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Developmental Process of Dialogical Critical Thinking in Groups of Pupils Aged 4 to 12 Years

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The objective of this study is to model the development of critical thinking in groups of pupils aged 4 to 12 years. A previous study, conducted with groups of pupils aged 9 to 12 years who practiced Philosophy for Children (P4C), proposed a model that shows how critical thinking develops in these age groups. The present empirical study was conducted in three geographical contexts (Quebec, Ontario and France) with 17 classrooms of pupils who had practiced P4C. Based on a qualitative method of analysis that stems from the Grounded Theory, analysis of the 17 transcripts of exchanges resulted in a revised model of the developmental process of critical thinking that is defined by four thinking modes and six epistemological perspectives. Using this revised model, a further analysis of the transcripts illustrated that the development of critical thinking occurred through a process of fading and appropriation/transformation, which is associated with "scaffolding".

Keywords: Critical Thinking, Epistemology, Philosophy for Children, Preschool and Elementary School Pupils, Scaffolding

Introduction

The challenges posed by globalization and social and ethical changes in the 21st century require the use of significant conceptual teaching tools to help young generations find the meaning of events, become involved in improving the common good, and co-construct solutions that are better adapted to this new reality. The conceptual tool favoured by UNESCO (2011) is the development of a critical mind; the medium suggested is teaching philosophy as early as elementary school (UNESCO, 2007).

According to M. Nussbaum (2010, chapter 4), Philosophy for Children (P4C) is considered to be one of the most eloquent approaches for stimulating complex thinking in children. Based on previous studies (among others: Daniel et al., 2005; Daniel et al., submitted), our methodological postulate is that P4C contributes to fostering critical thinking in preschool and elementary school pupils.

Inspired by Vygotsky's social-constructivism, and also by Socrates' maieutics and Dewey's pragmatism, P4C was developed by philosopher Matthew Lipman at the beginning of the 1970s (Lipman, 2003; Lipman et al., 1980). Philosophical dialogue within a community of inquiry, which constitutes the essence of P4C, represents a powerful means for the development of thinking in that it encourages pupils to become active in their reflections (instead of adopting ideas ready-made from adults) and to surpass their initial zone of certainty by co-constructing their points of view with the help of their peers. In the classroom, P4C sessions begin by reading a chapter of a philosophical novel. This narration serves as a context for exploring philosophical concepts (liberty, beauty, friendship, justice, etc.) in which there is no single correct answer. Pupils are then invited to formulate questions they would like to discuss together. Finally, the exchanges among pupils are meant to provide elements of response to the questions posed. The teacher's responsibility consists in guiding the pupils, with questions of a Socratic nature, to engage in a philosophical dialogue.

Although several studies have shown the effect of P4C on the development of thinking skills that are said to be complex, and especially skills related to pupils' logical reasoning (among others: Camhy & Iberer, 1988; Cannon, 1987; Cannon & Weinstein, 1985; Caron, 1990; Gazzard, 1988; Kennedy, 1996; Lane & Lane, 1986), few have focused on understanding the development of critical thinking. This is the objective of the present study[1]. In this paper, the authors present the results of a research project centered on the following question: How is the developmental process of critical thinking manifested in groups of pupils aged 4 to 12 years, when they use P4C? The objective is not to test Lipman's approach, but rather to describe the process of the development of critical thinking when pupils are stimulated using this approach. And since the essence of P4C is social, the analysis focuses on the development of class groups and not the development of individuals.

First, this paper introduces the concept of critical thinking and presents an initial model of the development of critical thinking as it emerged from analyses conducted with groups of pupils aged 9 to 12 years. Second, the paper presents, as a first result, a refined model, as it emerged from the study of groups of pupils aged 4 to 9 years and 9 to 12 years. Third, the paper presents, as a second result, an illustration of how the revised model can be used as an analysis grid. Finally, it offers a discussion about the model and an interpretation of the trends observed in the developmental process in these age groups.

Critical Thinking and Initial Model of the Development of Dialogical Critical Thinking of Groups of Pupils Aged 9 to 12 Years

The origin of the concept of critical thinking can be implic-

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itly found among 17th century philosophers such as Descartes, Bacon and Galileo, who were already aware of the importance of stimulating a mental attitude that would enable human beings to counter prejudices (Lipman, 2003). At the time, two currents clashed: theoreticians who favoured ideas and denigrated practical experimentation; and practitioners who insisted on validating their knowledge to verify its practical utility (see Belaval, 1973, 1974). From the latter perspective was born American Pragmatism, particularly in the writings of Peirce (1956, 1965) in which the rules of formal logic were de-emphasized in favor of applied logic. Following Peirce's footsteps, Dewey (1933, 1983) favoured the use of logic to improve the social experience.

Arising from these reflections, the concept of critical thinking was proposed in the middle of the 20th century. To Robert Ennis (1962, 1985), critical thinking implies logical and creative thinking; it signifies reasonable and reflected thinking that enables one to decide what ought to be believed or done (Ennis, 1985). Richard Paul (1990, 1993) recognized a similarity between critical thinking and the philosophical mind and, from this, linked critical thinking to moral attitudes such as humility, integrity, perseverance, empathy and courage. Matthew Lipman (1988, 2003) stipulates that critical thinking is not an end in itself, but rather a means to facilitate "good" judgment. He defines critical thinking as thinking that is based on criteria, is self-correcting and is sensitive to context. To Lipman, and most philosophers, critical thinking presupposes generic skills, that is, it is transferable to any subject matter.

