled	4	4	3.89	.96
Expensive	4	3	4.00	.98
Does not solve the problem of pesticides that get inside fruits and vegetables	4	3	4.09	.64
The spray could leave a bad taste	4	4	3.89	.94

Table 7.2. Selected arguments in favour and against each invention (advantages and disadvantages)

Invention	*Advantage*	*Disadvantage*
Recycling robot: it is a small robot that will go around a city and pick up any trash. It is able to identify and separate garbage using special-made sensors to look for recyclable materials. Material that can be recycled would be put into appropriate sections inside the robot	Cities would be cleaner	Expensive to put into practice in cities
Rain converter: it is a mobile water unit that can transform rain into drinkable water and supply homes. The unit is displayed in the roof of a house where it captures the rain.	Cheap alternative source of water	It would not work in places where it does not rain often
Translation telephone: it is a small device, similar to a regular mobile phone, with the ability for universal translation. People could call anyone in the world and the telephone would do instant language translation. Translation would be available for all languages in the world.	Improves communication in multiple languages	Calls would be expensive
Flying car: this car is made of lightweight material and would be able to take off and fly above the road at hundreds of miles per hour. Flying cars would have an automatic pilot, so people would not have to drive.	Quick to go to a distant place	It would be costly to build and maintain
Clever hat: this hat protects you in all weathers – sun, wind, snow, lightning – you press a button and things come out, for example an umbrella for rain.	People could ride a bicycle in the rain without carrying an umbrella in one hand	It would be too heavy for people's head and neck
Locator for lost things: this is a very small device with a hook on it to put on your glasses, on your house keys, etc. that will emit a shrill sound or flash a light after you dial a number on your mobile phone.	Finds misplaced or lost things quickly	People would need lots of locators for using on different things
Healthy ice-cream: healthy foods, such as broccoli, carrots, tomato soup, etc. would taste as good as a sweet ice cream. Instead of eating a meal of chicken and potatoes, you can eat a tasty ice cream with the same nutrients and vitamins.	Meals would be fun for children	Real fruit and vegetables are healthier
Spray for safe food: this spray is made of water and other organic components and cleans all fruit and vegetables from all chemicals. It is really easy to use: just spray your food and it is ready to eat!	Prevents diseases caused by chemicals	Does not solve the problem of chemicals that get inside fruits and vegetables

7.3. Development of materials

The next step was to create different types of strategic sequences using the reasons selected earlier (see again Table 7.2 above). Four types of strategies were created using the reasons in favour and against each invention: corner, rebuttal, case, and block. The example provided below illustrates the scenarios created for the *recycling robot* invention. Each sequence starts with an arguer presenting an argument in favour of the invention: “I am in favour of the recycling robot, because it would keep cities clean”. Similar strategic sequences were created for the remaining inventions, and they are fully described in Appendix 16. These scenarios were then played and video-recorded by a group of children who agreed to participate in the study.

Scenario 1: Corner sequence

Arguer	[argument] I am in favour of the recycling robot, because it would keep cities clean.
Opponent:	[clarify-?] So, you think we need robots to keep cities clean?
Arguer:	[clarify] Well, some cities are very dirty, so robots would very useful.
Opponent:	[counter-C] But cities already have recycling bins. If people recycle, we do not need robots to do it.

Scenario 2: Rebuttal

Arguer	[argument] I am in favour of the recycling robot, because it would keep cities clean.
Opponent:	[counter-C] But cities already have recycling bins. If people recycle, we don’t need robots to do it.
Arguer:	[counter-C] But some people don’t recycle, so we need other solutions, like robots to keep cities clean.

Scenario 3: Case sequence

Arguer:	[argument] I am in favour of the recycling robot, because it would keep cities clean.
Opponent:	[case-?] Let's say we live in a big city that gets very dirty every day. Would we have to buy lots of robots?
Arguer:	[clarify] Yes, we could get several robots to keep cities clean.
Opponent:	[counter-C] But this would be very expensive to put into practice in cities.

Scenario 4: Block

Arguer:	[argument] I am in favour of the recycling robot, because it would keep cities clean.
Opponent:	[case-?] Let's say we are in a big city that gets very dirty every day. Would we have to buy lots of robots to keep the city clean?
Arguer:	[counter-C] Maybe not. Robots last long and they can work several times a day. A few robots would be enough to keep large cities clean.

7.3.1. Preparation of recording sessions

Children's dialogues were recorded using a video camera. The video scenario consisted of a white background with two children seated in chairs or standing. The camera was placed in front of the children. A medium close-up was used to frame the pair, covering children's face and shoulders. The researcher seated facing the children (to show the cards) and near the left-hand side of the camera (to be able to operate it).

The videos were recorded in a quiet room at the university where the researcher works. Children were shown four cards (paper format A4, yellow colour), each one presenting the theme and the inventions associated (e.g., theme: "protecting the environment"; inventions: "recycling robot" and "rain converter"). For the video recording, children were not asked to memorise the script. Instead, children were shown cards and asked to read their lines. These cards included descriptions of the inventions and arguments in favour and against each invention. Cards in two different colours were used to facilitate children's identification of their lines (white cards for the arguer, and green cards for the opponent). A total of 96 cards were printed in A4 paper format, front and reverse. The front page of the card was facing the researcher and contained an identification title for the card, printed in small font size (e.g., "robot description" or "robot argument" or "robot strategy, first line"). The reverse page of the card was facing children and contained lines printed in large font size.

7.3.2. Children featuring in the videos

Participants were eight children (four girls, four boys); mean age 10 years and 4 months, recruited through acquaintances. Verbal consent to take part in all aspects of the study was obtained from parents. Children were also asked for personal approval before participating in the study and they were told that they could withdraw from the study at any time. All participants were placed in same-gender pairs with one peer of the same age group.

7.3.3. Recording the stimuli

The videos were recorded in two sessions in two separate days. Each session lasted approximately one hour, including time for instructions and rehearsals before recording the videos. Instructions given to children are outlined in Appendix 17. Four girls from the same school participated in the first session, and four boys from another school participated in the second session. All children were wearing their school uniforms.

The four inventions used in each recording session were selected randomly from a total of eight inventions. Before recording the videos, children chose their favourite invention. Children were also given the opportunity to choose a partner to record the dialogues. While one pair of children recorded the first video, the other two children were asked to wait for their turn, in a room adjacent to the recording room, accompanied by an adult (the mother of one child).

For each invention topic, five movie clips were produced (less than one minute each), including one clip for the description of the invention, and four clips for the presentation of short dialogues related to the invention. These dialogues represented four different persuasive strategies: corner, rebuttal, case, and block. The sequence of presentation and recording of these strategies was the same for all topics. Between each movie take, children were invited to take a break. Refreshments (water, juice, fruit, and cookies) were provided. Children were very engaged in the activity, and they decided to continue filming after each take. Children were praised for their effort during the task by the researcher (e.g., "well done!", "that's great!", "you sound like a real actor!"). Occasionally, the researcher asked a child to repeat a line, usually for mispronouncing a word. Once the task had been completed, the participants were thanked and each child received a book gift card for their collaboration in the study.

7.4. Method

7.4.1. Participants

One hundred and twenty seven children (64 boys and 63 girls) aged 8-9 years (*M* = 8, 79; *S.D.* = .41), and 11-12 years (*M* = 11, 95; *S.D.* = .22) participated in this study. Children were in their fourth and seventh year of school education. The sample was collected at two primary schools in the areas of Windsor, and Middlesex, and one secondary school in Slough, in South East England. Students from year 7 were from heterogeneous ethnic (primarily South Asian) and socioeconomic (mostly low-middle class) backgrounds. There were no exclusion criteria based on gender, race, or any other characteristic. All children from each age group, who were in attendance in the class during data collection and who had given consent, were invited to participate in the study. In the first instance, a letter explaining the study in more detail was sent to the Head Teacher of each school. This was followed up by a telephone call. After receiving permission from the schools, a consent letter was sent to children's parents. A template letter to schools (see Appendix 18) and consent forms for parents are attached (see Appendix 19). A more detailed debriefing was given to teachers and children. Debriefing to participating children in the main study took the form of a brief presentation to the class discussing how children at different ages might have different opinions about various topics, like inventions in science, and why researchers have interest in arguments and persuasive strategies at different ages. The researcher and her supervisor visited the schools where data were collected and gave a brief presentation of the results.

7.4.2. Materials

Children watched a video in a technology-equipped room available at their school. They were equipped with a wide screen and external speakers that could be connected to a laptop. The size of these rooms was ideal for working with small groups of children. Children were seated in an individual desk in front of the screen. Desks were placed in a row and approximately 20 cm apart. This was appropriate because the objective of the study was not to conduct a group discussion, but to collect students' individual responses before and after a video presentation.

The video was created using the program Windows Movie Maker 2007, and was eight minutes long. The video contained four clips, each one of two minutes in length. Video clips showed two children (aged 9-10 years) presenting and discussing an invention on a specific science topic. There were four different topics: *Environment, Technology, Lifestyle,* and *Health.* Children featuring in the video were instructed to present specific arguments (that formed different types of discourse strategies).

A total of twelve versions of the video were created, in order to randomise the topics and argument content. Table 7.3 illustrates how data were collected to guarantee randomisation of contents. For example, children assigned to group A were shown a video presenting comparisons between a corner sequence (with arguments about the recycling robot invention) and a rebuttal (with arguments about the rain converter); between a case sequence (with arguments about the translation telephone) and a block (with arguments about the flying car); between a rebuttal (with arguments about the clever hat) and a case (with arguments about the locator for lost things); and finally between a block (with arguments about the healthy ice-cream) and a rebuttal (with arguments about the spray for safe food). On the other hand, children assigned to group A' viewed an identical video presenting the same paired strategies, but with the content reversed (e.g., a corner sequence with the arguments related to the rain converter *versus* a rebuttal with arguments about the recycling robot).

Participants received a questionnaire for assessment of opinion ratings before and after video visualisation. They were also asked to complete a questionnaire regarding the arguments discussed in the dialogues between each video clip.

Table 7.3. Randomisation procedures and design for data collection

	Corner vs. Rebuttal	Case vs. Block	Rebuttal vs. Case	Block vs. Rebuttal	Corner vs. Block	Case vs. Corner
Robot vs. Rain converter	A, A’	B, B’	C, C’	D, D’	E, E’	F, F’
Translator vs. Flying car	F, F’	A, A’	B, B’	C, C’	D, D’	E, E’
Hat vs. Locator	E, E’	F, F’	A, A’	B, B’	C, C’	D, D’
Ice-cream vs. Food spray	D, D’	E, E’	F, F’	A, A’	B, B’	C, C’

Note: Letters A, A’, B, B’, C, C’, D, D’, E, E’, F, F’ represent 12 different groups of participants (N = 5 to 6 per group).

7.4.3. Procedure

The procedure involved a session of approximately 30 minutes for each group of participants. All children watched a video containing several debates. Before and after video visualisation, participants were asked about their positions on the ideas and arguments presented in the video.

Assessment of children’s initial positions before exposure to arguments

Participants were asked to complete a first questionnaire individually. This questionnaire assessed children’s initial opinions regarding the ideas that would be presented later in the video. Children’s task was to evaluate several inventions by giving points in a scale from 1 (*very weak*) to 5 (*very good*). Children were given the following instructions: “Hello! I am interested in knowing what you think about other children’s ideas and arguments. I am going to show you a video of children discussing inventions they created for a Science Competition in their school. Before listening to their ideas, I am going to give you this sheet (with two pages) that contains the description of children’s inventions. Your task is to read the information very carefully and rate how good you think these inventions are. This is not a test, so there are no wrong or right answers. If you do not understand a word or you have any questions, do not hesitate to ask me". All children completed the questionnaire in less than 10 minutes. The pretest questionnaire is attached in Appendix 20.

Video visualisation

A video was shown to small groups of children (five or six children for each group). Participants were given the following instructions: "As I explained earlier, you will now watch a video of other children discussing inventions they created for a Science Competition in their school. You have already read about their inventions, but now you will listen to the inventors giving arguments in favour of their creations. Please listen carefully to the dialogues, because afterwards you will be asked to evaluate the inventors' ideas and arguments, and choose which one who should win the contest in each category (e.g., Environment, Technology)". After each video clip, the researcher paused the film and asked children to answer a brief questionnaire about the video clip.

Assessment of children's final positions and evaluation of argumentative strategies

This assessment occurred immediately after children's visualisation of each video clip. Participants were asked to draw conclusions about the dialogues by completing a questionnaire individually. The instrument consisted of a one-page questionnaire designed to assess children's understanding of different persuasive strategies, and also children's positions regarding the inventions after exposure to arguments. Children were asked to answer several questions by using a 5-point scale, and also by choosing one out of several options. In order to evaluate children's understanding of different types of strategic sequences for each invention, the instrument included the following questions:

Inventions for the Environment category (Please check or circle where appropriate)	
In the debate, do you think the inventor of the recycling robot was good or weak at defending the invention?	(1) very weak (2) weak (3) average (4) good (5) very good
If you had to choose, which thing on the list would you pick as the most important thing to explain your previous answer?	(1) the inventor had the best arguments (2) the opponent had the best arguments (3) both inventor and opponent had strong arguments (4) I do not know

Figure 7.2. Illustration of part of the questionnaire used after video visualisation

The third question assessed children's final positions on each invention and it was identical to the question used prior to video visualisation. Children were asked to evaluate several inventions by giving points in a scale from 1 (*very weak*) to 5 (*very good*) (e.g., "After listening to the debate about the recycling robot, how would you rate this invention?").

Finally, after answering the questions regarding both inventions for each category, children were asked to choose the best inventor for the category (e.g., "Who do you think should be the winner for the category Environment in this competition: the inventor of the recycling robot, or the inventor of the rain converter?"). The complete questionnaire is attached in Appendix 21.

Missing data

There was a small number of missing values, which suggests that these were likely to be random (Brace et al., 2006). Three subjects missed one item of the questionnaire, so data from all individuals were used (N = 127), except for analyses involving those particular responses.

7.5. Results

7.5.1. Design and analysis

A mixed design was employed in this study. The first factor was the within-subjects factor of before and after measures of children's positions on different topics. The second factor was the between-subjects factor of age group, with two levels (8- and 11- years) and also the factor of paired-type of persuasive strategies, with six levels (corner vs. rebuttal, case vs. block, rebuttal vs. case, block vs. rebuttal, corner vs. block, and case vs. corner). Analyses examined children's ratings of inventors' effectiveness in defending their arguments in debates. Before and after measures of children's position on a topic were also analysed to explore any changes after exposure to arguments. Relations among variables were examined using parametric and non-parametric tests as appropriate.

Age differences in children's evaluation of arguers' skill

The first hypothesis concerned age differences in children's understanding of the goals of argumentative discourse entailed in several types of strategic sequences. More specifically, it was predicted that children in the two age groups would evaluate arguers' skill in dialogues containing different strategic sequences differently. These strategies were combined in six different pairs in order to contrast its effectiveness (or strategic power). This was assessed by asking children to listen to two children (a supporter and an opponent) engaging in short dialogues containing two different strategic sequences (e.g., corner sequence *versus* rebuttal) and then to give a score to the arguers' skill in defending their ideas. The following question was asked: "In the debate, do you think that the inventor of the (e.g., recycling robot) was good at defending the invention?" Children's scores for the inventor's performance in the dialogues were analysed across topics.

The following analyses detail: (1) age differences in children's evaluation of arguers' skill in dialogues containing different strategic sequences between groups (8-9 years and 11-12 years), and (2) a separate analysis by age group of children's evaluation of strategy persuasiveness in each paired combination of strategies.

Histograms for the two age groups were inspected separately. As data were skewed, and participant numbers were small, the most appropriate statistical tests were non-parametric. These included a Mann Whitney test of differences for independent samples, and a Wilcoxon test of differences for related samples. In addition, data descriptive statistics included median as a measure of central tendency and range as a measure of dispersion. The disadvantage of nonparametric tests is that they are less powerful than their parametric equivalents (Brace, Kemp, & Snelgar, 2006). Therefore, parametric tests were also used, including analysis of variance (ANOVA), and a Paired-Samples T-Test. Data descriptive reports also included values of mean as a measure of central tendency and values of standard deviation as a measure of dispersion. Use of parametric tests (e.g., one-way ANOVA) served to corroborate the results obtained in the non-parametric analyses. However, because they yielded the same results obtained in the previous analysis (the equivalent non-parametric test), it was decided to report only the results obtained from the non-parametric tests.

The Mann-Whitney test was used to assess whether there was a statistically significant difference between the mean ranks of arguer's performance in different strategic sequences rated by 8- year olds (*N* = 67) and 11-year olds (*N* = 60). Results showed a statistically significant difference for ratings of arguer's effectiveness in case sequence strategy in the *pair case sequence versus block* by comparing the two age groups, $U = 636$, $N_1 = 45$, $N_2 = 40$, $p < .01$. In this pair, 8- year old children gave higher ratings (median = 4) for arguer's performance in case sequence strategy than 11- year old children (median = 3). There were no significant age differences for the remaining paired combinations of strategies.

Next, differences of children's evaluation skill in each pair of strategies (for separate age groups) were analysed. Data descriptive statistics of ratings given by 8-year old children (*N* = 47) are reported in Table 7.4. A Wilcoxon Signed Ranks test was performed for this age group to test whether there were significant differences between ratings of arguer's performance in different pairs of strategies. Results showed a statistically significant difference only for the *pair rebuttal versus corner sequence,* $z = -2.48$, N – Ties = 42, $p < .01$. Specifically, there were more high ranks for the positive differences, that is, children's ratings for arguer's performance in the rebuttal strategy were significantly higher than the ratings for the arguer's performance in the corner sequence strategy. There were no significant differences between the ratings of other pairs of strategies, that is, there was a fairly equal spread of ranks for the evaluation of the arguer's effectiveness in the remaining strategies.

Descriptive data for scores given by 11-year old children (*N* = 40) are provided in Table 7.5. These data show that 11- year old children evaluated the arguer's performance in rebuttals and blocks more favourably than the other two strategies consistently across conditions. These data were explored further using a Wilcoxon Signed Ranks Test. A statistically significant difference was found for the ratings in the *pair rebuttal versus corner sequence,* $z = -2.79$, N – Ties = 29, $p < .01$, two-tailed. There were more high ranks for the positive differences (i.e., children's scores for arguer's performance in the rebuttal strategy were higher than the scores given to the arguer's performance in the corner sequence strategy). A significant difference was also found for the ratings in the *pair case sequence versus rebuttal*, $z = -2.91$, N – Ties = 24, $p < .01$, two-tailed. In this case, there were more high ranks for the negative differences (i.e., children's scores for the arguer's performance in the case sequence strategy were lower than the scores attributed to the arguer's performance in the rebuttal strategy). Finally, there was also a statistically significant difference for the ratings in the *pair block versus corner sequence,* $z = -2.73$, N – Ties = 31, $p < .01$. There were more high ranks for the positive differences (i.e., children's ratings for arguer's performance in the block strategy were higher than the ratings for the arguer's performance in the corner sequence strategy).

Table 7.4. Descriptive statistics for the evaluation of arguer's performance in each strategic sequence by younger children (8- years of age)

	corner vs. rebuttal		case vs. block		rebuttal vs. case		block vs. rebuttal		corner vs. block		case vs. corner	
	corner	rebuttal	case	block	rebuttal	case	block	rebuttal	corner	block	case	corner
Mean	3.20	3.87	3.80	3.60	3.44	3.24	3.60	3.31	3.21	3.60	3.18	3.34
Std.dev.	1.17	1.02	1.14	1.21	1.36	1.32	1.21	1.24	1.34	1.26	1.40	1.36
Median	3.00	4.00	4.00	3.00	4.00	3.00	4.00	3.00	3.00	4.00	3.00	4.00
Range	4	4	4	4	4	4	4	4	4	4	4	4
Mode	4	4	5	3[a]	4	3	4	3	3	4	2[a]	4

Note: [a] multiple modes exist; therefore the smallest value is reported.

Table 7.5. Descriptive statistics for the evaluation of arguer's performance in each strategic sequence by older children (11- years of age)

	corner vs. rebuttal		case vs. block		rebuttal vs. case		block vs. rebuttal		corner vs. block		case vs. corner	
	corner	rebuttal	case	block	rebuttal	case	block	rebuttal	corner	block	case	corner
Mean	3.00	3.70	3.25	3.43	3.65	3.05	3.68	3.58	3.05	3.83	3.40	3.10
Std.dev.	1.06	.97	.93	.87	.86	.82	.94	.59	1.18	.93	.90	.98
Median	3.00	4.00	3.00	3.00	4.00	3.00	4.00	4.00	3.00	4.00	3.00	3.00
Range	4	4	3	3	3	3	4	3	4	3	3	4
Mode	2	4	3	3[a]	4	3	4	4	3	4	4	3

Note: [a] multiple modes exist; therefore the smallest value is reported.