Then, with the intent of operationalizing dialogical critical thinking (DCT), a first empirical study (1998-2001)[2] was conducted with eight groups of pupils (aged 9 to 12 years) from three different cultural and linguistic backgrounds (Quebec, Mexico and Australia). From this study, the main lines of a developmental process of DCT emerged (Daniel et al., 2002, 2005). Here, the term "developmental" refers to a co-construction process, which presupposes the increasing complexity of thinking[3]. And critical thinking is said to be "dialogical" because it is situated in the context of philosophical dialogue among peers. The components of this first model were four thinking modes (logical, creative, responsible and metacognitive) that are manifested according to three epistemological "perspectives"[4] named egocentricity, relativism and inter-subjectivity.

Categorization of the four components of the model was conducted as follows: pupil interventions that were linked to a search for coherence, to informal logic, to order, to convergence, or to uniformity in discourse were grouped in the logical mode. Pupil interventions linked to a search for meaning, contextualization of points of view and transformation of meanings were grouped in the creative mode, as were interventions that implied original, different or divergent relationships. Interventions that established a connection between behaviour and moral rules or ethical principles with the intention of improving personal and social experience were grouped in the responsible mode. Finally, interventions linked to the ability to think about tasks completed, points of view or opinions expressed (by oneself or by peers) and that denoted a retrospective reflection were grouped in the metacognitive mode.

Thorough analysis led to the observation that the manifestations of these thinking modes were dynamic, that is, they vary from simple to complex[5]. For example, logical thinking begins with statements of perceptions and eventually manifests justification of concepts and argumentation. The authors linked the increasing complexity of thinking to three epistemological perspectives. Interventions that were focused on personal experience were grouped in Egocentricity. Interventions that referred to the idea of openness and tolerance in the awareness of a diversity of viewpoints were grouped in Relativism. Interventions that implied peer interaction and co-construction of arguments to enrich and transform the initial perspective were grouped in Inter-subjectivity.

Furthermore, although a thinking mode associated with egocentricity is considered less critical than a thinking mode associated with inter-subjectivity, both relate to critical thinking insofar as they lie within the scope of processes that lead to elaborating judgments. So the model that emerged from these initial findings constitutes a grid that enables us to analyze movements of thinking using the components associated with critical thinking, from its weakest to its strongest expression. A question remains: Does this initial model reflect the increasing sophistication of critical thinking in groups of younger pupils?

Method of Analysis of the 2009-2012 Study

The present study is qualitative[6]. Its objective is to understand how DCT manifests itself in groups of young pupils who practice P4C, and to model its development. It is inspired by the Grounded Theory (Charmaz, 2005; Glaser & Strauss, 1967). The objective of a Grounded Theory analysis is not to verify the foundations of existing theories, nor to measure the impact of an action with the help of control groups, but rather to draw out a new comprehension of a phenomenon from data collected on the ground (Laperrière, 1997). It is then a matter of coding the data and of making as many links as possible between the codes in order to bring out categories, to group these categories into viable concepts and to bring forth a theory or theoretical elements that are coherent and representative of the context being studied. All the steps of the analysis remain provisional until the end of the analysis, which occurs when a consensus among researchers is reached (Laperrière, 1997; Paillé, 1994).

Participants

The participants were 17 groups of pupils aged 4 to 12 years, from three different schools. To respect the required diversity for the Grounded Theory, the three schools were located in

[2]The project was realized with a grant from the Social Sciences and Humanities Research Council of Canada (SSHRC).

[3]In a different field of study but in a similar vein, Scardamalia & Bereiter use the expression "developmental trajectory" to illustrate the process inherent in knowledge building, which is transformed "from the natural inquisitiveness of the young child to the disciplined creativity of the mature knowledge producer" (2003: p. 1370). Hofer & Pintrick (1997) use the expression "sophistication" of the conceptions to refer to the epistemological levels and their continua (see Gagnon, 2011).

[4]We distinguish epistemological *posture* from epistemological *perspective*. Indeed, whereas the former is linked to an epistemic cognition process identified by the expression of a concept whose object refers to notions of knowledge, the latter refers to the manner in which meanings and representations of the world are constructed, no matter what the object in question: Are these meanings and representations centered on individuals; Do they take into account the points of view of others; Are they directed at principles or concepts; etc. Furthermore, epistemological *posture* refers more to the idea of personal epistemology, as it is studied in the field of cognitive psychology, whereas the social character of P4C, in which our work is situated, presents a "relational epistemology" (Thayer-Bacon, 2003).

[5]Here, variation indicates a movement from centering to decentering and from concrete to abstract (see Daniel et al., 2011).

[6]The project was subsidized by the Social Sciences and Humanities Research Council of Canada (SSHRC) (# 410-2009-0028). And an ethics certificate was granted for collection of the data (CPER 09-031-P(2)) from *Université de Montréal*.

three different geographical contexts: Quebec, Ontario and France. Although the French language was common to all three, these contexts offered a cultural diversity that underlies the diversity of their educational intents and aims. Furthermore, there was also a socioeconomic diversity, attested to by the three school principals: in Quebec the pupils belonged to a working-class environment, in France to a middle-class socio-economic environment, and in Ontario they belonged to a privileged environment[7]. Finally, diversity was also noted in the pupils' philosophical experience: in Quebec and France the pupils had been participating in P4C for one year; in Ontario most of the pupils studied had two years of experience with P4C.

In Quebec seven classrooms of pupils participated in the study, from kindergarten to grade 6. In Ontario six classrooms participated, from kindergarten to grade 5 (grade 6 is part of secondary school there). In France four classrooms participated, from preschool to the end of elementary school (kindergarten and grades 1, 2 and 5). Each group was composed of 25 to 30 pupils. Classes were mixed, approximately 50% girls and 50% boys.