Children’s justifications for the evaluation scores of the arguers

The next part of the questionnaire included an item to assess the reason that best explained children’s evaluation scores in the previous question. Children were asked: “If you had to choose, which thing on the list would you pick as the most important thing to explain your previous answer?” The following options were given: (1) The inventor had the best arguments, (2) The opponent had the best arguments, (3) Both inventor and opponent had good arguments, and (4) I do not know.

First, age differences in children’s chosen reasons were examined using multiple two-way tests. The percentage of participants who selected each category is reported in the tables below. Table 7.6 provides the data for 8- year old children and Table 7.7 reports the data for 11- year old children.

Results showed an association between children’s justifications for the ratings given to the *case sequence* strategy (in the pair rebuttal *versus* case sequence) and age group: χ^2 (3, N = 85) = 26.27, p < .001, Φ = .56 (Pearson’s chi-square). Specifically, the majority (67.7%) of 11- year old children said that “The opponent had the best arguments”, whereas the minority (only 13.3%) of 8- year old children chose this reason to justify their scores. There was also an association between children’s age and their justifications in evaluating the *corner sequence* strategy, χ^2 (3, N = 83) = 8.11, p < .001, Φ = .31 (Pearson’s chi-square), and the *block* strategy, χ^2 (3, N = 83) = 9.05, p < .001, Φ = .35 (Pearson’s chi-square). In the *corner sequence* strategy, 40% of 11-year old children indicated that the “Opponent had the best arguments, whereas the younger age group (8- years) did not agree with any particular reason, falling into all four categories. Moreover, for the *block* strategy, the majority of 11- year old children said that “The inventor had the best arguments”, whereas 8- year old children gave again answers that fell into all categories, for example with 34.9% of children choosing the category “I do not know”. For the other strategies in the remaining pairs, there was no association between children’s choices to justify the previous evaluation scores and their age.

Table 7.6. Percentages of children's justifications for their judgements at 8- years (year 4)

	corner vs. rebuttal		case vs. block		rebuttal vs. case		block vs. rebuttal		corner vs. block		case vs. corner	
	corner	rebuttal	case	block	rebuttal	case	block	rebuttal	corner	block	case	corner
The inventor had the best arguments	21.7	41.3	22.2	44.4	37.8	31.1	26.7	17.8	23.3	27.9	15.9	27.3
The opponent had the best arguments	41.3	21.7	24.4	15.6	28.9	13.3	17.8	20.0	20.9	14.0	36.4	15.9
Both inventor and opponent had good arguments	23.9	23.9	37.8	28.9	22.2	37.8	35.6	33.3	25.6	23.3	22.7	27.3
I do not know	13.0	13.0	15.6	11.1	11.1	17.8	20.0	28.9	30.2	34.9	25.0	29.5

Table 7.7. Percentages of children's justifications for their judgements at 11- years (year 7)

	corner vs. rebuttal		case vs. block		rebuttal vs. case		block vs. rebuttal		corner vs. block		case vs. corner	
	corner	rebuttal	case	block	rebuttal	case	block	rebuttal	corner	block	case	corner
The inventor had the best arguments	17.9	45.0	25.0	30.8	37.5	2.5	30.0	32.5	25.0	50.0	25.0	30.0
The opponent had the best arguments	38.5	15.0	30.0	25.6	17.5	62.5	20.0	12.5	40.0	15.0	25.0	27.5
Both inventor and opponent had good arguments	33.3	17.5	37.5	30.8	42.5	27.5	45.0	42.5	27.5	27.5	32.5	27.5
I do not know	10.3	22.5	7.5	12.8	2.5	7.5	5.0	12.5	7.5	7.5	17.5	15.0

Children's preference for a particular strategy at different ages

The previous assessments have looked at how children evaluate the strategic power of each sequence (or the inventor's skill in defending an argument) separately. In contrast, this assessment focused on the type of strategy children choose as the most effective or persuasive when they are given a forced-choice response option. Children were asked the following question after each debate (e.g., Environment topic): "Who do you think should be the winner for the category Environment in this competition; the inventor of the recycling robot, or the inventor of the rain converter?" The advantage of asking children to choose one option out of two alternatives is that it would indicate a definitive opinion or a clear preference from one strategy over the other. The following analyses include: (1) results of children's preference for a particular strategy in six different paired combinations, and then (2) the relationship between children's age and their preferences for a strategy.

First, a chi-square test was performed to contrast the effectiveness of several pairs of strategies. Results indicated a significant difference between strategies in the pair "rebuttal *versus* case sequence", χ^2 (3, N = 85) = 21.75, p < .001. More specifically, more children chose *rebuttal* as the most effective strategy (sixty-four out of 85 children), compared with the *case sequence* which, in turn, was preferred by twenty-one out of 85 children. There was also a significant difference between strategies in the *pair block versus corner sequence*, χ^2 (1, N = 83) = 5.31, p < .005. For this pair, more children (fifty-two out of 83) preferred *block* strategy over the *corner sequence* strategy (thirty-one out of 83).

However, no differences were found for the remaining four pairs of strategies (corner sequence vs. rebuttal, case-based sequence vs. block, block vs. rebuttal, and case-based sequence vs. corner sequence), that is, there was a fairly equal spread of ranks for the evaluation of the arguer's efficiency for these strategies. Specifically, in the *pair corner sequence versus rebuttal*, forty out of 86 children preferred *corner sequence* strategy and forty-six out of 86 children preferred *rebuttal* strategy. In the *pair case-based sequence versus block*, thirty-eight out of 85 children chose *case-based sequence* and forty-seven out of 85 children chose *block* strategy. Moreover, in the *pair block vs. rebuttal*, forty-three out of 85 children chose block as the most effective strategy, and forty-two out of 85 children preferred *rebuttal* strategy. Finally, in the *pair* *case-based sequence versus corner sequence*, forty out of 84 children chose the former strategy, and forty-four out of 84 children preferred the latter one.

Then, age differences in children's preferences for a particular strategy given two possible alternatives were analysed using a multiple two-way tests. The distribution of frequencies of children who selected a particular strategy in several different pairs by age group is displayed in Figure 7.3. There was not a significant relationship between 8-year olds and 11-year olds and whether or not they would tend to choose a particular strategy. Children in both age groups were likely to prefer the same strategies. For example, in the *pair rebuttal versus case sequence*, more 8- year old and 11- year old children chose the *rebuttal* strategy rather than a *case sequence* strategy (see Figure 7.3).

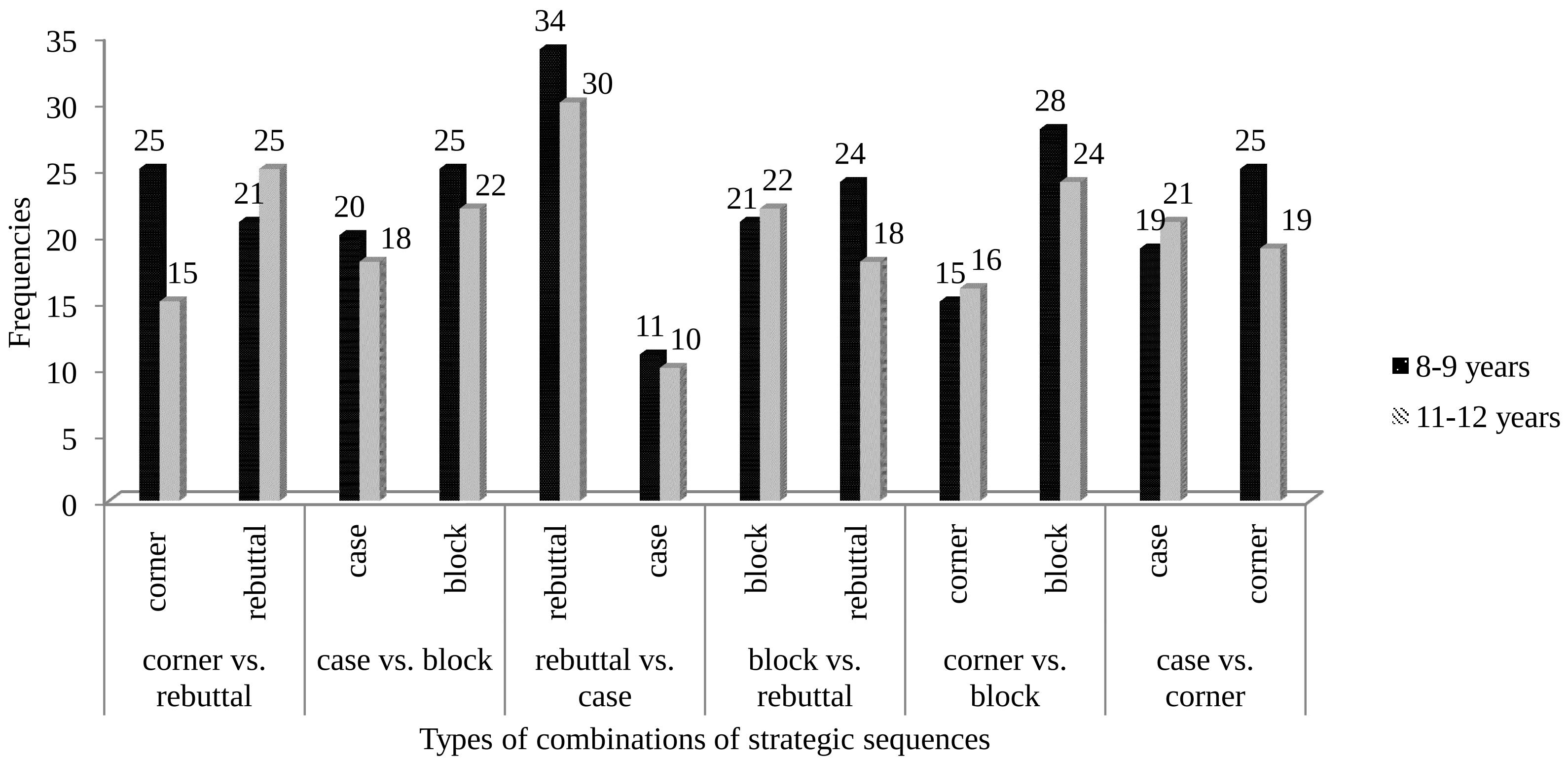


Figure 7.3. Frequencies of children's preference for a type of strategy in several paired combinations of strategic sequences by age group

Children's positions on several topics before and after exposure to arguments

The focus of this analysis was the evaluation of changes in children's initial positions after listening to arguments in favour and against several scientific inventions. The main hypothesis here was that argumentative debates would influence children's positions at different ages. A repeated measures ANOVA was performed to explore the relations among children's age group and their evaluation of eight different scientific inventions. This statistical test was chosen because there were several scores repeated in two conditions, and these scores were ordinal in nature (Howitt & Cramer, 2008). The first factor was the between-subjects factor of age group, with two levels (8- and 11-years), and the second factor was the within-subjects factor of initial and final evaluation of the strength of different inventions, operationalised on a 5-point scale. The following analysis details: (1) the main effect of differences in children's positions before and after visualisation of debates; (2) the effect of age group on children's positions; and then (3) the results of the interaction effect between age and differences on children's positions before and after they listened to the debates.

First, the within subject factor of differences in children's initial and final positions (N = 127) for each invention were explored. Results showed a statistically significant main effect of this factor for the *recycling robot*, F (1,125) = 18.03, $p < .001$, partial η^2 = .13. More specifically, children's initial ratings for the recycling robot invention were higher (M = 4.06) after children listened to the arguments in favour and against this invention (M = 3.67). There was also a statistically significant main effect of differences in children's positions before and after the video presentation for the *rain converter*, F (1,125) = 11.72, $p < .001$, partial η^2 = .09. Again, children's initial ratings for the rain converter were higher (M = 3.76) after children listened to the arguments in favour and against this invention (M = 3.37). For the *flying car* invention, there were also significant changes in children's initial and final positions, F (1,124) = 8.18, $p < .005$, partial η^2 = .06. For this invention, ratings of strength also decreased from the initial (M = 3.80) to the final evaluation (M = 3.60). There was also a statistically significant main effect of this factor for the *clever hat,* F (1,125) = 5.12, $p < .005$, partial η^2 = .04. Once more, children's ratings of strength for this evaluation decreased slightly from the initial (M = 3.65) to the final evaluation (M = 3.36). In conclusion, there were moderate changes of children's positions before and after exposure to arguments for four inventions: recycling robot, rain converter, flying car, and clever hat. Specifically, after listening to the debates related to these four inventions, children's ratings of strength became less favourable (though partial Eta-squared values revealed weak effects). There were no significant changes in children's initial and final positions for the other four inventions.

Secondly, the effect of the between-subjects factor of age on children's positions for each invention was examined. Statistically significant differences between age groups appeared with respect to only the *healthy ice-cream* invention, F (1,125) = 4.66, $p < .05$, partial $\eta^2 = .04$. Specifically, 8- year old children evaluated this invention slightly higher ($M = 3.61$), than 11- year old children ($M = 3.19$) in the initial evaluation. In conclusion, there were not significant differences in overall ratings for the remaining inventions between 8- year old and 11- year old children.

Finally, an examination of the two-way interaction between age and differences in children's initial and final positions for each invention showed no statistically significant results. Contrary to what expected, exposure to arguments did not affect children's initial evaluation of the inventions at different ages.

7.6. Discussion

The present study examined the roles of age, prior opinion, and evaluation of argument strategy in debates. Children, aged 8- and 11- years, were asked to listen to two children (a supporter and an opponent) discussing topics regarding original scientific inventions. The supporter tried to convince the research participants that their ideas were good and their supporting arguments were strong; whereas the opponent tried to challenge the supporters' ideas, by diminishing the strength of their arguments. After listening to a short sequence of dialogues comparing two argumentative strategies in a total of six possible pairs (e.g., rebuttal vs. block), participants were asked to (1) evaluate the arguers' skill in defending their ideas, (2) choose the most persuasive arguer, and (3) indicate initial and final positions regarding the topics.

This study points to the relevance of assessing how children evaluate arguments presented in a dialogic form. As highlighted in the introduction of this chapter, other researchers in developmental psychology have also examined argumentation processes in social interactions, but have focused mainly on the kinds of arguments children generate while interacting with their family or peers (e.g., Anderson et al., 1997; Chambers, 1995; Stein & Albro, 2001; Stein & Miller, 1993a, 1993b). Consistent with the literature on argument generation skill, the findings presented in this study suggest that the ability to evaluate arguments, in terms of its relevance and effectiveness, also follows a developmental trend. Results showed that older children (11-12 years) are better skilled than younger children (8-9 years) at recognising the role that different strategic sequences (corner sequence, rebuttal, block, and case-based sequence) play in discourse and the dynamics between arguers in pursuing the goals of argumentation.

As predicted, 11- year olds evaluated the supporters' performance (i.e., skill in arguing in favour of an invention) more favourably in *rebuttals* and *blocks* when these strategies were paired with *corner* and *case-based sequences* consistently across topics. Thus, older children were able to recognise that in *rebuttals* and *blocks*, the supporter is in a stronger position than the opponent, and that in *case* and *corner sequence,* the opponent gains advantage over the other arguer. According to Felton and Kuhn (2001), this is because in *rebuttals* and *blocks* a speaker is able to avoid being forced to undermine his or her initial position by immediately critiquing the counterarguments advanced by the opponent. In contrast, in corner and case-based sequences, the opponent directs the other's argument with the intent to rebut it at the end, thus gaining advantage over the first speaker. This is most noticeable when comparing case-based sequence and block strategies, which are similar in form, as shown in the example provided below (in this example, the same invention is used to best illustrate the differences between case-based sequence and block. However, in videos, children saw a sequence of dialogues comparing two different inventions):

Scenario 1: **Case-based sequence**

Supporter:	[argument] I am in favour of a *spray for cleaning food*, because it could prevent diseases caused by chemicals.
Opponent:	[case-?] What if chemicals get inside fruits and vegetables?
Supporter:	[clarify] Well, I think the chemicals stay on the surface of fruits and vegetables.
Opponent:	[counter-C] But if they do enter fruit, the spray doesn't solve this problem.

Scenario 2: **Block**

Supporter:	[argument] I am in favour of a *spray for cleaning food*, because it could prevent diseases caused by chemicals.
Opponent:	[case-?] What if chemicals get inside fruits and vegetables?
Supporter:	[counter-C] Maybe you cannot remove all chemicals, but the spray would definitely remove a substantial amount of surface chemicals, and prevent diseases.

In both scenarios, an opponent introduces a hypothetical situation ("What if chemicals get inside fruits and vegetables?") and asks the partner to indicate whether his or her invention (spray for cleaning food) will work in that case. The opponent's intent is to challenge the inventor's position in an extreme case in which the position is most difficult to defend. While in scenario 1, the opponent is able to point out that the inventor or supporter is inconsistent and that he or she will not be able to defend his or her position in all circumstances; in scenario 2, the inventor or supporter immediately counterargues the premise of the leading question posed by the opponent ("Maybe you cannot remove all chemicals, but the spray would definitely remove a substantial amount of surface chemicals, and prevent diseases"). Thus, in scenario 1 (case-based sequence) the inventor or supporter goes along with the opponent's hypothetical situation, whereas in scenario 2 (block), the inventor or supporter anticipates the damaging intent of the assertion, therefore gaining advantage over the opponent.

In contrast, the youngest group (8- years) perceived fewer differences of arguers' goals in these two strategic sequences compared with older children (11- years). In fact, 8- year olds gave higher ratings for the arguer's performance in the *case sequence* strategy (when it was paired with a *block*). This result suggests that younger children were less preoccupied with analysing the arguers' different perspectives. Instead, it is possible that their main focus has been on the inventor's personal characteristics or the invention itself, rather than the arguments advanced in the dialogues, as suggested by Petty and Cacioppo (1986). If so, then 8-year olds were likely to be more influenced by peripheral characteristics such as: the arguer they liked the most, or the arguer who favoured the position that they had already agreed with, or even the invention they preferred the most.

Furthermore, when children were asked to choose a reason that best justified these evaluation scores, 11- year old children were more likely to associate the reason "The inventor had the best arguments" with rebuttals and blocks, and "The opponent had the best arguments" with corner and case-based sequences. On the other hand, 8-year old children tended not to agree with any particular reason and gave answers that fell into all categories. They were also more likely to choose the category "I do not know" than older children.

In the next segment of the questionnaire, children were asked to choose the best inventor (or the most effective argumentative strategy underlying that invention). Here, results were strikingly different. No age differences were found in children's preference for a particular strategy given two possible alternatives (i.e., both 8- year olds and 11-year olds were likely to prefer the same strategies across the four topics). For example, as predicted earlier, in the *pair rebuttal versus case-based sequence*, more children chose *rebuttal* as the most effective strategy (sixty-four out of 85 children), compared with the *case sequence* which, in turn, was preferred by twenty-one out of 85 children. The following example illustrates this pair of strategies for the theme "Improving technology":

Scenario 3: **Rebuttal**

Supporter:	[argument] I am in favour of a *flying car*, because it would be quick to go to a distant place.
Opponent:	[counter-C] But we already have aeroplanes, and they are quick too.
Supporter:	[counter-C] But we cannot use aeroplanes on a daily basis.

Scenario 4: **Case-based sequence**

Supporter:	[argument] I am in favour of a *translation telephone*, because it would improve communication between people of different cultures who speak different languages.
Opponent:	[case-?] Let's say you work with people from different countries. Would you use the translator to call them every day?
Supporter:	[clarify] Yes, in that case you can use the translator.
Opponent:	[counter-C] But long calls could be very expensive.

As illustrated above, in scenario 3 (rebuttal), the inventor or supporter of the *flying car* is able to reduce the force of the opponent's counterargument ("But we already have aeroplanes and they are quick too"). This is done by critiquing the previous counterargument ("But we cannot use aeroplanes on a daily basis"), thereby restoring force to the original argument. In scenario 4 (case-based sequence), as explained earlier, the opponent leads the inventor or supporter in a line of reasoning. The opponent presents a case-based question about the practical issues of using a *translation telephone*: "Let's say you work with people from different countries. Would you use the translator to call them every day?", then elicits a response and points out that the inventor or supporter is inconsistent: "But long calls could be very expensive".

Based on the results of this particular example, one could argue that children said that the inventor in scenario 3 (rebuttal) was more persuasive than the inventor in scenario 4 (case-based sequence), because they had a preference for the *flying car* over the *translation telephone*. However, it is important to remember that this issue was controlled by counterbalancing all items. For instance, one group of children were shown a video presenting a comparison between a rebuttal (with arguments about the flying car) and a case-based sequence (with arguments about the translation telephone). The other group was shown an identical video presenting the same pair of strategies, but with the content reversed (a rebuttal with the arguments related to the translation telephone *versus* a case-based sequence with arguments about the flying car).

Results also showed that in the *pair block versus corner sequence*, more children (fifty-two out of 83) preferred *block* strategy over the *corner sequence* strategy (thirty-one out of 83). An example of this pair of strategies (related to the theme "protecting the environment") is provided below:

Scenario 5: **Block**

Supporter:	[argument] I am in favour of a *recycling robot*, because it would keep cities clean.
Opponent:	[case-?] Let's say we are in a big city that gets very dirty every day. Would we have to buy lots of robots to keep the city clean?
Supporter:	[counter-C] Maybe not. Robots last long and they can work several times a day. A few robots would be enough to keep large cities clean.

Scenario 6: **Corner sequence**

Supporter:	[argument] I am in favour of a *rain converter*, because it is the cheapest source of water.
Opponent:	[clarify-?] So, you think people would not have to buy fresh water anymore?
Supporter:	[clarify] Exactly, this would be the cheapest alternative source of water because rain is free.
Opponent:	[counter-C] But people would still have to buy water, because there might not be enough rain.

In scenario 5 (block), the inventor or supporter avoids being forced to undermine his or her position by immediately counterarguing the premise of the case-question posed by the opponent: "Maybe not. Robots last long and they can work several times a day. A few robots would be enough to keep large cities clean". In scenario 6 (corner sequence), the opponent asks the inventor or supporter to clarify his or her position: "So, you think people would not have to buy fresh water anymore?" The opponent's goal is to elicit a commitment from the inventor or supporter that the opponent is ready to critique. Thus, the opponent corners the supporter in a weak position.

However, no differences were found for the remaining four pairs of strategies (corner sequence vs. rebuttal, case-based sequence vs. block, block vs. rebuttal, and case-based sequence vs. corner sequence). In other words, there was a fairly equal spread of ranks for the evaluation of the arguer's effectiveness for these strategies. Does this result mean that children were not aware of the arguers' goals and strategies and, thus, were choosing the best arguers randomly? A closer inspection of the analysis of each pair suggests that this may not be the case, and two alternative explanations are advanced.

The first alternative explanation is that children had difficulty choosing one of the two when they were paired, because some strategies are equal in terms of strategic power. In terms of the inventor's performance, *block* and *rebuttal* are both strategically powerful. In both strategies, the arguer favouring the invention is able to respond to the challenges of the opponent, thereby restoring the force of the original argument. In contrast, for both *case-based sequence* and *corner sequence*, the inventor is in an untenable or weak position, because the opponent directed his or her arguments. Thus, even though children might have been aware of the arguers' goals in these strategies, for these particular pairs, there would make no difference choosing one strategy over another.

On the other hand, the arguers' performance in the other two pairs (corner sequence vs. rebuttal and case-based sequence vs. block) is clearly distinct, and yet, children did not show a preference for any particular strategy. Hence, the second alternative account is that children might have been persuaded by some arguments more than others. If so, rather than focusing on the overall strategy and following the line of reasoning, it is possible that children evaluated the arguers' skill based on a single argument, delivered either by the supporter or the opponent. For instance, in a rebuttal (see below an example), both supporter and opponent contribute with valid counterarguments. Although the supporter manages to rebut the opponent's critique, this does not guarantee that children consider the supporter's reply to be persuasive. It is possible that children have agreed more with the opponent's counterargument ("But people don't know what they are going to lose in advance") rather than the response the supporter gave in his or her defence ("But if you're always losing the same item, you can use the locator to prevent losing it again").

Scenario 7: **Rebuttal**

Supporter:	[argument] I am in favour of a locator for lost things, because it can find misplaced or lost things quickly.
Opponent:	[counter-C] But people don't know what they are going to lose in advance.
Supporter:	[counter-C] But if you're always losing the same item, you can use the locator to prevent losing it again.

Indeed, when children were asked to choose a reason that best explained their evaluation scores of the arguers' performance in the *pair rebuttal versus block*, the reason "Both inventor and opponent had strong arguments" received the highest percentage for both rebuttal and block strategies. Specifically, 45% of 11- year old children agreed that both arguers had strong arguments in the block strategy, and 43% of older children also regarded both arguers to have strong arguments in the rebuttal strategy. Moreover, 36% of 8-year olds also choose this reason for explaining their evaluation scores in the block strategy, and 34% did the same for the rebuttal strategy.

Overall, these results suggest that children do have a basic understanding of the goals in argumentation, but they also indicate that the dynamics between arguers in a dialogue are not linear or simple to uncover.

The final hypothesis in this study predicted that children would be influenced to revaluate their positions after exposure to arguments. Results showed that exposure to arguments, through the presentation of a series of debates, influenced children's ratings of the strength of some inventions. There were changes in children's initial and final positions for four (out of eight) inventions: *recycling robot*, *rain converter*, *flying car*, and *clever hat*. Specifically, after listening to the pros and cons for each invention in video-recorded dialogues, children's ratings of the strength of inventions decreased significantly. This result suggests that other forms of cognitive engagement, and in particular in a non-interactive condition, may also lead children to reconsider their original positions, as also shown by Staudinger and Baltes (1996).

7.6.1. Limitations

There are some limitations concerning the measures employed in the present study. For instance, the only measure used to evaluate children's points of view was based on children's reported opinion in initial and final assessments. While the results suggest that exposure to mixed evidence led children's to reconsider their original positions, it is unclear *how* exactly exposure to arguments affected their views and also the thinking underlying those views.

In order to find out whether exposure to arguments in a non-interactive experimental condition improved children's knowledge and arguments underlying their views on the topics, it would have been interesting to assess the outcome variable "quality of thinking" by asking participants to justify their positions before and after video presentation. For example, Lao and Kuhn (2002) examined the efficacy of different forms of cognitive engagement on the student's thinking underlying attitudes toward capital punishment. Participants in three interactive conditions engaged in dyadic discussions of the topic with a series of peers over six sessions. The conditions differed as to whether the dyads were composed of peers who (a) shared the participant's pro or con opinion, (b) opposed the participant's opinion, and (c) were equally divided between both types. In a non-interactive condition, students listened to audiotapes of other students' dialogues. In an assessment six weeks later, Lao and Kuhn (2002) found that participants in the interactive condition, but not the non-interactive condition, showed improvement of quality of thinking about the topic (e.g., generation of more reasons and two-sided arguments). Moreover, only those participants who engaged in the agreement and mixed condition (but not the disagreement condition) showed these improvements. Nevertheless, Lao and Kuhn's study (2002), along with other studies in attitude research, differ from the present study in several aspects. These include, as shown in Table 7.8, the nature of the topics discussed, the focus of the study, the age of participants, and the experimental conditions.

Table 7.8. Comparison between the present study and similar work by Lao and Kuhn (2002)

	The present study	*Similar research (Lao & Kuhn, 2002)*
Topic	• Opinions about common social issues	• Attitudes on capital punishment
Focus	• Opinion change	• Attitude development
Age of participants	• 8 to 12 year old children	• College students (around 20 years of age)
Experimental conditions	• Non-interactive condition only	• Comparison between interactive and non-interactive conditions

Although it would have been of interest to assess how children's views changed after exposure to argumentative dialogues, adding the variable "quality of thinking" would have led to further difficulties with data collection. As highlighted in the methodology chapter (Chapter Three), conducting studies with children in school settings poses numerous challenges. For example, there are the logistics of lessons and breaks to cope with, and therefore, limited time to interview children on an individual basis or to schedule follow-up assessments. In addition, a longer assessment (including video presentation and individual or group discussion of the content) would have made teachers and parents reluctant to let their children participate in the study.

Findings of the present study suggested age-related differences in children's ability to recognise and evaluate goals and strategies used by arguers in recorded dialogues. Compared with 11-year olds, younger children (8 years) showed less awareness and understanding of the dynamics involved in argumentation. However, interpretations of these findings include a number of cognitive factors. For instance, children's lack of knowledge regarding the topics and arguments discussed, their potential difficulty with language used in the videos and wording of the questions in the survey, their limited ability to distinguish sources of knowledge (i.e., children featuring in the videos) may have led to confusion in recall ("who said what?"). There are also some social factors to account for, such as the difficulty in understanding the researcher's questions, including the purpose of repeated questions. Although not completely overcome, some of these issues were addressed in the pilot stage and during the design of experimental conditions. These procedures are discussed in the next section.

7.6.2. Implications

A strength of this study is the good correspondence of the methodology to real interactive situations. Firstly, the stimuli used in this study (videos of children debating a topic) attempted to simulate, as accurately as possible, real dialogues between children. Secondly, the topic of discussion (original inventions for a science competition) was closely linked to activities that children normally take part in school, and concerned an evaluation task which participants found stimulating, realistic and motivating. Thirdly, the discussions included arguments that were carefully selected in the pilot stage. Moreover, video-recorded dialogues included the discussion of four different topics (related to Environment, Technology, Lifestyle and Health) and a total of eight subtopics (which included scientific inventions regarding the four main topics). The order of presentation of strategies and inventions within dialogues were randomised across groups of participants. In addition, children featuring in the videos were of a similar age of the research participants and included boys and girls. The role they played in a dyad (as either a supporter or an opponent) was also counterbalanced across topics.

The focus of the present research was on children’s perceived effectiveness or persuasiveness of four types of argumentative strategies (rebuttal, case-based sequence, corner sequence, and block) deployed in dialogues. Study Two (Chapter Five) showed that 5 to 11 year old children generate these strategies (which are typically found in adults’ discourse) infrequently and developmental differences were found only with respect to the use of rebuttal. Other studies (e.g., Leitão, 2000, 2003) have also found that successful argumentative interactions adhere to a specific pattern involving a claim, a responsive counter-claim, and an integrative reply that incorporates reply that incorporates the previous ideas.

However, the results discussed in this study suggest that children exhibit a basic understanding of more complex strategies, such as cornering a speaker in a weaker position, or proposing a hypothetical scenario or situation in which the speaker’s argument might not be applied. In the future, it will be necessary to confirm this conclusion by using samples which are more numerous, and by employing more direct measures. This conclusion, subject to further verification, could be of some interest also for its practical implications in learning and education. For instance, students would benefit from intervention programs that allow them to learn and incorporate these elements in argumentative discussions with their peers. This is further discussed in the final chapter of this thesis (Chapter Eight).

In conclusion, the study of children’s evaluation of arguments and discourse strategies provides another domain in which to study the development of argument skills. The present study points to the need for further research that will bridge studies of dialogic argumentation, cognitive engagement, persuasion and attitude change from a developmental perspective to provide a more comprehensive understanding of how argumentative skills develop with age.

Chapter Eight - Conclusion

8.1. Summary

This thesis described five interlinked studies that systematically investigated children's argumentative skills at different ages. The first study charted age differences in children's (5-, 8-, and 11-years) ability to generate arguments in response to socio-moral questions. Semi-structured interviews were used to explore the specific elements that children generate at different ages. Further, this study examined whether engagement in peer group discussions on similar topics led to subsequent improvement in children's individual use of sophisticated argument elements (e.g., two-sided arguments) compared to a control group who did not engage in group discussion.

The second study identified the argumentative strategies that children, in the three age groups, deployed in group discussions. Evaluation of argumentative discourse skills in these series of discussions was based on the assessment scheme developed by Felton and Kuhn (2001) that assessed similar skills in adolescents and adults. The present research is the first of its kind to use this assessment to investigate argumentative discourse skills at such young age.

Findings revealed that older children (8-9, and 11-12 years) produced arguments that contained more justifications and arguments that addressed alternative perspectives than younger children (5-6 years) in face-to-face interviews (Study One). Moreover, the oldest age group (11- year olds) intervened more in group discussions, not only in constructing their own arguments, but also in challenging and critiquing opposing arguments generated by the other speakers (Study Two). Increasing construction of stronger types of arguments suggested that older children were more aware of the others' perspectives and arguments. Thus, the next three studies focused on children's evaluative (or meta-level) skills in argumentation. Although generation and evaluation skills in argumentation are closely connected, some researchers have investigated these two components of argumentation in separate studies (e.g., Goldstein, Crowell, & Kuhn, 2009; Leitão, 2003).

Two studies examined children's ability to appreciate and evaluate arguments using computer-based tasks. In particular, Study Three examined how 8- year olds and 11- year olds differ in terms of their understanding and evaluation of argument strength, and how children's prior opinions on a topic influence their judgements of strong or weak arguments. Study Four examined how 8- year olds and 11- year olds evaluate the effectiveness or persuasiveness of different types of argument when the task goal is to influence arguers' points of view. The fifth and last study complemented this previous line of research by focusing on children's argument evaluative skills in real social interactions. More specifically, Study Five focused on children's ability to understand and evaluate goal-directed arguments and strategies employed in video-recorded argumentative dialogues.

Having presented evidence from this series of studies and having discussed each study alongside the relevant literature within each chapter, this final chapter provides a summary and a discussion of the main findings, outlines the strengths and limitations of this research, addresses the main theoretical implications of this research, and outlines areas for future research.

8.2. Discussion of the main research findings

8.2.1. The argument generation studies

In Study One (Chapter Four), children, aged 5-, 8-, and 11- years, engaged in interviewer dialogue and in peer group discussions. The first objective of this study was to identify age differences in the types of argument children generate when asked to talk about socio-moral issues. The literature review revealed that most research on children's argumentation has focused on spontaneous generation of arguments, either in family interactions (e.g., Stein & Albro, 2001; Stein & Miller, 1993a, 1993b) or peer interactions (e.g., Anderson et al., 1997). However, the study of spontaneous argumentative discourse is constrained by quality and type of evidence offered by the arguers. Indeed, sophisticated reasoning may be used only if necessary or demanded in response of a question or a counterargument (Stein & Miller, 1993a). Rather than relying on the results obtained on the basis of children's spontaneous interactions, this study examined children's ability to construct arguments under more structured circumstances. The use of a structured interview (adapted from Kuhn, 1991) allowed a better examination of the responses across participants at different ages. The topics were of a socio-moral nature (lying to others, and sharing things with others). In peer groups, children were asked to discuss three different socio-moral topics in response to a stimulus story (drawn from children's story books, Fisher, 1996, 1999). Using folktales and fables to challenge children to think about honesty, friendship, right and wrong, and other questions of ethics is a common activity in classrooms. Moreover, it allowed a better examination of assessing children's reasoning regarding simple, everyday topics, rather than complex academic tasks.

The second objective of this study was to examine the contribution of peer group discussions to improvement of individual arguments. As highlighted in the literature review (Chapter Two), the role that peer interaction plays on children's ability to articulate their positions and reasons (i.e., to argue effectively) remains unclear. Thus, this association needed to be determined.

As predicted, results revealed that older children (11- years) performed best at constructing and responding to arguments, and the 8- year old children performed better than the youngest children (5- years). A particularly relevant result was that *all* participants (even the youngest children) were able to construct a full argument (a statement supported by at least one reason), confirming earlier findings that suggest that the ability to understand and produce basic arguments emerges relatively early in development (e.g., Anderson et al, 1997; Orsolini, 1993; Orsolini & Pontecorvo, 1992; Stein & Albro, 2001; Stein & Miller, 1993a, 1993b).

Analysis of age differences, across the three age groups, also revealed significant changes in argument quality, demonstrated by the evolution from one-sided to two-sided arguments with age at the baseline condition, in response to the question "Should people share their things with others or keep what they like for themselves?", the youngest children produce simple arguments addressing their own perspective (e.g., "I think people should share their things with their friends, because it's the a kind thing to do", boy, 5- years old). As children get older, their responses become more elaborate and they often produce arguments addressing alternative perspectives, even when they are not prompted to do so (e.g., "I think that is best to share your things with others, for example sharing books with your friends, or sharing your food with poor people. It is good to share, because you are helping your friends or people in need, and when you are kind to someone, they will return the favour to you. But some things are not meant to be shared", girl, 11 years old). In this example, the child provides reasons in favour of her position and also addresses an alternative position, but does not give justification for the latter. However, when asked to provide opposing reasons, most 8- year olds and 11- year olds are able to do it. In the last example, the child completes her line of reasoning by saying "I think it is o.k. not to share things that are special or precious to you, because other people may lose or steal them from you. I also think that some things are not meant to say because they can hurt other people's feelings". Even 5- year olds were able to produce some counterarguments, although the average number was significantly lower compared with the average number of counterarguments produced by older children. Although there were no age differences in the ability to generate counterarguments by children aged 8-9 and 11-12 years, the oldest children produced a higher number and stronger opposing reasons (e.g., consequential or rule-based types) than 8- year olds. At the end of this section, a summary of the main results of this study is provided in Table 8.1.

Further, the first study (Chapter Four) examined the contribution of peer group discussions over a period of three days on the improvement of individual arguments generated by children. Results showed an important interaction between condition (group discussion vs. individual reflection) and age group in argument generation at pre- and posttest. Most notably, 8- year olds who engaged in peer discussions used more two-sided arguments at posttest, while their peers in the control group did not. However, for the youngest and oldest age groups, the use of two-sided arguments increased in both discussion and reflection (experimental and control) groups. This result suggests that peer group discussions are particularly beneficial for children at 8 years. At this age, children may not fully grasp the importance of considering that an argument may have two sides. However, discussion and conversation prompts children to consider this possibility. Moreover, group discussion appears to be an effective way to foster rebuttal skill, mainly at 8 years (see Table 8.1).

This suggestion is leant further support by the analysis conducted in Study Two (Chapter Five) of the arguments and strategies used by children in group discussions. The pattern of use of several different argument elements (clarifications, advance statements, counterarguments) and the rebuttal strategy are all consistent with idea that at 11 years children have acquired many important argument skills. For example, 11-year-olds deploy complex argument strategies when exploring and evaluating the reasons for one's own and other's positions or perspectives in a discussion. The analysis of group discussions points to a key shift between 8 and 11 years in terms of the mastery of many important argument skills. Again, at 8 years, children may only be beginning to appreciate and benefit from discussions as opportunities to exchange information about different perspectives (Leman & Duveen, 1996) (see again Table 8.1).

This previous set of studies showed developmental differences in children’s ability to generate arguments taking into account others’ perspectives. The next two studies (Chapter Six) were designed to further explore whether children would show a corresponding developmental change in the appreciation and evaluation of arguments and counterarguments.

Table 8.1. Summary of the main results in terms of children's generation of arguments at different ages

Age differences in children's ability to generate of arguments (*N*=190)		
5- year olds	**8- year olds**	**11- year olds**
• The youngest children produced only the simplest form of arguments (one-sided arguments) in the baseline assessment of argument skill (topic about sharing with others)	• Most 8- year olds produced one-sided arguments in the baseline condition. Only 14% constructed two-sided arguments.	• The oldest children were the most skilled at producing two-sided arguments. 58% of 11-year olds addressed alternative perspectives and opposing reasons on the baseline topic
• Half of the participants produced counterarguments (53%) and rebuttals (44%) in the baseline condition	• Most 8- year olds were skilled at generating counterarguments (84%) and rebutting the previous line of reasoning (73%) in the baseline condition	• They were the best skilled at generating counterarguments (93%) and rebuttals (86%) in the baseline condition
• Gave fewer reasons and opposing reasons to justify their positions than the older children in the baseline condition	• Gave more reasons to support their ideas than 5- year olds, but were less skilled at giving opposing reasons (to strength the other's position) than 11- year olds in the baseline condition	• Produced the highest number of reasons and the most complex type of reasons (abstract). They were also better skilled at giving strong opposing reasons (e.g., consequential, rule-based type) than younger children
• 5- year old children who engaged in both conditions (discussion and reflection) showed an increased use of two-sided arguments	• 8- year olds benefited from group discussions. Children who engaged in peer group discussions (experimental group) produced more two-sided arguments and rebuttals at posttest than the control group	• 11- year old children who engaged in both conditions (discussion and reflection) showed an increased use of two-sided arguments. However, for this age group, the posttest increases were from a high baseline

Age differences in children's ability to generate of arguments (*N*=190)

5- year olds	**8- year olds**	**11- year olds**
• In group discussions (Study Two), 5-year olds were able to communicate effectively their ideas, but were more preoccupied in expressing their own opinions, rather than addressing the other speakers' perspectives and arguments.	• In group discussions (Study Two), 8-year olds spent more time adding to their co-discussants' statements rather than elaborating, responding or criticising the other speakers' arguments.	• In group discussions (Study Two), 11-year olds showed the most advanced argumentative discourse skills, using often argument elements (clarifications, advance statements, counterarguments) and strategies (rebuttals)

8.2.2. The argument evaluation studies

Studies Three and Four (Chapter Six) assessed age differences in argument evaluative skills between 8- year olds and 11- year olds using computer-based tasks. The reason for choosing these two age groups was the interest in studying children for whom the handling of opposing positions and counterarguments seems to be critical, as shown in the first studies (Chapters Four and Five) and also in previous research on argumentative writing (e.g., Golder & Coirier, 1994, 1996; Leitão, 2003).