In all the classrooms, P4C was practiced weekly during the entire school year, from October until May or June. Sessions lasted between 30 and 60 minutes each, depending on the age of the pupils and according to the availability of the teachers. The teachers had all previously been trained with P4C, although each teacher applied it in a personal manner in the classroom (i.e.: with or without Lipman material, and with or without educational manuals).

Data Collection Instruments

At the end of the school year (in May or in June according to school availability), a philosophical exchange among the pupils was recorded in each classroom, for a total of 17 exchanges. Recordings were conducted using two microphones (one on the floor in the middle of the class, and a boom microphone that followed the pupils) and two video cameras (one camera covered the whole classroom while another focused on the pupil speaking).

To ensure that the context of the recordings remained as "natural" as possible, the themes were not imposed in advance by the researchers; they therefore differed from classroom to classroom. The length of the recording was equivalent to the normal duration of the weekly session in each class. The recordings were transcribed verbatim by a third party.

Coding and Analysis

Within the framework of this study, analysis of the different manifestations of critical thinking lies within the scope of a social dimension that implies examining the co-construction of meaning during peer exchanges rather than individual performance (as is usually the case in the field of cognitive psychology). This dimension reflects our conception of critical thinking as a social process (see Brookfield, 1987).

Coding focused on the form of thinking (e.g. whether a statement is justified or not) rather than on the content (e.g. whether a statement reflects a prejudice or not). In other words, coding took into account the manner in which points of view were articulated, not the matter that inspired them.

To ensure reliability in the context of a qualitative analysis (Charmaz, 2005; Laperrière, 1997; Savoie-Zajc, 2004; Van der Maren, 1996, 2006), the transcripts were first coded by the researchers, then blind-coded a few weeks later. Adjustments were made until a consensus was reached. Below are the steps followed to formulate a representative model of the developmental process of DCT in pupils aged 4 to 12 years.

The authors: 1) coded each statement from each transcript in order to highlight the thinking skills mobilized by the pupils (definition, description, example, question, etc.) during the exchanges; 2) associated the thinking skills with the corresponding thinking modes (see Table 1).

From this analysis, only the thinking modes observed in the initial model emerged, namely: logical, creative, responsible and metacognitive. Short answers ("yes", "no", "I don't know") directed at the teacher were not included in the coding of thinking skills. In point of fact, there is no means of verifying whether this type of answer implies some contribution from one of the thinking modes observed. A child may answer the teacher's question with a random "yes" or "no", without having given any autonomous thought to his or her position.

For analysis of the epistemological perspectives the authors: 3) recoded each transcript according to two general criteria (centering/decentering and concrete/abstract) that have been previously validated (Daniel et al., 2011); 4) grouped these codes into conceptual categories that correspond to the initial model's epistemological perspectives: egocentricity, relativism and inter-subjectivity (see Table 2).

When the transcript statements did not quite correspond to the three initial epistemological perspectives (among others, because of the participants different age groups), the authors: 5) reanalyzed the transcript by extracting the elements that seemed sufficiently recurrent to constitute specific reference points (see Table 3).

6) The final analysis was completed using general criteria and specific reference points. This enabled the authors to formulate intermediate categories in the model, expressed in terms of "post" and "pre" (post-egocentricity, pre-relativism, post-relativism/pre-inter-subjectivity), and thus further refine the model of the developmental process of DCT.

Results

Model of the Developmental Process of DCT of Groups of Pupils Aged 4 to 12 Years

To explain the model of the developmental process of DCT in groups of pupils aged 4 to 12 years, presented in Table 4, excerpts from exchanges among the pupils were used. The four thinking modes serve as starting points for the examples; the increasing complexity of each thinking mode is illustrated by the epistemological perspectives. Note that the excerpts chosen were simply examples to illustrate a given thinking mode. This does not mean that the excerpts do not display other thinking modes. Indeed, the analyses showed that a single statement could show the mobilization of more than one mode: logical thinking (if it contains a justification), creative thinking (if it implies a new relationship with what was previously stated) and responsible thinking (if it bears on social or moral values).

To highlight the difference between the DCT model and other traditional models that evolve in stages, and to demonstrate the recursive movement of the developmental process, excerpts from both preschool and elementary school classes are presented for those same thinking modes and epistemological perspectives. Finally, it should be noted that not all the compo-

[7]For an example of criteria used to measure a school's socioeconomic background, see the Ministry of Education of Quebec website.

Table 1.
Categorization of thinking skills into thinking modes.

Examples of thinking skills	Thinking modes
Statement, definition, description, explanation, justification, argumentation, etc.	Logical
Example, analogy, comparison, counter-example, nuance, critical question, divergent relationship, etc.	Creative
Statement, description, explanation… related to a social/moral behaviour, a rule, a value, etc.	Responsible
Recalling a thought, a task, an emotion, a situation… related to self or others with the idea of stating, describing, evaluating, correcting a thought, a task, etc.	Metacognitive

Table 2.
General criteria used to code and analyze epistemological perspectives.

Centering/Decentering	Concrete/Abstract	Epistemological perspective
Concerns personal interests (self)	Statements based on concrete experience	Egocentricity
Indicates sensitivity to another person (others)	Relationships grounded in somewhat generalized experience	Relativism
Concerns social values (common good)	Conceptual relationships	Inter-subjectivity

nents of the developmental model are shown by examples; the illustrations concentrate on components that were recurrent in the analyses.

Logical Thinking

Logical thinking, when it is manifested in an epistemology linked to egocentricity, is simply stated and is without nuance. It manifests itself in the concrete perception of an object or a particular situation that refers to the pupil's personal experience. The inferential process is rudimentary; nevertheless it shows coherence between the topic discussed, the teacher's question and the child's own perceptions and opinions.

When logical thinking is manifested in post-egocentricity, it is slightly decentered from the pupil's personal experience, opening up to the experience of his immediate surroundings (parents, friends). The experience is not generalized; it remains concrete and specific.