In particular, Study Three examined how 8- year-old and 11- year old children rated the strength of different arguments on a 5-point scale. Arguments were presented randomly in a computer screen and they varied in content (different reasons) and structure (number of reasons; inclusion of alternative views). Arguments either supported or opposed of four different statements: (1) Children should wear school uniforms; (2) Children should have a TV in their bedrooms; (3) School days should be two hours shorter than they are now; and (4) Children should get pocket money.

Results revealed both similarities and differences in terms of children's ratings of strength of arguments in the two age groups. First, regarding similarities between age groups, both 8- year olds and 11- year olds evaluated arguments based on their agreement with the statements. That is, when children had a favourable position on an issue, they evaluated arguments in favour of that statement as stronger. This finding is consistent with previous literature (e.g., Nussbaum & Kardash, 2005).

Moreover, children in both age groups did not regard arguments with greater number of reasons to be stronger, contrary to what was expected. In three out of four topics, both 8- year olds and 11- year olds rated multiple and single arguments as equally strong. However, this result is in accordance with a previous study conducted by Leitão (2003) that showed that children of a similar age selected arguments to be included in a text according to two criteria: (a) their agreement with the reasons included in the argument being evaluated, and (b) the restriction or modulation of an argument, that is, their acceptance of part of the argument content. In this respect, children in the present study may have agreed with one of the reasons stated in the argument, but not the other reason. Indeed, the content analysis revealed that children favoured some reasons more than others for the topic related to whether children should receive pocket money and the topic about children wearing school uniforms.

However, age differences were found concerning how children evaluate arguments and counterarguments. As predicted, 11- year old children gave higher scores to counterarguments than 8- year old children across most topics (TV in bedrooms, school days, and pocket money). This result suggests that younger children showed less appreciation for alternative arguments, an age-related pattern that parallels one found in the discourse of 8- year olds examined in Study Two (Chapter Five). At the end of this section, Table 8.2 summarises these findings.

Study Four (also described in Chapter Six) investigated how children evaluated arguments and counterarguments when the task goal was to persuade a hypothetical arguer to adopt a different position. This study used a similar computer-based task and the same topics deployed in the previous study, but focused on the pragmatic function of arguments (i.e., arguments' effectiveness).

As expected, results revealed that 8- year olds selected either single or multiple arguments over counterarguments to change the characters' views. This was consistent across all three topics. The most striking finding was that older children (11-12 years) also did not regard counterarguments to be more persuasive compared to other types of argument. Although 11- year olds may regard counterarguments as a strong type of argument when standing alone (as found in Study Three), they seem to adopt different evaluation criteria when the task involves a discourse or communicative goal. That is, both 8- year olds and 11- year olds do not regard arguments containing opposing elements as a valuable resource for making a position more acceptable and persuading arguers to change their views.

This finding can be interpreted in light of previous research on argumentative writing (Coirier, 1996; Ferretti, Lewis, Andrews-Weckerly, 2009; Ferretti, MacArthur, Dowdy, 2000; Leitão 2000, 2003; Nussbaum & Kardash, 2005), that has documented that students do not include alternative views and counterarguments when writing argumentative essays to persuade an audience to accept a point of view. The fourth study also revealed that 11- year old children, but not younger children, regard arguments with greater number of reasons as the most persuasive type of argument, consistently across topics (see Table 8.2).

Finally, the fifth study complemented the previous line of research by focusing on children's argument evaluation skills in real social interactions. More specifically, this final study (Chapter Seven) focused on children's ability to appreciate and evaluate goal-directed arguments and strategies employed in video-recorded argumentative dialogues. These videos were recorded by 9-10 year olds and they attempted to simulate real dialogues between children.

Participants, aged 8 and 11 years, were asked to listen to two children (a supporter and an opponent) discussing topics regarding original scientific inventions. The supporter tried to convince the research participants that their ideas were good and their supporting arguments were strong, whereas the opponent tried to challenge the supporters' ideas, by diminishing the strength of their arguments. After listening to a short sequence of dialogues comparing two argumentative strategies in a total of six possible pairs (e.g., rebuttal vs. block), participants were asked to (1) evaluate the arguers' skill in defending their ideas, (2) choose the most persuasive arguer, and (3) indicate initial and final positions regarding the topics.

The strategic sequences presented in the video-recorded dialogues were drawn from Felton and Kuhn's coding scheme of argumentative strategies (2001), but were adapted to the new topic to fit children's level of knowledge and understanding. The same coding scheme was applied in Study Two (Chapter Five), to explore whether children at different ages were able to generate these strategies in discussion with their peers. As described earlier, results showed that children's discourse at all ages was more *expository* than strategic. In fact, strategic discourse was observed infrequently in peer discussions. Age differences were only found in the use of rebuttals, which was used more frequently by older children (11- year olds).

The question posed in Study Five was whether these results (detailed in Study Two, Chapter Five) reflect children's difficulty in constructing effective argumentative strategies, or children's lack of understanding of the goals of argumentative discourse. If children do not understand the arguer's goals and intentions that argumentation implies, then they may find unnecessary to behave strategically. Furthermore, this last study complemented the previous set of studies on argument evaluation skills by further exploring how children evaluate others arguers' ability to produce persuasive arguments.

Consistent with the literature on argument generation skill, the findings presented in this study suggest that the ability to evaluate arguments, in terms of its relevance and effectiveness, also follows a developmental trend. Results revealed that older children (11-12 years) were better skilled than younger children (8-9 years) at recognising the role that different strategic sequences (corner sequence, rebuttal, block, and case-based sequence) play in discourse and the dynamics between arguers in pursuing the goals of argumentation. In particular, older children's ratings of the arguers' performance and the justifications for their decisions indicate that they recognised that, in some strategies (*rebuttals* and *blocks*), the supporter was in a stronger position than the opponent, or that in others (*case* and *corner sequence*), the opponent gained advantage over the other arguer.

In contrast, the youngest group (8 years) perceived fewer differences of arguers' goals. In fact, 8- year olds gave higher ratings for the arguer's performance in the *case sequence* strategy (when it was paired with a *block*). This result suggests that younger children were less preoccupied with analysing the arguers' different perspectives. Indeed, when asked to justify their decisions, 8- year olds tended not to agree with any particular reason and gave answers that fell into all categories. They were also more likely to choose the category "I do not know" than older children.

Results suggest that younger children were more focused on the inventor's personal characteristics or the invention itself, than on the arguments advanced in the dialogues. Thus, 8- year olds were likely to be more influenced by peripheral characteristics (Petty & Cacioppo, 1986) such as, the arguer they liked the most, the arguer who favoured the position that they had already agreed with, or the invention they preferred the most.

The most striking finding was that children's preference for a particular strategy when two possible alternatives were given did not vary with age. That is, when asked to choose the best arguer (or the most effective argumentative strategy underlying the discussion topic), both 8- year olds and 11-year olds preferred the same strategies across the four topics. As predicted, children preferred strategies in which the supporter had a stronger performance (e.g., rebuttals over case-based sequences, and blocks over corner-sequences). However, there were no differences for the remaining four pairs of strategies (corner sequence vs. rebuttal, case-based sequence vs. block, block vs. rebuttal, and case-based sequence vs. corner sequence), that is, there was a similar spread of ranks for the evaluation of the arguer's effectiveness for these strategies.

Taken together, these results suggest that children (even 8- year olds) have a basic understanding of the goals in argumentation. However, results also indicate that children's evaluation of arguments, presented in a dialogic form, do not rely solely on the *structural features* of strategic sequences (i.e., how arguers take turns in a sequential presentation of arguments). Other factors may influence their evaluations, such as the *content* of these argumentative strategies, and also their prior opinions on the object of evaluation (as also shown in Study Three).

The final analysis of Study Five showed that children's initial evaluations on a particular topic changed after listening to the arguments presented in the video-recorded dialogues. Specifically, after listening to the pros and cons for each invention in the dialogues, children's ratings of the strength of some inventions decreased significantly. This result suggests that other forms of cognitive engagement (in this case, the evaluation of mixed evidence in a non-interactive condition) may also lead children to reconsider their original positions (Staudinger & Baltes, 1996).

8.2.3. Assessing skills in generating and evaluating arguments

The purpose of the five studies reported in this thesis has been to develop a means to assess children's skill in argument generation and what is expected to be a parallel skill – the evaluation or appreciation of stronger arguments and superior moves in dyadic argumentation.

The first set of studies explored systematic age differences in children's ability to produce arguments. The first key finding was that 5-year-olds produce only simple forms of argument (e.g., a claim supported by only one reason). Ability to produce more sophisticated elements of arguments (e.g., addressing the opponents' ideas, generating opposing reasons) increased in 8-year-olds and the most in 11-year-olds, both individually and in group discussions. In analyses of children's argumentative discourse with their peers, results showed that younger children engaged in exposition regarding their own argument more frequently than they sought clarification of the opponent's argument. More rarely, did they offer critiques to the opponent's argument. The second key finding was that engaging in an argumentation activity was particularly beneficial at 8 years, prompting children to consider two-sided arguments and to generate more counterarguments in a subsequent test of individual argument skills.

There is much evidence in the cognitive development literature of children and adolescents having difficulty adressing others' arguments and producing counterevidence to rebut the opponents' ideas (Leitão, 2003; Kuhn & Franklin, 2006; Stein & Albro, 2001). A contributor to this challenge may lie in the cognitive demands involved in the deep-level processing of the opponent's argument. Children of primary school age may have considerable difficulty in coordinating different perspectives and multiple arguments. In addition, exposition of one's own argument and negotiation of the mechanisms of discourse may all represent cognitive overload for the younger arguers.

A third aspect of skilled argument, in addition to skill in argumentative discourse and in production of individual expository arguments, is skill in argument evaluation. The next three studies described in this thesis investigated this third component. A prediction made here was that evaluation skills would not simply parallel generation skills but would in fact precede them, a pattern that has been noted in other domains, such as language development and moral reasoning development: an individual first appreciates (and hence at least implicitly evaluates) a higher form prior to being able to produce it.

In the evaluation argument tasks, children were presented with written arguments and were asked to evaluate their strength (Study Three) or to choose the most persuasive argument given two alternative statements (Study Four). This set of studies used a framework focusing on formal argumentation structure (see Chapter Six). The main objective of these tasks was to explore whether children were able to identify the argument components (e.g., counterargument) that they tend to omit during argument construction. The final argument evaluation study assessed children’s ability to recognise or appreciate superior argumentative strategies in video-recorded dialogues.

This task was designed to mimic genuine argumentation.

In the studies involving non-dialogic argument evaluation (Studies Three and Four), children aged eight to 11 years found it difficult to recognise superior forms of argument (e.g., arguments addressing alternative positions). In contrast, children’s evaluation of arguments depended largely on their views of agreement or disagreement with the initial claim and each of the proposed statements. In the case of dialogic argument evaluation (Study Five), similar results were found, with older children (11 years) showing only modest superiority in appreciating stronger arguments and argumentative strategies over younger children (8 years).

In this latter task, children were asked not simply to evaluate two choices on their own merit as arguments, but rather to evaluate them in relation to the preceding argument. Although a seemingly straightforward task on the surface, the cognitive demands it poses are in fact considerable. Children likely hold views of agreement or disagreement with the content of the proposed arguments. Each of these positions must be temporarily set aside to allow execution of the task: the evaluation of each of statement with regard to its *relation* to the initial argument. As in the simpler non-dialogic evaluation tasks, a metacognitive stance is required (to enable reasoning about reasoning), but in the latter task in an even more complex form given the number of arguments involved.

Taken together, these findings further our understanding of the argumentative skills (including production and evaluation skills) that children exhibit at different ages. The previous chapters in this thesis have suggested some of the cognitive challenges that argumentation tasks pose. Confirming their role and more precise nature clearly requires further exploration. Such investigation is warranted, given the significance of argument and argumentation in education and in children's everyday thinking. Having a better understanding of the skills involved in argumentation and how they develop can contribute to its improvement.

In the last few years, there has been a rush to design and implement inquiry software and argumentation tasks in schools. Yet, educators have found that the capabilities of the technology tools far outstrip the ability of students to engage in them (Kuhn, 2008). In order to develop effective teaching tools (whether technology-based or not), cognitive and educational researchers should further explore the nature of students' argument skills. Teachers will certainly benefit from a roadmap of the skills that are most important for children to develop, and why.

Along with a number of researchers (e.g., Billig, 1995; Kuhn, 2008; Schwarz, 2009) the work undertaken in this thesis suggests that argument skills develop not only as a result of maturation of language and epistemological thinking, but also as a result of environmental factors and learning (education, knowledge, experience). In particular, the first set of studies provided further evidence that engaging in dialogic argumentation can lead to the development of individual expository arguments of children aged eight to 11 years. The contribution of the present work is to show that such advancement can be observed not only in the arguments that children construct to back up their ideas, but also in the quality of argumentative discourse generated in group discussions. Most children in the experimental condition showed improvement in their individual arguments for or against moral topics, as well as advances in their argumentative discourse skills across sessions. As discussed in Chapter Five, a significant feature of this intervention is the external representation of ideas (through the prompt questions and discourse) that made argument-counterargument-rebuttal structure explicit. By engaging as well in scaffolded argumentative discussions, children gain an enhanced overall sense of what an argument is (Reznitskaya et al., 2001). It is possible that with continued engagement and practice in argumentation across multiple topics and opponents, the cognitive and metacognitive demands of argument evaluation and generation become less challenging.

Table 8.2. Summary of the main results in terms of children’s evaluation of arguments at different ages

Age differences in children’s ability to evaluate arguments	
8- year olds	**11- year olds**
• Younger children (8- years) gave lower scores for the strength of counterarguments compared with 11- year old children in Study Three	• 11- year old children rated counterarguments as a strong type of argument across most topics (TV in bedrooms, school days, and pocket money) in Study Three
• 8- year olds also do not regard counterarguments as a persuasive or effective type of argument and , thus, do not select this type of argument to convince the characters to change their views (Study Four)	• Although 11- year olds regard counterarguments to be strong when standing alone (Study Three), the same is not true when the task involves achieving the persuasion goal (Study Four). Older children do not select counterarguments over other types to persuade the characters to change their views.
• Younger children (8- years) do not show a preference for arguments containing one or two reasons and select either single arguments or multiple arguments to achieve the persuasion goal (Study Four)	• 11- year old children choose most often arguments with higher number of reasons (multiple arguments) to persuade hypothetical characters to change their views (Study Four).
• When evaluating video-recorded dialogues of other children arguing (Study Five), 8-year-olds perceived the fewest differences between the arguers’ goals, possibly because they were more focused on the peripheral characteristics of the message (e.g., the arguer they liked the most, or the invention they preferred the most), rather than its content.	• When evaluating video-recorded dialogues of other children (Study Five), 11- year olds were better skilled than younger ones at recognising the role that different strategic sequences (corner sequence, rebuttal, block, and case-based sequence) play in discourse and the dynamics between arguers in pursuing the goals of argumentation, as revealed by their ratings of the arguers’ performance in each dialogue and the justifications for their decisions.

8.3. Strengths and limitations of the present research

8.3.1. Conducting research with children at schools

Argumentation is a socially and culturally situated activity and, thus, it is essential to consider the context in which argumentation takes place (Mirza, Perret-Clermont, Tartas, & Ionnaccone, 2009). Schools are an institutionalised setting which defines the units of knowledge that children should learn, and the methods to be used. Since the focus of formal education is on knowledge instruction, it is then comprehensible that most part of research on children's argumentation has focused on children's skills in arguing and learning academic concepts (e.g., Marttunen, Laurinen, Litosseliti, & Lund, 2005; Orsolini & Pontecorvo, 1992; Sampson & Clark, 2008). The present investigation contrasts with this previous line of research by using non-academic topics. Instead, topics were related to children's everyday life (e.g., wearing school uniforms or receiving pocket money) or socio-moral issues (e.g., sharing things with others or helping friends) and were, thus, relevant to children's social world.

The use of social-moral issues represents a strength of this investigation. This is particularly relevant for its implications in school settings, as education seldom deals with socio-emotional dimensions on a daily basis (Andriessen, 2009). Yet, a potential criticism is that using non-academic topics in the classroom may have affected children's willingness to participate in argumentative discussions, as demonstrated in a study conducted by Dolz and Schneuwly (1998). Children may have felt that the issues belong to their personal or family life, in which case they did not feel they were allowed to discuss them in the school setting. However, it is unlikely that this has occurred, as children were assessed individually or in small groups, rather than in activities involving the all classroom. Moreover, a variety of topics was used, including not only moral topics, but also social and policy-related issues.

In terms of collecting data, recruiting participants and conducting research at schools posed numerous challenges. As highlighted in the methodology chapter (Chapter Three), there were the logistics of lessons and breaks to cope with, and therefore, limited time to interview children on an individual basis or to schedule follow-up assessments. For instance, in Study Two (outlined in Chapter Five) it would have been of interest to conduct a delayed posttest assessment of children's individual arguments. However, this would have led to further difficulties with data collection. In addition, longer assessments would have made teachers and parents reluctant to let their children participate in the study.

Despite the difficulties associated with recruiting students at such young age in schools, the studies outlined in this thesis involved large samples. Indeed, the sample size of each of the five studies is one of the main strengths of this research. For instance, Study One (Chapter Four) and Study Two (Chapter Five) involved one-hundred and ninety children at three different ages (5-, 8-, and 11- years), which is a large sample compared to those reported in other investigations that have looked at argument skills using a similar methodology (e.g., Felton & Kuhn, 1991; Felton, 2004)

A possible limitation of this research was that it investigated group measures by taking into account the age factor rather than individual-level measures. As Goldsmith & Fulfs (1999) argue, group measures have less explanatory power when predicting individual-level variables. For instance, assessing whether individual difference variables correlate with children’s dispositions to engage in argumentation would have been of particular relevance in Study Two (Chapter Five), which explored children’s ability to generate and respond to arguments in argumentative discussions. As demonstrated in a study conducted by Lampert, Rittenhouse, and Crumbaugh (1996) with primary school children (aged 9-10 years), students are sometimes reluctant to criticise the ideas of their classmates. There could be a variety of reasons for such resistance, such as not valuing arguments, and concerns that criticism may disrupt friendship (e.g., Nussbaum & Bendixen, 2003; Stein & Albro, 2001).

It is also important to note that the present research used young children at different ages recruited from twelve different primary and secondary schools in different locations (although all in the south of England). Whilst this helped to increase the reliability, validity, representativeness, generalisability and comprehensiveness of the findings, it presented a number of challenges both in terms of gaining consent from school staff and parents and the nature of the study designs. Related to this, the different sample characteristics, which were the result of the recruitment of students from different school types (community, grammar, independent schools), and located in different areas (Berkshire, Middlesex, Windsor and Maidenhead, Slough, and Surrey), may have affected comparisons between groups and the results obtained in these studies. Although most students were of heterogeneous ethnic (mostly European) and socioeconomic (mostly middle class) backgrounds, schools in the area of Slough had a larger ethnic mix of students than, for example, the area of Windsor *and* Maidenhead.

Moreover, schools differed regarding the students' performance results, as reported by Ofsted. To date, there has been no systematic research on the effects of culture, educational context, and academic performance on children's argument skills. The potential limitations associated with the chosen sample should be considered when attempting to generalise the findings beyond the study populations.

Finally, it is important to recognise that with rare exceptions (e.g., Leitão, 2003; Rojas-Drummond, Mercer, & Dabrowski, 2001), most of the literature on children's argumentation is drawn from British (e.g., Mercer, 2009), and U.S. samples (Felton & Kuhn, 2001; Kuhn, 1991; Means & Voss, 1996; Nussbaum, 2005; Stein & Albro, 2001; Stein & Miller, 1993a, 1993b) who were entirely English speaking. While these samples are not identical culturally, the study of children's argumentation would be enriched and generalisability enhanced by a broader sampling of children from diverse ethnic and national backgrounds.

8.3.2. Using mixed methods

The present research integrated a synthesis of theoretical perspectives, using a mixed quantitative-qualitative approach. As referred in the methodology chapter (Chapter Three), other researchers who studied argumentation skills have also relied on a mixed-methods approach (e.g., Creswell, 2002; Felton & Kuhn, 2001; Nussbaum et al., 2002). It was intended that this would provide more insights into age differences in children's ability to engage in argumentation processes than would have been possible with either method alone.

In the initial stage of this research, semi-structured interviews were conducted with children in three age groups (5-, 8-, and 11- years) to examine the specific argumentative elements that children generate when asked to state and justify a position on socio-moral topics. The major obstacle in analysing the empirical evidence in this study was the lack of adequate coding schemes to assess and evaluate the quality of children's arguments and the cognitive skills entailed in children's argumentative reasoning. In particular, counterarguments were elicited by asking children to "Imagine that someone disagreed with his or her opinion", and to "Give opposing reasons that the hypothetical other could say to convince you that he or she is right". Given their limited skills in second-order perspective taking (Kuhn, 1999b), it is possible that children, particularly 5-year olds may have struggled to consider the hypothetical situation in the interviews. Another potential criticism is that the qualitative findings were not fed back to the interviewees to see whether the analysis was judged to be consistent with their perceptions. Despite this, the subsequent study and the quantitative studies provided some validation for children's narratives.