Logical thinking that is part of the pre-relativism epistemology was manifested in several classrooms. Although the quality of vocabulary and syntax in interventions varies between kindergarten pupils and grade 4 or 5 pupils, there are common characteristics such as: simply stated points of view (neither described nor explained), somewhat generalized statements (not referring to personal experience nor to that of someone close) and unjustified statements (see examples 1 and 2). Sometimes, a logical statement situated in pre-relativism manifests an attempt at justification by introducing a "because" in the speech, but it fails to materialize (see example 3) or it contains a false or a circular justification. In this perspective, DCT is not very sophisticated, but it allows progress to be observed in comparison with the manifestations of previous perspectives.

Example 1: Kindergarten—F10 answers a teacher's question concerning the behaviour of a character in a philosophical tale: *Audrey-Anne did not want to bother her mother*.

Example 2: 4th grade—In an exchange regarding the usefulness of school, M09 answers: *School serves to make you smart*.

Example 3: 3rd grade—In an exchange about the environment, F12 notes: *It's not good to play in amusement parks because*/ *you can't just go to an amusement park you can only play in other parks*.

Relativist logical thinking implies that the statement is both decentered from personal experience and justified. When pupils become aware that their personal point of view is not shared by all, they feel the need to justify that point of view. Decentering leads to justification. In this epistemological perspective, justification is experiential or concrete (examples 4 and 5). It is often stimulated by the teacher, who asks the pupils "*Why do you say that*…?" Our results have shown that even at five years of age (example 4), notwithstanding their syntactic difficulties, children were able to justify their points of view.

Example 4: Kindergarten—M07: (…*instead of yelling*…) *if for example someone wants his toy you can just ask if you can give it back because it was yours to begin with*.

Example 5: 3rd grade—M08: *It is always important to recycle because if you put a bottle outside it takes centuries years* (…).

Post-relativist/pre-inter-subjective logical thinking is manifested in a more elaborate statement. The statement is generalized, which is observable in its articulation in a "they" or "we" form. It is justified with a reason that implies resorting to an inference rather than referring to an experience (examples 6 and 7).

Example 6: 3rd grade—M08: (…) *but if we if people continue to do that it will pollute the Earth more and more and more and it will destroy again destroy the ozone layer and it is very dangerous because the ozone layer it* (*protects*) *a bit from the sun the sun can* (…) *destroy vegetation and things and fruits and things to eat*.

Example 7: 5th grade—F04: *I* (…) *agree with M*11 (*children should not go to war*) *because children are very young and if they are killed they will not have had time to live*.

Creative Thinking

Creative thinking, as a search for meaning, is manifested in an epistemology related to egocentricity through the use of a personal and specific example. In this case, the example can illustrate a point of view (example 8) or replace it (example 9).

Example 8: Kindergarten—F12: *I don't know. But I think that when people are sad when they are angry they cry. Like me sometimes it's like what I do*.

Example 9: 1st grade—In an exchange about handicaps, in particular the disadvantages of deafness, M04, who does not seem to have a point of view on the question, provides a per-

Table 3.
Specific reference points used to code and analyze epistemological perspectives.

Specific reference points	Epistemological perspectives
Statements: -Concrete and referring to the pupil's specific personal experience. -Centered on simple units (vs. Relationships). -Not justified. -Without nuance. -Formulated in "i" form.	Egocentricity
Statements: -Concrete and slightly de-centered, referring to the specific experience of the pupil's immediate circle (family). -Centered on simple units (vs. Relationships). -Not justified. -Generally formulated in "we" form (including self and others) or possessive "he/she" form (*my brother, he is…*).	Post-egocentricity
Statements: -More elaborate than in the previous perspectives because they "describe" a simple situation. -Concrete with the beginnings of an underlying generalization that is grounded in familiar surroundings (parents, friends). -Without nuance or with very little nuance. -Not justified or with an underlying unsuccessful attempt at a justification: justification in "I" form, implicit, circular, false justification, etc. -Generally formulated as a general "we" (*we must love everyone*) or with a generalized "they" (*parents they love their children*).	Pre-relativism
Statements: -Concrete, with underlying beginnings of generalization, and justified. Justifications: -Explicitly articulated. -In the form of concrete and/or incomplete explanation. -With underlying simple relationships between ideas (vs. Units that are independent from each other). -Generally formulated in "you", "we" or generalized "they" form.	Relativism
Statements: -Generalized and show the beginnings of conceptualization. -Justified. Justifications: -Explicitly articulated (i.e.: "because" or "on account of"). -Presented in the form of a reason (supposing an underlying inference rather than linked to a concrete experience). -Related to peer points of view. -Implies the beginnings of a constructive evaluation and divergent thinking.	Post-relativism/ pre-inter-subjectivity
Statements: -Conceptualized. -Justified. -Presented in the form of questioning, doubt or a constructive evaluation of points of view, premises, etc. -Underlying search for different meanings (vs. For a single truth). -Included an argumentation expressed in negotiation form. -Centered on social or ethical preoccupations. -Sometimes explicitly included a self-correction. Justifications: -Explicitly articulated (i.e.: "because" or "on account of"). -Presented in the form of criteria (subjective or objective). -Well developed although not comprehensively. -Linked to peer points of view.	Inter-subjectivity*

*In this study, no manifestations of inter-subjectivity emerged from the transcript analysis. Therefore we chose to reproduce some of the specific criteria which emerged from the previous analysis conducted with groups of pupils who had more than two years of experience with P4C, in relation to criteria inherent in exchanges of a "dia-logical critical" nature (Daniel et al., 2002). The specific criteria related to inter-subjectivity have yet to be verified in a future study.