Using the same sample of children, group discussions were conducted to identify the argumentative discourse strategies that children use to convey their ideas and arguments effectively with their peers. The use of the *transactive coding scheme* (Felton & Kuhn, 2001) to analyse children's utterances and argumentative strategies revealed difficult to apply to group interactions, as discussed in the relevant study chapter (Chapter Five).

In order to extend this research it is necessary to device more reliable and sensitive evaluation systems to determine whether children generate progressively better arguments with age. Nevertheless, these two interconnected studies were important to gain understanding of the complex processes involved in the study of argumentation, and were then used to inform the development of quantitative measures for subsequent studies.

The next two studies (Chapter Six) focused on argument evaluation skills and examined how children evaluate arguments and counterarguments considering their own and others' perspectives. The major methodological advantage of these studies was that they involved computer-based tasks. These tasks made it feasible to quantitatively assess children's evaluation of claims and reasons across multiple kinds of arguments and content. In addition, its simplicity made it more appropriate for children than a long interview or paper-pencil test formats with which oral and written argumentative skills have been typically assessed. As discussed in the methodology chapter (Chapter Three), other advantages of using computers to devise and conduct research tasks are related to how information is presented (Stangor, 2007). In particular, computers can randomly select stimuli from lists, allowing counterbalancing across research participants. Moreover, information can be presented in many formats, including text pictures, hyperlinks, etc., which makes the task more fun and interesting for children.

A further strength of these studies was conducting a pilot study prior to the design of the tasks. This guaranteed that the tasks were adequate to children's content knowledge. The pilot study consisted of a small-scale focus-group that was carried to gather information on the sort of reasons children give to justify their points of views; select the most suitable topics to be incorporated in the main studies, based on children's level of knowledge and the arguments they generate; and create a list of arguments to incorporate in the design of the main studies. The pilot stage was important to assure that participants had enough knowledge regarding the topics, and understood the wording in the questions.

The final study (Chapter Seven) further explored the developmental differences in children's argument evaluation skills that were identified in the previous studies. A strong point of this study was the good correspondence of the methodology to real interactive situations. Firstly, the stimuli used in this study (videos of children debating a topic) attempted to simulate, as accurately as possible, real dialogues between children. Secondly, the topic of discussion (original inventions for a science competition) was closely linked to activities that children normally take part in school, and concerned an evaluation task which participants found stimulating, realistic and motivating. In addition, qualitative research techniques were used, including surveys (questionnaires).

Taken together, the importance of these three studies lies in the extension of the limited literature on children's ability to understand and evaluate goal-directed arguments. Particularly relevant was the findings related to the criteria children at different ages adopt to evaluate strong (Study Three) and persuasive arguments (Studies Four and Five). However, in all three studies, the quantitative measures did not allow drawing inferences regarding the psychological processes that underlie children's evaluation and selection of arguments. One of the possible ways to address this issue could have been to use qualitative measures. Moreover, in Study Five (outlined in Chapter Seven), it would have been interesting to assess *how* exactly children's views changed after exposure to argumentative dialogues. Again, a possible way to address this question would be to conduct a qualitative analysis (e.g., add the variable "quality of thinking").

In order to gain insight on the conceptions or justifications children have for evaluating arguments, future research could explore new methodological paradigms. Combining more quantitative and qualitative measures is one of the possible ways to address the questions these studies raised.

8.3.3. Other methodological considerations

Despite the frequent use of Toulmin's model in argumentation research, some of the limitations of this model are worth noting. First, many researchers have argued that some elements of arguments, such as data, warrant, and backing are not easily distinguished in empirical research (van Eemeren, Grootendorst, & Kruiger 1987; Fulkerson, 1996; Stein & Albro, 2001; Stein & Bernas, 1999; Voss & van Dyke, 2001). As Fulkerson (1996) argues, the model is primarily an analytical tool, that is, a framework for analysing individual arguments. Even when the model is used for analysis, argument scholars themselves have difficulty identifying warrants in an argument or an argumentative text. Further, as Perelman (1984) points out, Toulmin neglected the role of the audience; his model is one of structure and not of pragmatics. In everyday situations, however, individuals are required not only to understand the logic and form of arguments, but also their contextual meaning and coherence.

For these reasons, the present research did not rely exclusively on Toulmin's model as a theoretical and methodological framework. Rather, a simplified argument structure was adopted, which included the following elements: claim, reasons, opposing claims and opposing reasons (i.e., counterarguments). In addition, this investigation was also based on the coding schemes developed by Means and Voss (1996), and Felton and Kuhn (2001). Indeed, one of the major objectives of this investigation was to focus on pragmatics (i.e., the goals arguers pursue when generating and evaluating arguments) rather than logic.

8.4. Theoretical and practical applications

8.4.1. Implications for learning and education

Argumentation is a cognitive activity which involves the skills of logic and reasoning. It is also a discourse activity, conducted with the purpose to convey ideas to others effectively (van Eemeren & Grootendorst, 2004). This is what makes argumentation valuable in educational situations.

Arguing is not, however, an easy task. It requires the use of language and other cognitive skills, including the ability to understand and appreciate another person's perspective. As Kuhn (2008) notes, contrary to elementary skills such as classification or number which emerge in all typically developing children during the early years, the skills involved in argumentation do not necessary develop at the level desired. It is in the family context that children become familiar with argumentation, by participating in an increasingly active way in discussions with their parents and siblings (Stein & Albro, 2001). However, not all children encounter means to experience and practice their argument skills in their home. For some, the observation of, or participation in a reasoned discussion may be a rare event. Moreover, in everyday life, there are no ground rules of communication or reflection on what constitutes effective communication. Thus, individuals have to figure it out for themselves how to effectively communicate with others (Mercer, 2009).

This is why schools have a crucial role to play in the development of children's argumentation. Education should help children to become competent thinkers and learners, so they can use the acquired skills productively in adult lives (Kuhn, 2008; Mercer, Dawes, Wegerif, & Sams, 2004; Schwartz, 2009).

However, the importance of argumentation and the defining rules of its place and role in classroom learning have not been acknowledged within the educational system in the U.K., and it has not figured prominently in national or school curricula (Mercer, 2009). Moreover, while teachers are aware of many of the skills they would like students to exhibit, the steps to achieve desirable performance often remain unarticulated or vague. For instance, the two broad aims of the school curriculum reflected in section 351 of the Education Act 1996 requires that all maintained schools in the U.K. provide a balanced and broadly based curriculum that: (i) promote the spiritual, moral, cultural, mental and physical development of pupils at the school and of society, and (ii) prepare pupils at the school for the opportunities, responsibilities and experiences of adult life (National Curriculum, 2011). No specifications are, however, advanced regarding the theoretical and methodological framework within which schools should develop their own curriculum in order to achieve these goals. Another difficulty of encouraging children to engage in argumentative tasks in British school may be related to the dilemma that teachers face in combining these tasks (e.g., open argumentative discussions) with their professional responsibility to teach a set curriculum (Littleton, Mercer, Dawes, Wegerif, Rowe, & Sams, 2005).

The present research contributes to further understanding of the argumentative that children exhibit at different ages (5-, 8-, and 11- years). It also explores age-related patterns of how the cognitive skills entailed in argumentation develop. In doing so, one can better understand how to promote them in educational environments. The series of studies outlined in this thesis has demonstrated that the ability to develop complex argumentation (i.e., to justify, negotiate, and persuade) develops gradually in children.

In this respect, argument generation and argument evaluation skills may differ. For instance, Study Two (Chapter Five) showed that 5 to 12 year old children generate argumentative strategies (e.g., case-based sequences, blocks) infrequently in unstructured peer group discussions. However, in an evaluative task which displayed the same strategies, children aged 8- and 11- years exhibited a basic understanding of more complex strategies, such as cornering a speaker in a weaker position, or proposing a hypothetical scenario or situation in which the speaker's argument might not be applied. This result suggests that evaluative skills may precede argument generation skills. In the future it will be necessary to confirm this conclusion by using samples which are more numerous and by employing more direct measures.

This conclusion, subject to further verification, could be of some interest also for its practical implications in learning and education. For instance, students would benefit from intervention programs that allow them to learn and incorporate these elements in argumentative discussions with their peers. To date, no educational programmes have been devised in the U.K. to promote children's understanding and acquisition of these argumentative discourse elements and strategies.

A further contribution of this investigation is that it explored children's argumentation skills related to everyday topics that are relevant to their social world. Previous educational research has been mainly concerned with argument performance in academic subjects (e.g., Marttunen, Laurinen, Litosseliti, & Lund, 2005; Orsolini & Pontecorvo, 1992; Sampson & Clark, 2008). Specifically, any interventions should consider that children need to be motivated and interested in a topic in order to engage efficiently in argumentation. Some topics are more relevant than others for children at different ages, for instance, arguing whether students should or should not wear uniforms at school is more relevant for children aged 11- years than younger children. This is possibly due to the fact that, at age 11, children are becoming more aware of themselves as autonomous individuals (as discussed in Studies Three and Four).

Findings also indicated that, in argumentative situations, children (both at 8 and 11 years) take from their previous experiences references to beliefs and norms that they share in interactions with other people. These beliefs interfere with the judgements children make about the arguments being evaluated, as demonstrated in all five studies presented in this thesis.

Further, it provided evidence that argumentation processes change according to the goals children pursue in an argumentative task (e.g., influencing the audience's point of view). As shown in Study Four (Chapter Six), the arguers' or evaluators' involvement in making their positions and arguments acceptable to an audience, plays a major part in the criteria they adopt for evaluating the effectiveness or persuasiveness of arguments. Very few studies in developmental and educational literature have established a link between argumentation and persuasive goals. The present research has addressed this issue and demonstrated that children's performance on argumentative tasks depends on the communicative goals entailed in these tasks.

8.4.2. Implications for decision-making on social, moral and health-related issues

In everyday situations, children and adolescents have to face situations of uncertainty in which decisions have to be taken. Trying to make good choices, carry out the right actions or find solutions to a problem involve processes related to argumentation, such as taking a position, or producing justifications and refutations (Mirza et al, 2009; Voss & van Dyke, 2001). As Udell (2007) proposes, argument provides a foundation for effective decision-making, helping decision-makers to better define and justify choices and engage in more thoughtful processing of harms and benefits of a choice. Designing interventions based on argumentation (including reasoning and communication strategies) has the potential of improving thinking underlying individuals' decisions. For instance, Udell (2007) found that adolescents, aged 14-15 years, who engaged in argumentative discussions regarding a personally relevant topic (teen pregnancy) improved in the use of counterarguments. Udell (2007) also explored whether the learned argument skills transferred to other topic domains. Results revealed that only the intervention focusing on the personal topic (teen pregnancy) resulted in transfer to the non-personal topic (capital punishment). Transfer in the opposite direction did not occur. A further limitation of this intervention was that it did not significantly increase *rebuttal*.

Bernas and Stein (2001) asked college students who supported opposing positions on abortion to state their reasons for and against their own position as well as their reason for and against the opposition. Students then served as judges on four cases in which women were seeking an abortion (the circumstances motivating a woman varied across the cases). Case information either challenged or supported prototypic assumptions and beliefs that underlie a prolife or prochoice stance. Results revealed that students who received information directly challenging their position on abortion changed stances more frequently than those who did not. Additional factors also predicted changes in stances, such as, taking a prochoice rather than a prolife position; being able to cite more problems with one's own position; and receiving challenging cases that present novel rather than anticipated conditions motivating a woman's desire for abortion. According to Bernas and Stein (2001) changes in stances come about because of awareness of new information about the negative consequences and also the benefits of each position, which in turn causes a shift in the relative ranking of important moral beliefs that an arguer uses to support a position.

Although these two examples did not focus directly on developing adolescents' decision-making, they contribute to better understand the thinking underlying adolescents' positions and to develop cognitive skills that contribute to thoughtful and sound decisions. Further research is needed to explore the factors that promote transfer of argument skills across topics and also contextual settings. In particular, in these two interventions, it is not certain whether adolescents would implement the skills they acquired (e.g., evaluating evidence and considering the pros and cons of a position; using counterarguments) when making decisions outside of the context of the school-based activities. Further research on argumentation and decision-making is needed to enhance understanding of individuals' cognitive development, but also the personal lives of decision-makers.

8.5. Possible future educational programmes

In comparison with the vast volume of research focused on argumentation as a tool for learning specific content (e.g., Howe, Tolmie, Greer, & Mackenzie, 1995; Felton, 2004), less theoretical, empirical, and design efforts have been invested in designing programmes to foster argumentative skills and in evaluating their efficacy. For the most part, previous educational programmes, for example *Point Zero* (Perkins, 1992); *Philosophy for Children* (Lipman, 1991), and *Thinking Together* (Mercer, 2000) have focused on promoting “critical thinking” rather than fostering argumentation. The intriguing issue, as observed by Schwarz (2009) is that, although not explicitly stated in the programme rationales, their implementation depends heavily on the instilment of argumentative practices. Moreover, even though most of these programs emphasise the importance of understanding rather than acquiring skills, their impact has been measured by using tools pertaining to the acquisition of skills, thus leading to mixed results (Schwarz, 2009).

In order to design effective argumentative programmes, it is important to clearly distinguish between meta-level skills and the other cognitive skills entailed in argumentation. The research outlined in this thesis focused on the later set of skills, including argument generation and argument evaluation abilities. As mentioned earlier, these skills are essential for engaging in thoughtful consideration of alternative ideas, and for making sound decisions, either related to educational matters or everyday life situations. In order to help children to develop such skills, schools should provide opportunity for students to exercise them. This would involve activities in which children could learn the following skills: (1) construct strong, coherent, persuasive arguments to sustain their points of view, both individually or in groups; (2) recognise others' perspectives and alternative arguments; (3) develop argumentative strategies to engage in effective argumentative discussions; and (4) transfer the acquired skills to other domain topics and contexts.

Moreover, it would be particularly beneficial if these activities employed a variety of technology resources (e.g., videos and computer-based tasks). For instance, the computer tasks devised for studies Three and Four (both described in Chapter Six) could be used in school classes to teach children how to identify strong arguments and how to critically evaluate them. In fact, most teachers, who had collaborated in the data collection, expressed interest in using these materials in class. And so, after data have been collected, teachers used some of the topics (e.g., children receiving pocket money or having a television in their bedrooms) in Assembly and debate classes to elicit argumentative discussions. In addition, the work presented in this thesis suggests that school-based activities should not focus solely on curriculum topics, but rather on other cultural reference frames (e.g., policy issues, socio-moral topics). This would be relevant for transfering the learned skills to other domain topics and contexts outside school settings.

8.6. Final remarks

This thesis examined age differences in children's ability to evaluate and constructed arguments. This research has contributed to the field of children's argumentation in the following ways:

1. This was the first research to look at whether 5-, 8-, and 11-year old children are able to generate complex types of arguments and argumentative strategies, either individually or in group settings, related to topics they are familiar with and know about.
2. Rather than relying on either qualitative or quantitative methods alone, a variety of mixed-methods techniques (for data collection and analysis) were used to capture the complexity of argumentation processes.
3. The above studies contributed to further understanding of the cognitive skills that children possess at such young age, including those involved in argument construction and argument evaluation.
4. This investigation examined how the communicative goals entailed in a task (e.g., persuasion goal) affects children's understanding of arguments.

As referred to earlier, the findings may have practical implications in learning and education, and also in many instances of children's lives outside school. It is hoped that teachers, educational researchers and those involved in the implementation of programmes for promoting children's learning will find this research interesting and useful.

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Appendices

Appendix 1. Example of a covering letter for schools (Studies One and Two)

[University Headed Paper]

Date here

Dear (Name of Head Teacher),

I am a PhD student studying at Royal Holloway University of London. I am writing to ask if you would be interested in participating in my study of children's discussion and argument skills. It is supervised by Dr Patrick Leman.

Dr Leman and I fully appreciate the pressures and demands upon children and staff at schools, and want to reassure you that the work we have planned will be designed to cause minimal disruption to your regular classroom routines. In fact, what we envisage involves merely reading some short stories to groups of children and engaging them in discussion afterwards. The stories are taken from well-known and widely-used text books and are suitable for children of all ages. The stories are based on traditional folk tales from around the world and, as such are probably similar to many of the stories that are told to children of the same age in many classrooms. The stories themselves are taken from two books for children aged 5 years and upwards, "Stories for thinking", "First stories for thinking", written by R. Fisher (1996). We can, of course, send you full texts of the stories we plan to use, on request.

Briefly, what we plan to do is to read the stories to groups of children. Some children will discuss the story for around 5 minutes afterwards (the stories focus on moral themes like stealing, friendship and helping). Some other children will not discuss the stories in a group but answer some questions on it on their own. Our aim is to explore whether simply discussing issues within the peer group improves discussion and argument skills. By this we mean the abilities to form a strong, coherent, and persuasive argument *and* to understand and listen to another's argument.

If you are able to participate, I would be hoping to visit your school around a week later in January or early February, including time reading stories and discussing them with the children in smaller groups. Dr Leman or I would be very happy to explain any of the details further to you or your staff at a convenient time. All of our work is subject to approval by our departmental ethics committee which conforms to the ethical standards of the British Psychological Society (BPS) and American Psychological Association (APA) including full parental consent.

Please do feel free to contact me (01784 443703; A.P.Macedo@rhul.ac.uk) or Dr Leman (01784 414406; Patrick.Leman@rhul.ac.uk) if you wish to discuss the project any further. We stress again that the project would be fun for your children and we very much hope that your staff would feel happy to discuss and input to these issues with us as well. We will contact you again by telephone in a week's time. But in the meantime, if you are interested in being involved in this study, please let us know by using either of the contact numbers above.

Yours with best wishes,

[Names of the researcher and her supervisor]

Appendix 2. Consent form for parents (Studies One and Two)

[University Headed Paper]

Re: Study of children's conversation and argument skills

Dear Parent/ Guardian

I am a PhD student studying at Royal Holloway, University of London. For my research project, I am carrying out a study of children's discussion and argument skills, supervised by Dr. Patrick Leman.

Briefly, what we plan to do is to read stories to groups of children. The stories are taken from well-known and widely-used text books and are suitable for children of all ages. The stories are based on traditional folk tales from around the world and, as such are probably similar to many of the stories that are told to children of the same age in many classrooms. Some children will discuss the story for around 5 minutes afterwards (the stories focus on moral themes like stealing, friendship and helping). Some other children will not discuss the stories in a group but answer some questions on it on their own. The aim is to explore whether simply discussing issues within the peer group improves discussion and argument skills. By this we mean the abilities to form a strong, coherent, and persuasive argument *and* to understand and listen to another's argument. I would appreciate the participation of your child in my study. The results of this research may help teachers to understand and enhance argument skills. This work can be also important to maximize potential benefits of peer collaboration in educational settings.

All children will find these activities fun and similar to the normal activities they would undertake in school everyday. In terms of the study itself, nobody except Dr Leman and me will see the data or any video-recorded material, and information on each child will be recorded using an anonymous identifying number only. If you would like to discuss any aspect of the research with Dr. P. Leman you can contact him by email on Patrick.Leman@rhul.ac.uk, or by phone on 01784 414406. If you need to contact me, please call 017843703 or email me (A.P.Macedo@rhul.ac.uk). We will also ask your child, personally, whether they are happy to take part in the study and they will be allowed to withdraw from a session at any time if they do not wish to continue.

This study has been reviewed and approved by the Psychology Department internal ethical procedure at Royal Holloway, University of London. (Name of head teacher), the Head Teacher, has also given permission for this study to be carried out.

We assume that all children will want to participate. But if you DO NOT want your child to participate, please complete and return the consent from below. Please retain a copy of this sheet for your future information.

Thank you for taking the time to read this information.

[Names of the researcher and her supervisor]

✄---

STUDY OF CHILDREN’S CONVERSATION AND ARGUMENT SKILLS

CONSENT FORM FOR RETURN TO CLASS TEACHER

Please tick the box indicating consent and then complete the remaining details and detach and return this form to your child’s class teacher. Please keep the information sheet for your own records.

Please tick the appropriate box to the right:

EITHER;

I consent to my son/daughter taking part in the research ☐

into children’s understanding and evaluation of arguments.

OR;

I do not consent to my son/daughter taking part in the research ☐

into children’s understanding and evaluation of arguments.

I have received an information sheet explaining the purpose of the study and of the opportunity to ask further questions and with the assurance that my son’s or daughter’s right to privacy and confidentiality will be respected at all times.

Name of parent/ guardian ………………………………………………………..

Signature of parent/ guardian…………………………………………….……....

Name of child ………………………………….......... Date …………………...

Appendix 3. Interview for assessment of argument skill illustrated for *sharing* topic (adapted from Kuhn, 1991, p. 299-300)

Generating arguments and reasons

1) Do you think that people should share their things with others or keep what they like for themselves?

2) Why? Try to give reasons to explain your position.

a) *(Probe, if necessary)* Can you give some reasons why you think "people should ___?"

b) If you were trying to convince someone (or a child with the same age) that your view is right, what reasons could you mention to convince the person that "people should ___?"

c) *(Probe, when child completes initial response)* Can you think of anything else?

Generating counterarguments and opposing reasons

1) Imagine now that someone (or a child with the same age) disagreed with your opinion that "people should ___ because ___" What opposing reasons could this person say to show that you were wrong?

a) (*If child doesn't understand)* Suppose a person has a view very different from yours – what might they say to convince you that you were wrong?

b) *(Probe, if necessary)* Can you think of anything else?

c) *(If both sides of the question mentioned and counterarguments already indicated)* You mentioned some reasons why "people should ___" Just to be sure I understand, can you explain a little bit more about these reasons, or think about other reasons to justify this alternative position?

Generating rebuttals

1) And what could you say to convince this person wrong?

a) *(Include if no counterargument generated)* Suppose that someone disagreed with you and said that people should ___ because ___. What could you say to show that the person was wrong?

b) (*If not already indicated)* What could you say to show that your own opinion is the correct one and what reasons would you give to defend it?

Appendix 4. Materials for storytelling

Story 1. “The black tulip” - Dutch folktale (Fisher, 1996, p. 95-96).

“Ever since tulip flowers were first found in Turkey people have been trying to grow one special tulip – a black tulip! Many tulips have been the darkest brown or the deepest blue, but none has been truly black.

Many years ago there was a competition among the bulb growers of Holland. A prize of one thousand golden crowns was offered to the first person who could grow a black tulip. There was great activity among the bulb growers. They tried every way they knew to grow a black tulip. They produced dark blue and brown ones, deep purple and bottle green ones, striped and blotchy ones.

At last one of the keenest growers produced a small bulb which was a mixture of all the darkest colours he had ever grown. ‘This surely’, he said, ‘must be the first and only *black* tulip’.

It was just a small bulb, but he could see it in his mind’s eye growing and opening into a velvety black flower. He didn’t even think of the handsome prize he might win. The black tulip would be the most valuable flower in the world, but for him it would be the most beautiful.

The bulb grower knew that he had better keep the news of his bulb a secret. The only people he told were his family and closest friends. But like many a well-kept secret it travelled from person to person until it reached the ears of a bulb grower who was his greatest rival. This man had been trying to grow a black tulip, without success, for years. He would dearly love to get his hands on the prize – a thousand gold crowns! Now he had been beaten to it – or had he? A plan began to form in his mind. Perhaps he could win the prize after all.

That night, when all was dark and quiet, he slipped out of his house and made his way to the garden where he thought the black tulip bulb would be kept. In through the garden gate he went and up to the great glass greenhouse where all the bulbs sat ready for planting. There they lay in rows, with each one neatly labelled. His hand reached down for the latch. Just as he thought – not locked!

Quietly he let himself in to the greenhouse. It was quite dark so he struck a light and quickly moved along the rows of bulbs. Yes, there it was – a bulb labelled ‘The Black Tulip’, on a special shelf all to itself. He put the bulb safe in his pocket, placed another bulb where the bulb of the black tulip had been, and hurried home in triumph.

Back inside his house the thief placed the precious bulb carefully on his mantelpiece. The black tulip! It looked like any other tulip bulb, but this one he was sure would make him rich and famous.

The following day his housekeeper found what she thought was an onion lying on the mantelpiece. ‘Funny place for an onion’, she thought. ‘Oh well, it’ll make a nice omelette’.
So she took the ‘onion’ out into the kitchen. There she cracked two eggs, chopped up the ‘onion’ and proudly presented to her master for his breakfast – an onion omelette. The thief’s mind was full of the money he would win, and he tucked into his breakfast.

When he had finished the omelette he went over to the mantelpiece. The bulb! Where had it gone? In a panic he searched high and low, to no avail; it had quite disappeared. He questioned all his servants. No they hadn’t seen a tulip bulb. Had they seen anything unusual? - he asked.

'Well', said his housekeeper, 'only an old onion, but you ate that for breakfast'. All of a sudden the thief began to feel rather ill. 'Thieves never prosper', he groaned, and he went to bed and vowed never to steal again.

And we are still waiting for the first black tulip".

Story 2. "The bear that spoke" - Canadian folktale, a variation of one of Aesop's fables (Fisher, 1996, p. 50-51)

"One day in the cold lands of Canada two friends went out hunting. They were tracking a moose through the great pinewood forests. Snow carpeted the ground and as they trod through it they heard no sound. They did not suspect that as they followed the track of the moose there were two eyes watching them.

The two hunters stopped, hoping to spot the flash of antlers through the trees. Behind them a dark shadow moved across the snow. Closer and closer it came. One of the hunters glanced round. 'It's a bear!' – he shouted.

The huge grizzly bear, a mass of brown fur and claws, was almost upon them. Without a second's thought the two men ran. They knew that their only hope was to find a place of refuge. One of them pointed to a nearby pine tree, and ran towards it. As soon as he reached it he began to climb faster than he had ever climbed before. His friend however tripped over a root in the snow. He fell with a crash into the snow.

'Help! I think I've sprained my ankle!' – he shouted.

The man in the tree looked round. He could see that the bear was still some way off. But what still some way off. But what could he do? What should he do? He decided to carry on climbing.
The man on the ground lay quite still and held his breath. The nerves in his body tingled with fear as he could hear the 'scrunch, scrunch' of pawns snow coming nearer and nearer. The bear lumbered up to him, and began to snuffle suspiciously round his head. The man could feel the bear's hot breath on his face. He didn't move a muscle. The bear's claws scratched at the snow. Then there was a soft padding sound as the bear ambled slowly away.

'He's left me alone', thought the man. 'He must have thought I was dead'. At once he felt a surge of pain in his sprained ankle.

High in the tree his friend saw the bear disappear into the bushes. He waited a few minutes until he was sure it was quite safe, then carefully climbed down. He ran quickly to his friend who was still lying flat in the snow. He helped the man sit up, and bandaged his ankle.

Seeing his friend was none the worse for his meeting with the bear, the hunter who had climbed the tree said, 'I knew you'd be all right. I guess you were safer down there than I was up that tree'. Trying to cheer his friend, who still looked hurt, he added, 'Hey, that bear was so close he seemed to be whispering something in your ear. Come on, tell me, did he say something to you?'

'Well', the other replied, 'what he said was, I should never trust a friend who deserts you when things get difficult'."

Story 3. "The ungrateful crocodile" – Story from India (Fisher, 1999, p. 46)

"One day a holy man was walking along the bed of a dried-up river. It had not rained for weeks and the earth was hard and dry. Suddenly the holy man saw a crocodile lying in the dust painting for breath.

‘Please save me,’ gasped the crocodile. ‘Take me to some water or I shall die.’

The holy man looked at the crocodile and said, ‘I would like to save you but I’ve heard that you are fierce and not to be trusted. How do I know you won’t eat me once I’ve rescued you?’

The animal looked hurt. ‘Do you really think that I would eat someone who had saved my life?’ he asked. ‘Is there anyone in the whole world who would do such a cruel thing? Not me, my friend; if you let me live I shall be your friend until my dying day’. A big tear began to roll down the crocodile’s face.

The holy man was so sorry for the crocodile that he picked him up, put him into his bag and walked seven miles to the nearest river. Then he let the crocodile out of the bag and told him to crawl into the water.

‘Please carry me into the river’, panted the crocodile. ‘I am so weak I cannot walk.’ The holy man did as he was asked, carried him into the water, and let him go. At once the crocodile seized the holy man’s leg and began dragging him under.

‘You rogue!’ roared the holy man. ‘You broke your word.’

‘I’m hungry’, said the crocodile and it carried on trying to drown the man.

‘Wait!’ shouted the holy man. ‘There’s a jackal, let us ask him whether you are right to eat me or not. If he says that you should, I will stop struggling and you can have me for supper.’ The crocodile grumbled but finally agreed to ask the jackal.

When the jackal had heard the story he scratched his head and said, ‘I am not very clever. I don’t understand how the man brought you to the river. Can you show me?’ The crocodile grumbled again and climbed into he holy man’s bag.

‘Like this’, he growled. The holy man tied up the bag tightly.

‘Take him back’, said the jackal, ‘and leave him where you found him.’

The holy man laughed as the crocodile writhed in his bag. ‘What a clever fellow you are’, he said. ‘What a villain *he* is! I saved his life and he tried to take mine. Who would have thought that anyone could be so ungrateful?’

‘Nearly everybody!’ said the jackal. ‘You are too trusting to your own good. Carry on being kind to everyone, but don’t expect people to be kind to you in return. It doesn’t always work out that way.’

The holy man picked up the bag of crocodile, and realised the jackal was right.”

Appendix 5. Key questions and prompt questions for discussion of stories

Key questions for each of the three stories

1. In the story, the thief said that thieves never prosper. Do you think this is true; is stealing always wrong?

2. Is there any difference between helping a stranger or a friend?

3. In the story the man is kind and also trusting of others, but *someone* took advantage of it. If someone breaks a promise, should people trust this person again?

Prompt questions

1. Why? Try to refer to all reasons that explain your position.
2. *(Probe, when subject completes initial response)* Anything else?
3. Someone (*child's name*) seems to disagree with your opinion. Do you agree with the opposing reasons he/she is saying?
4. What could you say and what reasons could you give to explain to (*child's name*) that your own view is the right one?

Appendix 6. Worksheet for the control condition (Study Two)

Reflection Worksheet (illustrated for the story "The ungrateful crocodile")

ID number: [PLACE STICKER HERE]

Today's date ……………………………

Listen carefully to the questions given by the researcher and try to write a brief answer:

1. In the story the man is kind and also trusting of others, but *someone* took advantage of it. If someone breaks a promise, should people trust this person again? Why? (Try to write all reasons you can think of to explain your view)

____

____

____

2. Imagine someone disagrees with your opinion. What reasons do you think this person could give you to show you that his or her view is the right one?

____

____

____

3. And what would you reply to this person to explain that your position is the right one?

____

____

____

Appendix 7. Example of a covering letter for schools (Pilot Study)

[University Headed Paper]

Date here

Dear (Name of Head Teacher),

I am a PhD student studying at Royal Holloway University of London. I am writing to ask if you would be interested in participating in my study of students' evaluation of the strength of arguments. It is supervised by Dr Patrick Leman.

Dr Leman and I fully appreciate the pressures and demands upon children and staff at schools, and want to reassure you that the work we have planned will be designed to cause minimal disruption to your regular classroom routines. In fact, what we envisage involves asking children to think about various topics and evaluate different arguments related to those issues.

Briefly, what we plan to do is asking a few children to discuss common social issues in a group with some children from the same class. These issues will not be controversial but will generate discussion and, we hope, will include familiar topics such as whether children should wear school uniforms, or whether it is right to keep animals in zoos. Our aim is to gather some information about the sorts of arguments children typically use on these topics. Then, we will ask children to work individually at a computer to let us know what they think are good or bad arguments by rating these on a simple scale. Our aim here is to explore what kind of arguments children find strong or persuasive. We hope to involve children aged 5, 8, and 11 years-of-age, and do not expect that it will take more than 10 minutes for each child to complete the tasks.

If you are able to participate, I would be hoping to visit your school and assist in classroom activities for a day in early October. All of our work is subject to approval by our departmental ethics committee which conforms to the ethical standards of the British Psychological Society (BPS) and American Psychological Association (APA) including full parental consent.

Please do feel free to contact me (01784 443703; A.P.Macedo@rhul.ac.uk) or Dr Leman (01784 414406; Patrick.Leman@rhul.ac.uk) if you wish to discuss the project any further. We stress again that the project would be interesting for your students and we very much hope that your staff would feel happy to discuss and input to these issues with us as well: this is a new topic for research and our work would benefit from the input of professionals who have experience of children's abilities on a daily basis and at first hand. We will contact you again by telephone but, in the meantime, if you are interested in being involved in this study, please let us know by using either of the contact numbers above.

Yours with best wishes,

[Names of the researcher and her supervisor]

Appendix 8. Consent form for parents for (Pilot Study)

[University Headed Paper]

Re: Study of children's conversation skills

Dear Parent/ Guardian

I am a PhD student studying at Royal Holloway, University of London, and I am currently carrying out a study of children's understanding and evaluation of the persuasiveness of arguments. My work is supervised by Dr Patrick Leman, Reader in Psychology at Royal Holloway. This study forms part of a larger body of work in which we hope to be able to establish how argument skills change with age and develop in conversation.

Your school has kindly agreed to allow us to approach you, as a parent, to ask if you would permit your child to participate in some of this research. We plan two different types of activity. First, we will ask a few children to discuss common social issues in a group with some children from the same class. These issues will not be controversial but will generate discussion and, we hope, will include familiar topics such as whether children should wear school uniforms, or whether it is right to keep animals in zoos. Our aim is to gather some information about the sorts of arguments children typically use on these topics. For the second type of activity we will ask children to work individually at a computer to let us know what they think are good or bad arguments by rating these on a simple scale. Our aim here is to explore what kind of arguments children find strong or persuasive. We hope to involve children aged 5, 7, and 9 years-of-age, and do not expect that it will take more than 30 minutes for each child to complete the tasks.

Although we are engaged in pure academic research at this stage we very much hope that this work will, in due course, inform practice and have implications in educational settings, such as helping teachers to understand and enhance children's argument skills. We will certainly keep parents, staff, and the children informed of the outcomes of this work. We have extensive experience of conducting this sort of research, and we know that children find this sort of activity stimulating – most children really want to take part and we have never encountered a situation where a child has not wanted to participate in a discussion such as this. However, alongside your consent as a parent, we also check that every child is happy to take part and make it clear that they can withdraw from the study at any point if they wish.

We also take issues of data protection and participant anonymity very seriously: Information on each child will be held using an anonymous identifying number only, and nobody except Dr Leman and me will see the data or listen to any audio-recorded material. If you would like to discuss any aspect of the research with Dr Leman you can contact him by email on Patrick.Leman@rhul.ac.uk, or by phone on 01784 414406. If you need to contact me, please call 01784 443703 or email me (A.P.Macedo@rhul.ac.uk).

This study has been approved by the Psychology Department Ethical Committee (which reports to the Royal Holloway, University of London Ethics Committee). Our work conforms to the ethical guidelines laid out by the *British Psychological Society* (BPS), *American Psychological Association* (APA), and *Society for Research in Child Development* (SRCD).

Please complete and return the consent form, attached, and retain a copy of this sheet for your information.Thank you for taking the time to read this information.

[Names of the researcher and her supervisor]

✄---

STUDY OF CHILDREN’S UNDERSTANDING AND EVALUATION OF ARGUMENTS

CONSENT FORM FOR RETURN TO CLASS TEACHER

Please tick the box indicating consent and then complete the remaining details and detach and return this form to your child’s class teacher. Please keep the information sheet for your own records.

Please tick the appropriate box to the right:

EITHER;

I consent to my son/daughter taking part in the research ☐

into children’s understanding and evaluation of arguments.

OR;

I do not consent to my son/daughter taking part in the research ☐

into children’s understanding and evaluation of arguments.

I have received an information sheet explaining the purpose of the study and of the opportunity to ask further questions and with the assurance that my son’s or daughter’s right to privacy and confidentiality will be respected at all times.

Name of parent/ guardian ………………………………………………………..

Signature of parent/ guardian…………………………………….....................

Name of child ………………………………….......... Date …………………

Appendix 9. Outline script/ information for focus group discussions (Pilot Study)

Date ……………………….................................. Focus group session no. ……………………

Step One

Introduce myself

- Explain the purpose of the group discussion. The objective of this session is to gather information on what children think about some everyday topics and what sorts of arguments they typically use to support their opinions.
- Explain that there are no "correct" answers. The researcher is interested in their own personal opinions.
- Ask for permission to record and take notes (explain confidentiality, length of the interview - approximately half an hour).
- Instructions for children: "The purpose of this study is to help me understand what children think about everyday issues. I am going to give you a statement, and then ask your opinion about the statement and the reasons why you agree or disagree with it. For example, some people think that Internet brings people of the world closer together. Do you agree or disagree with this idea, and why?"

Step Two

- "Warm-up" (ask children's names and their age at the start so they can become familiar with the researcher).

Step Three

- Carry out the interview. Each conversation topic should be discussed in less than 10 minutes. Introduce the first topic: Students should wear uniforms at school.
- Do you agree or disagree with this statement? (Pro – or/ and anti- positions).
- Try to refer to all reasons you know to explain your positions (Generation of pro- and anti- arguments)
- Use probes (silence, mmhmm, "anything else?") and prompts ("what is your personal opinion?").
- Imagine that someone is in favour or against the use of uniforms in school. What reasons would this person give to explain you that your opinion is wrong? (Generation of counterarguments).
- Give examples: "Some people might say that school uniforms are expensive and have no use outside school". Do you agree with this argument, and why? Would you say it is a strong or a weak argument, and why? (Evaluation of the strength of arguments).
- Final questions: Which discussion topic did you like the most?; What were the most difficult and the easiest discussion topics? Show appreciation and end the interview.
- How familiar are you with this topic? (ask children to complete the questionnaire)

Appendix 10. Questionnaire of children's reported knowledge on the topics (Pilot Study)

ID number: [PLACE STICKER HERE]

Today's date ……………………………

Thank you for taking the time to complete this questionnaire. Please provide the following information about yourself:

Date of birth ……………………………

Please tick:

Male ☐ Female ☐

Instructions: This questionnaire is about your personal knowledge regarding the topics you have discussed. Please read the information below and check or circle the appropriate option.

Topics	How much would you say you know about each of the following topics? *(Please check or circle the appropriate option below):*		
School uniforms	I know nothing ( )	I know a little ( )	I know a lot ( )
Zoos	I know nothing ( )	I know a little ( )	I know a lot ( )
Technology	I know nothing ( )	I know a little ( )	I know a lot ( )
Machines	I know nothing ( )	I know a little ( )	I know a lot ( )
Television	I know nothing ( )	I know a little ( )	I know a lot ( )
Laws	I know nothing ( )	I know a little ( )	I know a lot ( )
School time	I know nothing ( )	I know a little ( )	I know a lot ( )
Famous people	I know nothing ( )	I know a little ( )	I know a lot ( )
Pocket money	I know nothing ( )	I know a little ( )	I know a lot ( )
Naughty children	I know nothing ( )	I know a little ( )	I know a lot ( )

Appendix 11. Example of a covering letter for schools (Study Three)

[University Headed Paper]

Date here

Dear (Name of Head Teacher),

I am a PhD student studying at Royal Holloway University of London. I am writing to ask if you would be interested in participating in my study of students' evaluation of the strength of arguments. It is supervised by Dr Patrick Leman.

Dr Leman and I fully appreciate the pressures and demands upon children and staff at schools, and want to reassure you that the work we have planned will be designed to cause minimal disruption to your regular classroom routines. In fact, what we envisage involves asking children to think about various topics and evaluate different arguments related to those issues. The topics concern common social issues, such as the importance of wearing school uniforms, or the reasons why children should get pocket money.

Briefly, what we plan to do is asking children to evaluate arguments related to everyday issues. Children will work individually at a computer to evaluate and select the most persuasive arguments. This task will take no longer than 10 minutes. Our aim is to explore how children at different ages (8-9 and 11-12 years-old) might think and feel about different issues, what kind of arguments persuade children, and also whether children can be persuaded by these arguments.

If you are able to participate, I would be hoping to visit your school and assist in classroom activities for a day in early October. Dr Leman or I would be very happy to explain any of the details further to you or your staff at a convenient time. All of our work is subject to approval by our departmental ethics committee which conforms to the ethical standards of the British Psychological Society (BPS) and American Psychological Association (APA) including full parental consent.

Please do feel free to contact me (01784 443703; A.P.Macedo@rhul.ac.uk) or Dr Leman (01784 414406; Patrick.Leman@rhul.ac.uk) if you wish to discuss the project any further. We stress again that the project would be interesting for your students and we very much hope that your staff would feel happy to discuss and input to these issues with us as well: This is a new topic for research and our work would benefit from the input of professionals who have experience of children's abilities on a daily basis and at first hand. We will contact you again by telephone but, in the meantime, if you are interested in being involved in this study, please let us know by using either of the contact numbers above.

Yours with best wishes,

[Names of the researcher and her supervisor]

Appendix 12. Consent form for parents (Study Three)

[University Headed Paper]

STUDY OF CHILDREN'S UNDERSTANDING AND EVALUATION OF ARGUMENTS

Dear Parent/ Guardian

I am a PhD student studying at Royal Holloway, University of London, and I am currently carrying out a study of children's understanding and evaluation of the persuasiveness of arguments. My work is supervised by Dr Patrick Leman, Reader in Psychology at Royal Holloway. This study forms part of a larger body of work in which we hope to be able to establish how argument skills change with age and develop in conversation.