Table 4.
Model of the developmental process of DCT in groups of pupils aged 4 *to* 12 *years.*

Modes/ Epistemology	Logical	Creative	Responsible	Meta Cognitive
Egocentricity	Statement based on the perceptual experience of a specific and personal fact.	Statement that gives meaning to a personal point of view.	Statement that is related to a personal and specific behaviour tied to a social or moral belief.	Retrospective statement about a personal and specific task, point of view, feeling, etc.
Post-Egocentricity	Statement based on experience (personal or of someone close) + reasoning.	Statement that gives meaning to a personal point of view (but distanced from self).	Particular/concrete statement tied to a moral or social rule (learned). Not contextualized.	Retrospective statement about a personal task, point of view, feeling, etc. (distanced from self).
Pre-Relativism	Somewhat generalized statement that is not justified or with an implicit, circular or false justification.	Statement that is new, divergent, or that presents different situations/ solutions/hypotheses (units) in relation to a personal idea or to someone else's idea.	Statement linked to a somewhat generalized action in a moral or social perspective.	Descriptive retrospective of a personal task, point of view, feeling, etc. (distanced from self).
Relativism	Statement based on a generalization that stems from reasoning and experience. Incomplete/concrete justifications. Sometimes prompted by an adult.	Relationship that gives meaning to a peer's point of view (by completing it or adding a nuance or a new relationship/perspective).	Statement that explains a will to understand/include others (from the immediate environment) with or without appealing to an integrated moral/social rule (contextualized/justified)	Descriptive retrospective of another person's task, thought, etc. (from the immediate environment).
Post-Relativism/ Pre-Inter-Subjectivity	Justification based on "good reasons" that stem from simple reasoning.	Relationship that presents a different context that takes into account the group's perspective.	Statement that justifies a desire to understand/include others (distant environment) with or without the use of an integrated moral/social rule (contextualized/justified).	Descriptive retrospective of another person's task, thought, etc. (distant environment).
Inter-Subjectivity	Justification based on criteria. Conceptualization based on simple reasoning.	Evaluative relationship that provides a different meaning and transforms the perspective.	Doubt that underlies the evaluation of categories (rules, principles, social/moral values).	Evaluative statement that expresses a change in perspective (correction/ self-correction) following the integration of criticism.

sonal example: *In my building there were four fire alarms and I heard one in the night.*

Post-egocentric creative thinking also rests on a personal example, but this example is slightly decentered from the pupil's own experience and includes a person from the pupil's immediate surroundings (parents, friends) (example 10).

Example 10: 4th grade—F07: (…) *each time you want something you think you don't have many things/like if you have lots of things and your friend has just a rabbit you want a rabbit because your friend has one.*

Creative thinking situated in the pre-relativism perspective, although it is still simple, presents two or more contexts or alternatives or hypothetical solutions or explanations (example 11), or it adds an additional and new element to the exchange (example 12). Statements can be related to the pupil's point of view or to the point of view of a peer.

Example 11: Kindergarten—F12: *Because his mother was not very nice and because Audrey-Anne said that his question was stupid.*

Example 12: 2nd grade—Differently from those pupils who agreed that a person who acted badly was a bad person, M07 brings a new distinction: *I acted badly a little but that doesn't mean I am not a good person it means that at that time I didn't have a good behaviour* (…).

Creative thinking that is situated in a relativist perspective increases in complexity to construct relationships between points of view. It is characterized by decentering, in that the relationships produced are intended to give meaning to peer statements. This type of thinking is not dissociated from the point of view of peers, but completes it (example 13), or provides nuances and adds a new dimension (example 14).

Example 13: 1st grade—Taking up the words of a peer, F11 completes them: *I agree with F*14 *because it is true that if you are in a wheelchair you can it's for your whole life and if you break your foot it's not for your entire life because if we break a foot* (…) *we can't walk but we can jump on one foot with crutches that hold us up.*

Example 14: 5th grade—M13: *I agree with everyone, but you have to think that* (…) *before the Civil War if you were Black you couldn't go work in the fields* (…).

Post-relativist/pre-inter-subjective creative thinking also takes into account peer perspectives. However taking these perspectives into account results in a different relationship than that produced by the group (examples 15 and 16); it is not a clear-cut opposition but rather a divergence that implies the beginnings of a constructive evaluation; it often contributes to transforming the course of the exchange.

Example 15: 3rd grade—M10: (*I don't agree*) *neither with F*01 *nor with M*15 *because it's not just cars that pollute it's all things like factories parks like Canada's Wonderland because they use a lot of electricity* (…).

Example 16: 4th grade—F08: To the consensus among pupils that the main objective of schools is to learn to read and write, F08 adds a divergent point of view: *Schools aren't just to learn to read and write they help you* (…) *get on with others because if you don't go to school you are just with your family and that's all but if you go to school you have you learn to get on with people you don't like* (…).

Responsible Thinking

Responsible thinking is situated in the egocentric perspective in that it states a personal and specific behaviour within a social or a moral context (example 17).

Example 17: 2nd grade—While the group took for example an argument between two pupils, M07 stated: (…) *I didn't do it on purpose. I will never do that action again.*

Post-egocentric responsible thinking is decentered from the self but is turned toward a known source of authority or toward a social or moral rule. The rule is considered to be learned (rather than integrated) because it is simply stated, without explanation or justification or without being contextualized (example 18). The statement is not nuanced.

Example 18: 5th grade—In an exchange about the more important role of men compared to that of women during warfare, M03 states: *Usually it's boys that have to protect* (…) *who protect girls it's always like that.*

Pre-relativist responsible thinking distances itself from learned rules and the specific behaviour of a known individual to focus on a social or moral action that is somewhat generalized (example 19).