Your school has kindly agreed to allow us to approach you, as a parent, to ask if you would permit your child to participate in some of this research. The activity involves asking students to work individually at a computer to let us know what they think are good or bad arguments by rating these on a simple scale. The task includes familiar topics such as whether students should wear school uniforms, or whether they should get pocket money. Our aim here is to explore what kind of arguments children find strong or persuasive. We hope to involve students aged 11 and 12 years-of-age, and do not expect that it will take more than 10 minutes for each student to complete the task.

Although we are engaged in pure academic research at this stage we very much hope that this work will, in due course, inform practice and have implications in educational settings, such as helping teachers to understand and enhance students' argument skills. We will certainly keep parents, staff, and the students informed of the outcomes of this work. We have extensive experience of conducting this sort of research, and we know that students find this sort of activity stimulating – most students really want to take part and we have never encountered a situation where a student has not wanted to participate in a discussion such as this. However, alongside your consent as a parent, we also check that every participant is happy to take part and make it clear that they can withdraw from the study at any point if they wish.

We also take issues of data protection and participant anonymity very seriously: Information on each participant will be held using an anonymous identifying number only, and nobody except Dr Leman and me will see the data or listen to any audio-recorded material. If you would like to discuss any aspect of the research with Dr Leman you can contact him by email on Patrick.Leman@rhul.ac.uk, or by phone on 01784 414406. If you need to contact me, please call 01784 443703 or email me (A.P.Macedo@rhul.ac.uk).

This study has been approved by the Psychology Department Ethical Committee (which reports to the Royal Holloway, University of London Ethics Committee). Our work conforms to the ethical guidelines laid out by the *British Psychological Society* (BPS), *American Psychological Association* (APA), and *Society for Research in Child Development* (SRCD).

Please complete and return the consent form, attached, and retain a copy of this sheet for your information. Thank you for taking the time to read this information.

[Names of the researcher and her supervisor]

✄---

STUDY OF CHILDREN’S UNDERSTANDING AND EVALUATION OF ARGUMENTS

CONSENT FORM FOR RETURN TO CLASS TEACHER

Please tick the box indicating consent and then complete the remaining details and detach and return this form to your child’s class teacher. Please keep the information sheet for your own records.

Please tick the appropriate box to the right:

EITHER;

I consent to my son/daughter taking part in the research ☐

into children’s understanding and evaluation of arguments.

OR;

I do not consent to my son/daughter taking part in the research ☐

into children’s understanding and evaluation of arguments.

I have received an information sheet explaining the purpose of the study and of the opportunity to ask further questions and with the assurance that my son’s or daughter’s right to privacy and confidentiality will be respected at all times.

Name of parent/ guardian ………………………………………………………..

Signature of parent/ guardian…………………………………………..……….

Name of student …………………………………… Date ………………….

Appendix 13. Example of a covering letter for schools (Study Four)

[University Headed Paper]

Date here

Dear (Name of Head Teacher),

I am a PhD student studying at Royal Holloway University of London under the supervision of Dr. Patrick Leman. I am writing to ask if you would be interested in participating in my study of children's evaluation of persuasive arguments.

Dr Leman and I fully appreciate the pressures and demands upon children and staff at schools, and want to reassure you that the work we have planned will be designed to cause minimal disruption to your regular classroom routines. In fact, what we envisage involves asking children to think about various topics and evaluate different arguments related to those issues. The topics concern common social issues, such as the importance of wearing school uniforms, or the reasons why children should get pocket money.

Briefly, what we plan to do is asking children to evaluate arguments related to these topics. Children will work individually at a computer to evaluate and select the most persuasive arguments. This task will take no longer than 8 minutes. Our aim is to explore how 8-9 years-old children (year 4) might think and feel about different issues, what kind of arguments persuade children, and also whether children can be persuaded by these arguments.

If you are able to participate, I would be hoping to visit your school and assist in classroom activities for a day in January or early February. All of our work is subject to approval by our departmental ethics committee which conforms to the ethical standards of the British Psychological Society (BPS) and American Psychological Association (APA) including full parental consent.

Please do feel free to contact me (01784 443703; A.P.Macedo@rhul.ac.uk) or Dr Leman (01784 414406; Patrick.Leman@rhul.ac.uk) if you wish to discuss the project any further. We stress again that the project would be interesting for your students and we very much hope that your staff would feel happy to discuss and input to these issues with us as well: this is a new topic for research and our work would benefit from the input of professionals who have experience of children's abilities on a daily basis and at first hand. We will contact you again by telephone but, in the meantime, if you are interested in being involved in this study, please let us know by using either of the contact numbers above.

Yours with best wishes,

[Names of the researcher and her supervisor]

Appendix 14. Consent form for parents (Study Four)

[University Headed Paper]

Re. Study of children's understanding and evaluation of arguments

Dear Parent/ Guardian

I am a PhD student studying at Royal Holloway, University of London. For my research project, I am carrying out a study of children's understanding and evaluation of the persuasiveness of arguments, supervised by Dr. Patrick Leman.

Briefly, what we plan to do is asking children to discuss ideas and generate arguments about common social issues, such as the importance of wearing school uniforms, or the reasons why animals should be kept in zoos. Children will engage in a group discussion with their peers. Our aim is to gather some information about the sorts of arguments children at different ages typically use on various topics. We also plan asking children to work individually at a computer to evaluate different arguments by rating its strength according to a scale. Our aim is to explore what kind of arguments persuade children, and also whether children can be persuaded by these arguments. This work may have future implications in educational settings, such as help teachers to understand and enhance children's argument skills.

All children will find this activity interesting and similar to the normal activities they would undertake in school everyday. In terms of the study itself, nobody except Dr Leman and me will see the data or any audio-recorded material, and information on each child will be recorded using an anonymous identifying number only. If you would like to discuss any aspect of the research with Dr. P. Leman you can contact him by email on Patrick.Leman@rhul.ac.uk, or by phone on 01784414406. If you need to contact me, please call 017843703 or email me (A.P.Macedo@rhul.ac.uk). We will also ask your child, personally, whether they are happy to take part in the study and they will be allowed to withdraw from a session at any time if they do not wish to continue.

This study has been reviewed and approved by the Psychology Department internal ethical procedure at Royal Holloway, University of London. Ms. Susan Porter, the Head Teacher, has also given permission for this study to be carried out.

Please complete and return the consent form overleaf to indicate whether or not you agree to your child taking part in this study. Please retain a copy of this sheet for your future information.

Thank you for taking the time to read this information.

[Names of the researcher and her supervisor]

✂---

I have received an information sheet explaining the purpose of the study and have had the opportunity to ask further questions.

I agree that my son or daughter may participate in the above research to be carried out by Ana Macedo.

I am assured that my son's or daughter's right to privacy and confidentiality will be respected at all times.

Please return this section to (name of teacher) by (date)

ID number …………………..

I CONSENT/ DO NOT consent to my son/daughter taking part in the research being conducted by Ana Macedo.

Name of parent/ guardian ……………………………………………………..

Signature of parent/ guardian……………………………………..................…

Name of child ……………………………..................... Date ………...

Appendix 15. Questionnaire of evaluation of argument strength (Pilot Study)

[University headed paper]

Evaluation of the Strength of Arguments

Information sheet

[names and email addresses of researcher and her supervisor]

You are invited to take part in a research study. We are interested in gathering information about the sorts of arguments adults consider strong. Your task is to respond to a simple questionnaire designed to evaluate your preference for different arguments related to scientific inventions created by children. The information you provide will be used to help us design a study about children's understanding of persuasive arguments.

You do not have to take part in this study if you don't want to. If you decide to take part you may withdraw at any time without having to give a reason.

Please be assured that the information you provide in this questionnaire is confidential. Individual information and data obtained are not accessible to third parties outside our research group. If you would like to discuss any aspect of the research with Ana Macedo, please contact her by email on a.p.macedo@rhul.ac.uk, or by phone on 01784 443703.

You may retain this information sheet for reference. Please feel free to ask any questions you may have before completing the consent form (which will be stored separately from the anonymous information you provide for the research project).

This study has been approved by the Psychology Department Ethical Committee (which reports to the Royal Holloway, University of London Ethics Committee). Our work conforms to the ethical guidelines laid out by the *British Psychological Society* (BPS), *American Psychological Association* (APA), and *Society for Research in Child Development* (SRCD).

[University headed paper]

Evaluation of the Strength of Arguments

Consent form

You have been asked to participate in a study about how students evaluate different arguments, which is being carried out by Ana Macedo. Have you (please circle yes or no):

• Read the information sheet about the study?	yes	no
• Had an opportunity to ask questions?	yes	no
• Got satisfactory answers to your questions?	yes	no
• Understood that you're free to withdraw from the study at any time?	yes	no
• Do you agree to take part in the study?	yes	no

Signature____ Date _______

Name in block letters ____

NB: This consent form will be stored separately from the anonymous information you provide.

[University headed paper]

Evaluation of the Strength of Arguments

Thank you for taking the time to complete this questionnaire. Please provide the following information about yourself:

Date of birth ________________ (Day / Month / Year)

Please tick:

Male ☐ Female ☐

Please read the following instructions:

This questionnaire is in FOUR sections. Each section asks you to evaluate the strength of arguments in favour and against several inventions created by children regarding different scientific topics.

Section I – asks you to evaluate the advantages and disadvantages of two inventions for “Protecting the environment”

Section II – asks you to evaluate the advantages and disadvantages of two inventions for “Advances in Technology”

Section III – asks you to evaluate the advantages and disadvantages of two inventions for “Improving people’s lifestyle”

Section IV – asks you to evaluate the advantages and disadvantages of two inventions for “Health”

Thank you for taking the time to complete this questionnaire!

Section I*: Below you will find several arguments in favour and against two inventions related to the theme: "Protecting the Environment". Please evaluate the strength of each argument, using a 1 to 5 scale, where 1 is marked "very weak", and 5 "very strong"*

Invention 1: City recycling robot. It is a small robot that will go around a city and pick up any trash. It is able to identify and separate garbage using special-made sensors to look for recyclable materials. Material that can be recycled would be put into appropriate sections inside the robot	
Advantages of a city recycling robot	
Cheap to build	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
Cities would be cleaner	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
Some people do not care about recycling, but the robot would do it automatically	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
Recycling avoids pollution	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
Recycling avoids deforestation	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
Disadvantages of a city recycling robot	
The robot picks up the trash, but it is incapable to recycle materials	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
Expensive to put into practice in cities	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
Does not solve the problem of factories that do not recycle materials	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
Robots would consume fuel	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
Robots would pollute the environment	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
Invention 2: Rain converter. It is a mobile water unit that can transform rain into drinkable water and supply homes. The unit is displayed in the roof of a house where it captures the rain.	
Advantages of a rain converter	
Prevent the world of running short of fresh water	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
Reduce the harm done to the environment by the water industry	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
Cheap alternative source of water	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
Reduces flooding	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
Water storage could be used for fire prevention	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
Disadvantages of a rain converter	
It would not work in places where it does not rain often	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
If people capture all rain, rivers would run dry.	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
Quality of filtered rainwater might be not very good	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
It does not rain during the Summer	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
A small device ca not filter rainwater	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong

Section II*: Below you will find several arguments in favour and against two inventions related to the theme: "Advances in Technology". Below you will find several arguments in favour and against these innovative ideas. Please evaluate the strength of each argument, using a 1 to 5 scale, where 1 is marked "very weak", and 5 "very strong"*

Invention 1: Translation telephone. It is a small device, similar to a regular mobile phone, with the ability for universal translation. People could call anyone in the world and the telephone would do instant language translation. Translation would be available for all languages in the world.	
Advantages of a translation telephone	
Improve communication in multiple languages	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
Make friends from other cultures	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
Deliver information in multiples languages	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
Cheaper than human translation	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
Quicker than human translation	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
Disadvantages of a translation telephone	
Machines would not be able to translate ambiguous words and sentences	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
Translators would be unemployed	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
Calls would be expensive	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
People would not be interested in learning new languages	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
Machines are not reliable	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
Invention 2: Flying car. This car is made of lightweight material and would be able to take off and fly above the road at hundreds of miles per hour. Flying cars would have an automatic pilot, so people would not have to drive.	
Advantages of a flying car	
Cheaper than airplanes	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
Quick to go to a distant place	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
People would not have to drive	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
There would not be traffic jams	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
Flying cars would be good as ambulances	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
Disadvantages of a flying car	
It is not a safe method of transport	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
It would be costly to build	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
It would consume a lot of fuel	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
There would be a lot of air crashes	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
It would not be practical	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong

Section III: *Below you will find several arguments in favour and against two inventions related to the theme: "Improving people's lifestyle". Below you will find several arguments in favour and against these innovative ideas. Please evaluate the strength of each argument, using a 1 to 5 scale, where 1 is marked "very weak", and 5 "very strong"*

Invention 1: Clever hat. This hat protects you in all weathers – sun, wind, snow, lightning – you press a button and things come out. For example, an umbrella for rain.	
Advantages of a clever hat	
It would be fun to wear	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
It would be practical	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
It would protect the eyes from the sunlight	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
Good for bold people	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
People could ride a bicycle in the rain without carrying an umbrella in one hand	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
Disadvantages of a clever hat	
It would not be feasible	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
It is not an important invention	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
It would make hair dry and puffy	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
It is better to have different varieties of hats	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
It would be too heavy for people's head and neck	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
Invention 2: Locator of lost things. This is a very small device with a hook on it (or other means of attachment) to put on your glasses, on your house keys, etc. that will emit a shrill sound or flash a light after you dial a number on your mobile phone.	
Advantages of a locator of lost things	
Find misplaced or lost things quickly	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
Reduce people's stress	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
People wouldn't be late for work	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
Cheap to build	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
People could also used it to locate a lost dog or cat	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
Disadvantages of a locator for lost things	
People would forget to use it	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
It is not very practical	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
People would need lots of locators for using it on different things	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
It is not an original idea	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
People already use too many electronic devices	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong

Section IV*: Below you will find several arguments in favour and against two inventions related to the theme: "Health". Below you will find several arguments in favour and against these innovative ideas. Please evaluate the strength of each argument, using a 1 to 5 scale, where 1 is marked "very weak", and 5 "very strong"*

Invention 1: Healthy ice cream. Healthy foods, such as broccoli, carrots, tomato soup, etc. would taste as good as a sweet ice cream. Instead of eating a meal of chicken and potatoes, you can eat a tasty ice cream with the same nutrients and vitamins.	
Advantages of a healthy ice cream	
Good for people who are picky eaters	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
Meals would be fun for children	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
Prevent obesity	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
Parents would not problems to convince their children to eat healthy food	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
Cheaper than real food	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
Disadvantages of a healthy ice cream	
Vegetable ice creams would not taste as good as chocolate ice creams	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
Real fruit and vegetables are healthier	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
It would not be popular amongst adults	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
Restaurants would be empty	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
It would be boring to eat ice creams every day	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
Invention 2: Spray for safe food. This spray is made of water and other organic components and cleans all fruit and vegetables from all bacteria, toxins, and pesticides. It's really easy to use: just spray your food and it's ready to eat!	
Advantages of a spray for food	
People would not have to peel fruit	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
Easy to use	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
More efficient in killing germs than using water	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
Prevent diseases provoked by toxins and pesticides	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
More hygienic	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
Disadvantages of a spray for food	
Difficult to create a safe spray	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
No use in some fruits and vegetables that need to be peeled	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
Expensive	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
Does not solve the problem of pesticides that get inside fruits and vegetables	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong
The spray could leave a bad taste	(1) very weak, (2) weak, (3) neutral, (4) strong, (5) very strong

Appendix 16. Script of the video-materials (Study Five)

Recycling robot (Environment category)

Scenario 1: Corner sequence

Arguer [argument] *I am in favour of the recycling robot, because it would keep cities clean.*

Opponent: [clarify-?] *So, you think we need robots to keep cities clean?*

Arguer: [clarify] *Well, some cities are very dirty, so robots would very useful.*

Opponent: [counter-C] *But cities already have recycling bins. If people recycle, we do not need robots to do it.*

Scenario 2: Rebuttal

Arguer [argument] *I am in favour of the recycling robot, because it would keep cities clean.*

Opponent: [counter-C] *But cities already have recycling bins. If people recycle, we don't need robots to do it.*

Arguer: [counter-C] *But some people don't recycle, so we need other solutions, like robots to keep cities clean.*

Scenario 3: Case sequence

Arguer: [argument] *I am in favour of the recycling robot, because it would keep cities clean.*

Opponent: [case-?] *Let's say we live in a big city that gets very dirty every day. Would we have to buy lots of robots?*

Arguer: [clarify] *Yes, we could get several robots to keep cities clean.*

Opponent: [counter-C] *But this would be very expensive to put into practice in cities.*

Scenario 4: Block

Arguer: [argument] *I am in favour of the recycling robot, because it would keep cities clean.*

Opponent: [case-?] *Let's say we are in a big city that gets very dirty every day. Would we have to buy lots of robots to keep the city clean?*

Arguer: [counter-C] *Maybe not. Robots last long and they can work several times a day. A few robots would be enough to keep large cities clean.*

Rain converter (Environment category)

Scenario 1: Corner sequence

Arguer	[argument] *I am in favour of rain converter, because it is the cheapest source of water.*
Opponent:	[clarify-?] So, you think people would not have to buy fresh water anymore?
Arguer:	[clarify] Exactly, this would be the cheapest alternative source of water because rain is free.
Opponent:	[counter-C] But people would still have to buy water, because there might not be enough rain.

Scenario 2: Rebuttal

Arguer	[argument] *I am in favour of rain converter, because it is the cheapest source of water.*
Opponent:	[counter-C] But I think people would spend a lot of money buying a rain converter and maintaining it. Maybe a large family needs to acquire several rain converters
Arguer:	[counter-C] But that it is still cheaper than buying water regularly for the whole family.

Scenario 3: Case sequence

Arguer:	[argument] *I am in favour of rain converter, because it is the cheapest source of water.*
Opponent:	[case-?] let’s say it doesn’t rain for weeks. How would we get water then?
Arguer:	[clarify] In that case, people would have to buy fresh water.
Opponent:	[counter-C] So, the rain converter wouldn’t work in places where it doesn’t rain often.

Scenario 4: Block

Arguer:	[argument] *I am in favour of rain converter, because it is the cheapest source of water.*
Opponent:	[case-?] Let’s say it doesn’t rain for 4 weeks. How would you get water then?
Arguer:	[counter-C] Well, people could store water for times when it doesn’t rain.

Translation telephone (Technology category)

Scenario 1: Corner sequence

Arguer [argument] *I am in favour of a translation telephone, because it would improve communication between people of different cultures who speak different languages.*

Opponent: [clarify-?] So you think people could have a normal telephone conversation using different languages?

Arguer: [clarify] Well, I am not saying is a regular telephone. It is an electronic translator device that people can use to communicate with each other.

Opponent: [counter-C] So it would not be used in everyday life like a normal telephone.

Scenario 2: Rebuttal

Arguer [argument] *I am in favour of a translation telephone, because it would improve communication between people of different cultures who speak different languages.*

Opponent: [counter-C] But people can learn languages; they don't need a device to do translation.

Arguer: [counter-C] But the telephone would be very useful for people who travel often and have to talk in a language they don't know.

Scenario 3: Case sequence

Arguer: [argument] *I am in favour of a translation telephone, because it would improve communication between people of different cultures who speak different languages*

Opponent: [case-?] Let's say you work with people from different countries. Would you use the translator to call them every day?

Arguer: [clarify] Yes, in that case you can use the translator.

Opponent: [counter-C] But long calls could be very expensive.

Scenario 4: Block

Arguer: [argument] *I am in favour of a translation telephone, because it would improve communication between people of different cultures who speak different languages.*

Opponent: [case-?] Let's say you work with people from different countries, and you need to call them every day. Would you use the telephone regularly?

Arguer: [counter-C] In that case it would be good to learn their language. But the translator would be useful at the start.

Flying car (Technology category)

Scenario 1: Corner sequence

Arguer [argument] *I am in favour of flying car, because it would be quick to go to a distant place.*

Opponent: [clarify-?] Why do you think it would be quicker to travel?

Arguer: [clarify] Well, flying cars would fly at hundreds of miles per hour.

Opponent: [counter-C] But we could use aeroplanes, because they are quick too.

Scenario 2: Rebuttal

Arguer [argument] *I am in favour of flying car, because it would be quick to go to a distant place.*

Opponent: [counter-C] But we already have aeroplanes, and they are quick too

Arguer: [counter-C] But we cannot use aeroplanes on a daily basis.

Scenario 3: Case sequence

Arguer: [argument] *I am in favour of flying car, because it would be quick to go to a distant place.*

Opponent: [case-?] What if you just need to go a place situated at a short distance from your home?