Example 19: Kindergarten—In an exchange about sadness, F08 explains: *And babies cry* (…) *to say they are thirsty or because they are hungry* (…) *you can try different things and if he still cries it means he wants something else.*

Responsible thinking is situated in a relativistic perspective when it expresses concern for others. This concern can be manifested with questions that show empathy (example 20) or with an explanation that aims at inclusion (example 21). If a social or moral rule is called upon, this rule is considered to be integrated because it is justified or put into context.

Example 20: 1st grade—In an exchange about the difficulties of being visually handicapped, M06 asked in a worried voice: *If he wants to go to school how can he work*?

Example 21: 4th grade—Several pupils take pleasure in repeating that school is useless because the teacher repeats the same things too often and pupils are wasting their time. F10 manifests a concern for inclusion when she adds: *When we are taught something for the fourth time it's because someone else has forgotten and it has to be explained to that person.*

Responsible thinking is situated in a post-relativist/pre-inter-subjective epistemology when empathy and concern for inclusion are oriented toward another person who is not part of the pupil's surroundings. If the statement is based on a social or moral rule (e.g. *we must*, *we shouldn't*), this rule is considered to be integrated because it is justified by a reason or because it is placed into context (examples 22 and 23).

Example 22: 3rd grade—M19: *You must always recycle because if you throw a plastic bag on the ground instead of recycling it well it will take years even centuries to disappear.* (…) *not only can it pollute the Earth some more but on top of that if it goes in the water there are turtles and fish that can mistake them for food and they can die.*

Example 23: 5th grade—Regarding the question about whether or not children should participate in warfare, F17 answers: (…) *it's good to help but I don't think it is the children's duty to help because it is because children shouldn't go to war they are much too young plus children shouldn't see people die* (…) *it really isn't fair and the only thing they should have to do is help like support parents and I don't think that anyone should go to war* (…).

Metacognitive Thinking

Metacognitive thinking implies awareness of thought ("thinking about thinking"), but also awareness of a point of view, strategy, emotion or task. This thinking mode was scarcely mobilized in the groups that participated in the research. When it is situated in a perspective linked to egocentricity, metacognitive thinking is manifested by a simple reflection about one's point of view or action (examples 24 and 25). In other words, the awareness is oriented towards oneself and is simply stated.

Example 24: 2nd grade—F14: (…) *when I forgot my homework in class I told you I phoned X so* (*she would give it to me*).

Example 25: 3rd grade—M10: *What* 3*M*15*TO and* 3*M*19*TO said is true. But like I said, it's the Earth's rays that protect the Earth from* (…) *global warming*.

Post-egocentric metacognitive thinking is manifested with a simple reflection regarding an action, task, point of view, etc., of a person belonging to one's immediate surroundings (example 26).

Example 26: Kindergarten—To answer the teacher's question regarding the manifestations of anger, F12 recalls the reactions she observed in her sister: *But my sister when she's angry she goes "it's not fair"* (*and stamps her feet*).

Pre-relativist metacognitive thinking implies a reflection, no longer simply stated, but descriptive of an action, a task, a point of view, etc., of a member belonging to the person's surroundings (family).

Relativist metacognitive thinking is also descriptive, but it shows an interest in what a peer said or did (example 27). The notion of peer (vs. immediate surroundings/family) is important here, in that it marks a step toward decentering.

Example 27: 4th grade—F05 expresses her agreement with F12's words, which she describes in full: *I agree with F*12 *because in some countries* (…) *like in China like you said there are so many people that there is so much pressure and there are people who do not have enough money to go to school* (…).

Post-relativist/pre-inter-subjective metacognitive thinking takes up and describes the words, points of view and so on of persons who do not belong to the pupil's immediate environment nor are peers. In example 28, the reflection implies a conscious relationship between what an author has written and the actual discussion in which the pupils are engaged—a reflection that contributed to enriching the pupils' and the group's thinking.

Example 28: 5th grade—F09: (…) *I already read a book or a page of a book that said that* 97,000 *people were killed in the Second World War and* 15,000 *were children* (…).

In conclusion, the first result of this study stems from the analysis of transcripts of exchanges among groups of pupils aged 4 to 12 years. It presents a refined and operational model of the developmental process of DCT. The four thinking modes (logical, creative, responsible, metacognitive) now spreads out over six epistemological perspectives named egocentrism, post-egocentrism, pre-relativism, relativism, post-relativism/pre-inter-subjectivity and inter-subjectivity. The examples provided to present the components of the model show that within the increasing epistemological complexity, various perspectives were identified among different age groups.

The Model as a Grid for Analysis: An Illustration

The model can be used as a grid to analyze the developmental process of DCT by applying its components (4 thinking modes × 6 epistemological perspectives) to the transcripts of exchange. After coding, the number of incidences that emerge from the analysis in relation to thinking modes and epistemo-

logical perspectives were totaled (and transferred into percentages) for each transcript. The analysis allows a global portrait of the developmental process of DCT to be drawn for each classroom (see the example of the grade 4 class in Table 5).

In this section, the case of the Ontario school (six classrooms) will serve as an illustration. For illustrative purposes, the analysis that refers to epistemological perspectives of Ontario classrooms is presented (see Table 6).

From the outset, it was noted that the epistemology linked to egocentricity was mobilized in a low percentage of instances; the post-egocentricity perspective was slightly more mobilized than the previous perspective; pre-relativism predominated in preschool classrooms and at the beginning of elementary school; and relativism predominated in end-of-elementary classrooms. The epistemology linked to post-relativism/pre-inter-subjectivity was mobilized to a lesser degree, but increasingly so beginning in the middle of elementary school. No manifestation linked to inter-subjectivity was noted in any of our groups.

More specifically, it came to light that the epistemological perspectives that were more significantly mobilized were as follows: pre-relativism was at a maximum in kindergarten and 1st grade (respectively 62% and 68% of instances). It began to decrease as early as 2nd grade and dropped to 25% by grade 5. Relativism, although present in all classrooms, was less mobilized in kindergarten (5%). It grew beginning in first grade (20%), reaching its highest percentage of mobilization in grade 4 (47%). Post-relativism/pre-inter-subjectivity, absent in kindergarten and first grade, began to manifest itself slightly in the 2nd grade (2%), and kept evolving starting from the 3rd grade, to reach its highest percentage of mobilization in the 5th grade (27%).

Furthermore, an analysis of Table 6 highlights certain trends. In kindergarten, the analyses indicated that the epistemological perspectives, although anchored in pre-relativism (62%), still had roots in egocentricity and post-egocentricity (respectively 13% and 20%).

In the 1st grade, pre-relativism also dominated (68%), but this percentage clearly distinguished itself from the two previous perspectives (egocentricity and post-egocentricity) to take root in relativism (20%).

Grade 2 illustrates an uncertainty in epistemological development[8]: pre-relativism still dominates, although in a lesser percentage (53%) than in grade 1. This decrease was offset by a corresponding increase in post-egocentricity (18%), while there was also progress toward relativism (20%), a more complex epistemology.

The 3rd grade marks a movement in the developmental process, as relativism, an epistemology that implies decentering and the beginning of abstraction, was dominant at 45%. However the previous perspective, pre-relativism, remains mobilized at 38%, and the subsequent one, post-relativism/pre-inter-subjectivity, accounted for 12%.

The 4th grade carries on the trend begun in the previous classes, as relativism was mobilized at 47%. Although the foothold in the previous perspective (pre-relativism) is still strong (32%), the process does not stop increasing in complexity, with

Table 5.
Example using the model as an analysis grid—grade 4*, Ontario.*

Modes/Epistemology	Logical	Creative	Responsible	Meta-cognitive	Total of incidences and percentages
Egocentricity	0	0	0	0	0 (0%)
Post-egocentricity	0	2	0	0	2 (2%)
Pre-relativism	19	7	0	0	26 (32%)
Relativism	6	17	3	12	38 (47%)
Post-relativism/pre-inter-subjectivity	2	3	9	1	15 (18%)
Inter-subjectivity	0	0	0	0	0 (0%)
TOTAL of incidences and percentages	27 (34%)	29 (36%)	12 (15%)	13 (16%)	81

Table 6.
Developmental process in Ontario classrooms—percentage of epistemological manifestations for each grade.

Epistemological perspective/Grade	Preschool	1st	2nd	3rd	4th	5th
Egocentricity	13%	6%	7%	2%	0%	0%
Post-egocentricity	20%	6%	18%	2%	2%	7%
Pre-relativism	62%	68%	53%	38%	32%	25%
Relativism	5%	20%	20%	45%	47%	41%
Post-relativism/pre-inter-subjectivity	0%	0%	2%	12%	18%	27%
Inter-subjectivity	0%	0%	0%	0%	0%	0%

[8]According to formal and informal data provided by the school administration, this group of pupils, from kindergarten on, had concentration and learning difficulties. For relationships between epistemological development and intellectual skills in adolescents and adults, see Friedman, 1995 and Jensen, 1998 quoted in King & Kitchener, 2001.

a mobilization of 18% in post-relativism/pre-inter-subjectivity (vs. 12% in grade 3 and 2% in grade 2).

In grade 5, relativism still dominates (41%), but the foothold in pre-relativism lessens (25%) in comparison to the percentages observed in grades 3 and 4, and mobilization in post-relativism/pre-inter-subjectivity increases significantly (27%).

In conclusion, from the illustration presented in Table 6, the following elements emerge: First, the epistemology of a majority of preschool children's interventions surpassed the limits of egocentricity, which is traditionally expected of children in these age groups, to find their expression in a pre-relativist discourse. Then, a majority of 5th grade pupil's interventions were situated in relativism and in post-relativism/pre-inter-subjectivity, and none in the more complex perspective of inter-subjectivity.

The increasing sophistication of DCT that emerged from the analysis seems to indicate an underlying trend, which was repeated in each classroom; the authors suggest an interpretation of this trend in the following section.

Discussion

The first contribution of this paper is related to the revised model of the developmental process of DCT.

In the model, DCT is defined as multimodal (logical, creative, responsible and metacognitive thinking), rather than being defined in reference to the rules of formal logic, as is the case with most theories related to critical thinking (Kwak, 2007). The second element in the definition of DCT is that it is a process, as each thinking mode increases in complexity through qualitative differences, spread out across six epistemological perspectives (see Table 4).

The model the authors propose is developmental in that it illustrates a "progression in reflection" (see Kuhn, 1999; Kuhn & Weinstock, 2001) that is, an increasing sophistication in the manner in which the pupils' representations and meanings are co-constructed during exchanges within a community of inquiry. The progression in reflection is observed in the epistemological perspectives (pre-relativism is more complex than post-egocentricity, and the latter is more complex than egocentricity), as well as in the groups' epistemologies between preschool and grade 5 (see Table 6).

In the model, the development of DCT is a "recursive" process (Chandler et al., 2001; Schommer-Aikins, 2001) in that it is not linear; it is revisited, revised, re-utilized during all grades of elementary school. As illustrated in Table 6, interventions of pupils at the end of elementary school, although situated in more complex perspectives such as relativism and post-relativism/pre-inter-subjectivity, continued to be manifested in simple perspectives such as post-egocentricity and pre-relativism.