Arguer: [clarify] You could use a flying car as well.

Opponent: [counter-C] But a flying car would cost a lot to build and maintain.

Scenario 4: Block

Arguer: [argument] *I am in favour of flying car, because it would be quick to go to a distant place.*

Opponent: [case-?] What if you just need to go a place situated a short distance from your home?

Arguer: [counter-C] A flying car could be used for short and long distances, and you would get there quickly, especially if you’re in a hurry.

Clever hat (Lifestyle category)

Scenario 1: Corner sequence

Arguer [argument] *I am in favour of clever hat, because people could do more stuff in the rain without carrying an umbrella.*

Opponent: [clarify-?] So you think that it would be useful in rainy days?

Arguer: [clarify] Yes, people could ride a bicycle in the rain without carrying an umbrella in one hand.

Opponent: [counter-C] But people would get wet anyway.

Scenario 2: Rebuttal

Arguer [argument] *I am in favour of clever hat, because people could do more stuff in the rain without carrying an umbrella.*

Opponent: [counter-C] But people already have hats for different weathers.

Arguer: [counter-C] But it is better to have just one that protects you in all weathers.

Scenario 3: Case sequence

Arguer: [argument] *I am in favour of clever hat, because people could do more stuff in the rain without carrying an umbrella.*

Opponent: [case-?] What if someone is very tiny and uses a heavy hat like this?

Arguer: [clarify] Well, the hat would come in different sizes for different people.

Opponent: [counter-C] But it would be too heavy for people's heads and necks!

Scenario 4: Block

Arguer: [argument] *I am in favour of clever hat, because people could do more stuff in the rain without carrying an umbrella.*

Opponent: [case-?] What if someone is very tiny and uses a heavy hat like this?

Arguer: [counter-C] Well, the hat would come in different sizes, so all people could use it.

Locator for lost things (Lifestyle category)

Scenario 1: Corner sequence

Arguer [argument] *I am in favour of a locator for lost things, because it can find misplaced or lost things quickly.*

Opponent: [clarify-?] So you're saying that it would save people's time?

Arguer: [clarify] Yes, it would help people finding lost things more efficiently.

Opponent: [counter-C] But people don't know what they are going to lose in advance!

Scenario 2: Rebuttal

Arguer [argument] *I am in favour of a locator for lost things, because it can find misplaced or lost things quickly.*

Opponent: [counter-C] But people don't know what they are going to lose in advance.

Arguer: [counter-C] But if you're always losing the same item, you can use the locator to prevent losing it again.

Scenario 3: Case sequence

Arguer: [argument] *I am in favour of a locator for lost things, because it can find misplaced or lost things quickly.*

Opponent: [case-?] What if you're one of those people who are always losing everything, like your keys, your glasses and your camera?

Arguer: [clarify] You could use the locator on all those things.

Opponent: [counter-C] But then people would need lots of locators for using on different things.

Scenario 4: Block

Arguer: [argument] *I am in favour of a locator for lost things, because it can find misplaced or lost things quickly.*

Opponent: [case-?] What if you're one of those people who are always losing everything, like your keys, your glasses, your camera…?

Arguer: [counter-C] Then you need to pay more attention to the items you frequently can't find, and use the locator to prevent it.

Healthy ice-cream (Health category)

Scenario 1: Corner sequence

Arguer	[argument] *I am in favour of healthy ice-creams, because these would make meals fun for children.*
Opponent:	[clarify-?] So, you think children would like to eat ice-creams every day?
Arguer:	[clarify] Well, I'm saying that this could be a meal replacement option.
Opponent:	[counter-C] But it could be boring to eat ice-creams every day!

Scenario 2: Rebuttal

Arguer	[argument] *I am in favour of healthy ice-creams, because these would make meals fun for children.*
Opponent:	[counter-C] But ice-creams might not be popular amongst some children and adults.
Arguer:	[counter-C] But it would be good for people who are picky eaters.

Scenario 3: Case sequence

Arguer:	[argument] *I am in favour of healthy ice-creams, because these would make meals fun for children.*
Opponent:	[case-?] What if healthy ice-creams don't have all the essential nutrients and vitamins?
Arguer:	[clarify] Well, ice creams would be specially made to have all essential nutrients and vitamins.
Opponent:	[counter-C] But I think real fruit and vegetables are healthier.

Scenario 4: Block

Arguer:	[argument] *I am in favour of healthy ice-creams, because these would make meals fun for children.*
Opponent:	[case-?] What if healthy ice-creams don't have all the essential nutrients and vitamins?
Arguer:	[counter-C] Ice creams would have all essential nutrients and vitamins, because they would be made of real fruits and vegetables.

Spray for safe food (Health category)

Scenario 1: Corner sequence

Arguer [argument] *I am in favour of a spray for safe food, because it could prevent diseases caused by chemicals.*

Opponent: [clarify-?] So you think it could be used to clean all fruits and vegetables?

Arguer: [clarify] Yes, the spray would clean the chemicals that stay on the surface of fruits and vegetables.

Opponent: [counter-C] But it would have no use in some fruits and vegetables that need to be peeled.

Scenario 2: Rebuttal

Arguer [argument] *I am in favour of a spray for safe food, because it could prevent diseases caused by chemicals.*

Opponent: [counter-C] But people can use water to wash off chemicals from fruits and vegetables.

Arguer: [counter-C] But the spray would be more efficient in eliminating chemicals than using water.

Scenario 3: Case sequence

Arguer: [argument] *I am in favour of a spray for safe food, because it could prevent diseases caused by chemicals.*

Opponent: [case-?] What if chemicals get inside fruits and vegetables?

Arguer: [clarify] Well, I think the chemicals stay on the surface of fruits and vegetables.

Opponent: [counter-C] But if they do enter fruit, the spray doesn’t solve this problem.

Scenario 4: Block

Arguer: [argument] *I am in favour of a spray for safe food, because it could prevent diseases caused by chemicals.*

Opponent: [case-?] What if chemicals get inside fruits and vegetables?

Arguer: [counter-C] Maybe you cannot remove all chemicals, but the spray would definitely remove a substantial amount of surface chemicals, and prevent diseases.

Appendix 17. Outline script/ information for children featuring in the videos (Study Five)

Instructions regarding the aim of the study:

"Hello, I am interested in knowing what children at different ages think about scientific inventions created by other children. I will be testing children's responses to videos of two children debating their inventions, and I need your help in preparing these videos. The videos will be shown to small groups of children in schools"

Instructions regarding the content of the videos:

"I would like you to imagine the following scenario: there is a Science Invention Contest in your school, and all of you will be participating with different projects. Each one of you will be asked to introduce the invention you created for the competition, and to explain its purpose. You do not have to come up with your own ideas for the inventions, because they were arranged in advance. Please remember that the videos will be seen and evaluated by other children, so your task is to give a convincing performance, i.e., to persuade other children that your invention is interesting and the potential winner of the competition".

Instructions regarding the materials/script:

"We will record the videos in pairs, i.e., I will ask two of you to participate in the first video, and then the other two will participate in the second video. As you can see [researcher holds the cards], there are two pairs of inventions (e.g., recycling robot/ rain converter, and clever hat/locator of lost things), related to two themes respectively (e.g., Environment and Lifestyle). Please have a look at the cards, and choose which invention you would like to represent"

Instructions regarding video recording (script rehearsal):

"You are going to present two inventions about the topic (e.g., Environment). Your task is to engage in an argumentative dialogue about the advantages and disadvantages of your inventions. One of you [researcher says child's name] will be the arguer, and the other [researcher says child's name] will be the opponent. Then you will switch roles for the second invention. I will show white cards with lines for the arguer (i.e., the child defending the invention), and I will show green cards with lines for the opponent (i.e., the child opposing the invention)" [Give time for children get familiar with the script and read the lines. Let children rehearse as long as necessary]

Further instructions regarding video recording:

"That's great! You read your lines very well! Now, let's try to simulate a real dialogue. I know this might be a bit difficult to do, but remember that the audience (other children) will not know that you are reading a text. So, to give the impression that you are talking naturally, try to look at each other whenever possible, instead of looking straight to the camera all the time. Also, try to give emphasis to your speech when you are reading sentences ending in a question mark or an exclamation mark".

Appendix 18. Example of a covering letter for schools (Study Five)

[University Headed Paper]

Date here

Dear (Name of Head Teacher),

I am a PhD student studying at Royal Holloway University of London under the supervision of Dr. Patrick Leman. I am writing to ask if you would be interested in participating in my study of children's evaluation of arguments.

Dr Leman and I fully appreciate the pressures and demands upon students and staff at schools, and want to reassure you that the work we have planned will be designed to cause minimal disruption to your regular classroom routines. In fact, what we envisage involves asking students to think about science topics and evaluate different arguments related to those issues.

Briefly, what we plan to do is showing a video about a scientific topic (e.g., protecting the environment) to groups of children. Children will then be asked to fill out a simple questionnaire regarding their opinions on the arguments discussed in the video. We hope to engage students aged 8-9 and 11-12 years, and do not expect that the task will take more than 10 minutes to complete. Our aim is to explore what kind of strategic arguments persuade children, and also whether children can be persuaded by these arguments.

If you are able to participate, I would be hoping to visit your school and assist in classroom activities for a day in early June. Dr Leman or I would be very happy to explain any of the details further to you or your staff at a convenient time. All of our work is subject to approval by our departmental ethics committee which conforms to the ethical standards of the British Psychological Society (BPS) and American Psychological Association (APA) including full parental consent.

Please do feel free to contact me (01784 443703; A.P.Macedo@rhul.ac.uk) or Dr Leman (01784 414406; Patrick.Leman@rhul.ac.uk) if you wish to discuss the project any further. We stress again that the project would be interesting for your students and we very much hope that your staff would feel happy to discuss and input to these issues with us as well: this is a new topic for research and our work would benefit from the input of professionals who have experience of children's abilities on a daily basis and at first hand. We will contact you again by telephone but, in the meantime, if you are interested in being involved in this study, please let us know by using either of the contact numbers above.

Yours with best wishes,

[Names of the researcher and her supervisor]

Appendix 19. Consent form for parents (Study Five)

[University Headed Paper]

STUDY OF CHILDREN'S UNDERSTANDING OF PERSUASIVE ARGUMENTS

Dear Parent/ Guardian

I am a PhD student studying at Royal Holloway, University of London, and I am currently carrying out a study of children's understanding and evaluation of persuasive arguments. My work is supervised by Dr Patrick Leman, Reader in Psychology at Royal Holloway. This study forms part of a larger body of work in which we hope to be able to establish how argument skills change with age and develop in conversation.

Your school has kindly agreed to allow us to approach you, as a parent, to ask if you would permit your child to participate in some of this research. Briefly, what we plan to do is showing a video about a scientific topic (e.g., protecting the environment) to groups of children. Children will then be asked to fill out a simple questionnaire regarding their opinions on the arguments discussed in the video. We hope to engage children aged 8-9 years (year 4) and 11-12 years (year 7), and do not expect that the task will take more than 10 minutes for each group to complete. Our aim is to explore what kind of strategic arguments persuade children, and also whether children can be persuaded by these arguments.

Although we are engaged in pure academic research at this stage we very much hope that this work will, in due course, inform practice and have implications in educational settings, such as helping teachers to understand and enhance children's argument skills. We will certainly keep parents, staff, and the children informed of the outcomes of this work. We have extensive experience of conducting this sort of research, and we know that children find this sort of activity stimulating – most children really want to take part and we have never encountered a situation where a child has not wanted to participate in a discussion such as this. However, alongside your consent as a parent, we also check that every child is happy to take part and make it clear that they can withdraw from the study at any point if they wish.

We also take issues of data protection and participant anonymity very seriously: Information on each child will be held using an anonymous identifying number only, and nobody except Dr Leman and me will see the data. If you would like to discuss any aspect of the research with Dr Leman you can contact him by email on Patrick.Leman@rhul.ac.uk, or by phone on 01784 414406. If you need to contact me, please call 01784 443703 or email me (A.P.Macedo@rhul.ac.uk).

This study has been approved by the Psychology Department Ethical Committee (which reports to the Royal Holloway, University of London Ethics Committee). Our work conforms to the ethical guidelines laid out by the *British Psychological Society* (BPS), *American Psychological Association* (APA), and *Society for Research in Child Development* (SRCD).

Please complete and return the consent form, attached, and retain a copy of this sheet for your information. Thank you for taking the time to read this information.

[Names of the researcher and her supervisor]

✄---

STUDY OF CHILDREN’S UNDERSTANDING OF PERSUASIVE ARGUMENTS

CONSENT FORM FOR RETURN TO CLASS TEACHER

I have received an information sheet explaining the purpose of the study and have had the opportunity to ask further questions.

I agree that my son or daughter may participate in the above research to be carried out by Ana Macedo.

I am assured that my son’s or daughter’s right to privacy and confidentiality will be respected at all times.

I understand that I may withdraw my son or daughter from the study at any point during the schedule of research. If my son or daughter indicates that he or she does not wish to participate, their wishes will be respected.

The study will take place on ……….. (specify date) so please return this section to the class teacher by ………………….(specify date)

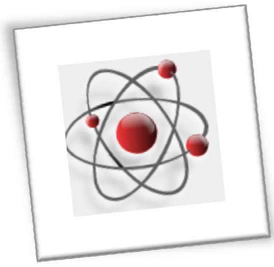
ONLY IF YOU DO NOT WISH YOUR CHILD TO TAKE PART

I DO NOT consent to my son/daughter taking part in the research being conducted by Ana Macedo.

Signature of parent/ guardian ……………………..…Name of parent/ guardian ………………

Name of child ……………………………………   Date …………………………………

Appendix 20. Initial assessment of children's opinions on the topics (Study Five)

 Science Competition

What do you think about scientific inventions?

Please provide the following information about yourself:

Date of birth __________________

Please tick:

Male ☐ Female ☐

Thank you! Please read the instructions:

You will watch a video of children discussing inventions they created for a Science Competition in their school. Before listening to children's ideas, let's look at the description of their inventions.

Inventions are divided by themes: Environment, Technology, Lifestyle, and Health. Please read the following information and rate how good you think these inventions are.

Do you think these are good inventions for protecting the environment? **(Please check or circle where appropriate)**	
City recycling robot. It is a small robot that will go around a city and pick up trash. It's able to identify and separate garbage using special-made sensors to look for recyclable materials. Material that can be recycled would be put into appropriate sections inside the robot	1. very weak 2. weak 3. average 4. good 5. very good
Rain converter. It is a mobile water unit that can transform rain into drinkable water and supply homes. The unit is displayed in the roof of a house where it captures the rain.	1. very weak 2. weak 3. average 4. good 5. very good

Do you think these are good inventions for improving technology? **(Please check or circle where appropriate)**	
Translation telephone. It is a small device, similar to a regular mobile phone, with the ability for universal translation. People could call anyone in the world and the telephone would do instant language translation. Translation would be available for all languages in the world.	1. very weak 2. weak 3. average 4. good 5. very good
Flying car. This car is made of lightweight material and would be able to take off and fly above the road at hundreds of miles per hour. Flying cars would have an automatic pilot, so people would not have to drive.	1. very weak 2. weak 3. average 4. good 5. very good

Do you think these are good inventions for improving people's lifestyle? **(Please check or circle where appropriate)**	
Clever hat. This hat protects you in all weathers – sun, wind, snow, lightning – you press a button and things come out. For example, an umbrella for rain.	1. very weak 2. weak 3. average 4. good 5. very good
Locator of lost things. This is a very small device with a hook on it to put on your glasses, and on your house keys, that will emit a shrill sound or flash a light after you dial a number on your mobile phone.	1. very weak 2. weak 3. average 4. good 5. very good

Do you think these are good inventions for improving health? **(Please check or circle where appropriate)**	
Healthy ice-cream. Healthy foods, such as broccoli, carrots, tomato soup, etc. would taste as good as a sweet ice-cream. Instead of eating a meal of chicken and potatoes, you can eat a tasty ice-cream with the same nutrients and vitamins.	1. very weak 2. weak 3. average 4. good 5. very good
Spray for safe food. This spray is made of water and other organic components and cleans all fruit and vegetables from all chemicals. It's really easy to use: just spray your food and it is ready to eat!	1. very weak 2. weak 3. average 4. good 5. very good

Appendix 21. Final assessment of children's opinions on the arguments (Study Five)

Inventions for the Environment category (Please check or circle where appropriate)	
In the debate, do you think the inventor of the recycling robot was good or weak at defending the invention?	(1) very weak (2) weak (3) average (4) good (5) very good
If you had to choose, which thing on the list would you pick as the most important thing to explain your previous answer?	(1) the inventor had the best arguments (2) the opponent had the best arguments (3) both inventor and opponent had strong arguments (4) I do not know
After listening to the debate about the recycling robot, how would you rate this invention?	(1) very weak (2) weak (3) average (4) good (5) very good
In the debate, do you think the inventor of the rain converter was good or weak at defending the invention?	(1) very weak (2) weak (3) average (4) good (5) very good
If you had to choose, which thing on the list would you pick as the most important thing to explain your previous answer?	(1) the inventor had the best arguments (2) the opponent had the best arguments (3) both inventor and opponent had strong arguments (4) I do not know
After listening to the debate about the rain converter, how would you rate this invention?	(1) very weak (2) weak (3) average (4) good (5) very good
Who do you think should be the winner for the category "Environment" in this competition?	Inventor of the recycling robot ☐ Inventor of the rain converter ☐

Inventions for the Technology category (Please check or circle where appropriate)	
In the debate, do you think the inventor of the translation telephone was good or weak at defending the invention?	(1) very weak (2) weak (3) average (4) good (5) very good
If you had to choose, which thing on the list would you pick as the most important thing to explain your previous answer?	(1) the inventor had the best arguments (2) the opponent had the best arguments (3) both inventor and opponent had strong arguments (4) I do not know
After listening to the debate about the translation telephone, how would you rate this invention?	(1) very weak (2) weak (3) average (4) good (5) very good
In the debate, do you think the inventor of the flying car was good or weak at defending the invention?	(1) very weak (2) weak (3) average (4) good (5) very good
If you had to choose, which thing on the list would you pick as the most important thing to explain your previous answer?	(1) the inventor had the best arguments (2) the opponent had the best arguments (3) both inventor and opponent had strong arguments (4) I do not know
After listening to the debate about the flying car, how would you rate this invention?	(1) very weak (2) weak (3) average (4) good (5) very good
Who do you think should be the winner for the category "Technology" in this competition?	Inventor of the translation telephone ☐ Inventor of the flying car ☐

Inventions for the Health category (Please check or circle where appropriate)	
In the debate, do you think the inventor of the healthy ice-cream was good or weak at defending the invention?	(1) very weak (2) weak (3) average (4) good (5) very good
If you had to choose, which thing on the list would you pick as the most important thing to explain your previous answer?	(1) the inventor had the best arguments (2) the opponent had the best arguments (3) both inventor and opponent had strong arguments (4) I do not know
After listening to the debate about the healthy ice-cream, how would you rate this invention?	(1) very weak (2) weak (3) average (4) good (5) very good
In the debate, do you think the inventor of the spray for safe food was good or weak at defending the invention?	(1) very weak (2) weak (3) average (4) good (5) very good
If you had to choose, which thing on the list would you pick as the most important thing to explain your previous answer?	(1) the inventor had the best arguments (2) the opponent had the best arguments (3) both inventor and opponent had strong arguments (4) I do not know
After listening to the debate about the spray for safe food, how would you rate this invention?	(1) very weak (2) weak (3) average (4) good (5) very good
Who do you think should be the winner for the category “Health” in this competition?	Inventor of the healthy ice-cream ☐ Inventor of spray for safe food ☐

Inventions for the Lifestyle category (Please check or circle where appropriate)	
In the debate, do you think the inventor of the clever hat was good or weak at defending the invention?	(1) very weak (2) weak (3) average (4) good (5) very good
If you had to choose, which thing on the list would you pick as the most important thing to explain your previous answer?	(1) the inventor had the best arguments (2) the opponent had the best arguments (3) both inventor and opponent had strong arguments (4) I do not know
After listening to the debate about the clever hat, how would you rate this invention?	(1) very weak (2) weak (3) average (4) good (5) very good
In the debate, do you think the inventor of the locator for lost things was good or weak at defending the invention?	(1) very weak (2) weak (3) average (4) good (5) very good
If you had to choose, which thing on the list would you pick as the most important thing to explain your previous answer?	(1) the inventor had the best arguments (2) the opponent had the best arguments (3) both inventor and opponent had strong arguments (4) I do not know
After listening to the debate about the locator for lost things, how would you rate this invention?	(1) very weak (2) weak (3) average (4) good (5) very good
Who do you think should be the winner for the category "Lifestyle" in this competition?	Inventor of the clever hat ☐ Inventor of the locator for lost things ☐