Unlike most models related to reflexive thinking (among others, King & Kitchener, 1994, 2001) or critical thinking (among others, Kuhn, 1999; Kuhn & Weinstock, 2010) that apply to adolescents or adults, the DCT model concerns groups of pupils aged 4 to 12 years.

The model does not pretend that preschool and elementary school pupils' thinking is in itself critical, that is, evaluative and argumentative, but it supposes that the developmental process of critical thinking begins as early as preschool as long as children are stimulated in this direction (see Chandler et al., 2001). Of course, critical thinking is a product because it supposes knowledge/experience that is articulated to generate a judgment, whether it is actualized or not (Lipman, 2003). However, the authors emphasize the fact that critical thinking is first and foremost a research process, in that it attempts to satisfy certain standards of quality during the effort to generate a judgment: thinking critically means learning to think well (Lipman et al., 1980). The research process begins as soon as pupils' thinking is fed by doubts that stem from significant problems presented by the teacher (Dewey, 1933) or by peers (Lipman et al., 1980).

The second contribution of this paper is to bring to light trends in the developmental process of DCT, for which the authors propose an interpretation.

Whereas designers of other models refer to the trends they observed in terms, for example, of "falls" (Perry, 1970) or "waves" (King et al., 1994; King & Kitchener, 2001), the authors suggest an interpretation drawn from the "scaffolding" metaphor and which the authors extend to the cognitive development of groups of pupils who have been previously stimulated by an adult and peers during dialogues within a philosophical community of inquiry. The authors use the scaffolding metaphor for its key concepts rather than its instructional and pedagogical techniques.

A review of the literature indicates that the original notion of scaffolding applies to individual performances and tasks and refers to the instructional and pedagogical fields (Pea, 2004). At the end of the 1950s, Bruner introduced the "scaffolding" theory to refer to language skills that young children acquired with the help of their parents. Wood, Bruner, and Ross (1976) took up the scaffolding metaphor and applied it to the field of education. Scaffolding describes the type of accompaniment that teachers can offer pupils to help them master a task or a concept that is difficult to understand *a priori*. The scaffolding process includes two ideas, that of "fading" or "gradual withdrawal" (Collins et al., 1989; Davis & Miyake, 2004; Pea, 2004) and that of "appropriation" (Rogoff, 1995). The fading process begins when pupils start to understand the task or the concept, and the teacher gradually withdraws to leave them more and more responsibility, until they are able to work autonomously. Appropriation is not only the internalization of another person's behaviour, it is a process by which children acquire new skills as they participate in an activity; it is linked to the "transformation" of comprehension following an interaction. These skills are gradually "integrated" and used in other activities (Jadallah et al., 2011). Brown, Collins and their colleagues have incorporated notions of fading and scaffolding into instruction grounded in cognitive learning (Brown, Collins, & Duguid, 1989; Collins, Brown, & Holum, 1991).

As illustrated in Table 6, for each classroom there is one epistemological perspective that emerges more significantly. However, this dominant perspective is not isolated: it coexists with preceding and subsequent perspectives. A decrease, but not a disappearance, (fading) is therefore observed in preceding perspectives that are less complex, and a gradual emergence of subsequent perspectives that are more complex (appropriation and transformation). For example, at the end of the school year in kindergarten, pre-relativism (mobilized in a percentage of 62%) seems on its way toward integration by the group; however its complete appropriation cannot be asserted since their epistemology remained strongly anchored in the less-complex perspectives of egocentricity (13%) and post-egocentricity (20%). Bridges toward relativism were beginning to be built, but remained weak (5%). In grade 1, however, pre-relativism seemed more appropriated (68%) since its footholds in egocen-

tricity (6%) and post-egocentricity (6%) had significantly diminished, and a more complex perspective, relativism, was already being constructed by the group (20%).

The same trends (fading and appropriation/transformation) were displayed in the higher-level classrooms, but within epistemological perspectives that were progressively more complex. An example of this is the 5th grade pupils. This group had integrated and surpassed perspectives linked to egocentricity (egocentricity and post-egocentricity), which were mobilized respectively in percentages of 0% and 7%. The appropriation/transformation occurred around relativism, which was the dominant perspective (41%) in the group. The preceding perspective was still being mobilized, but it was fading, at 25% of interventions, while the more complex perspective, mobilized in a percentage of 27%, was being constructed. In other words, the class group, in an appropriation/transformation process, was still looking for concrete support in pre-relativism, while it was trying to integrate post-relativism/pre-inter-subjectivity.

Since our research is of the qualitative type, it does not provide direct evidence regarding developmental processes, but only avenues to explore sequences of change that underlie these processes. And because of the social character of the analysis, the research does not provide any data on how individuals change over time. Research in cognitive psychology could provide evidence about change over time by assessing individuals at multiple points in time. Also, quantitative analyses with large numbers of participants could be used to ensure the reliability of the model's components, and to interweave these components with other measures of the development of critical thinking could serve to validate the model. Furthermore, the DCT model the authors propose originated from exchanges among pupils who were experimenting with P4C, and this context may have influenced the thinking modes manifested. It would therefore be useful to verify the components of the model in the context of exchanges in other school disciplines and in the context of informal exchanges. The study was conducted within a framework of verbal exchanges; it would also be useful to study pupils' DCT as manifested in written works. Finally, the proposed model is essentially descriptive. Therefore, research in social and cognitive psychology aimed at analyzing and explaining the transition regarding the mobilization of a thinking mode into the expression of a point of view, and comparing them to the simultaneous mobilization of several modes of thinking into the expression of a similar but more complex point of view, would also be useful.

Conclusion

This study, conducted with groups of P4C pupils from preschool and elementary school, presents a refined and operational model of the development of DCT. The model represents a (social) process of co-construction of meanings. It is composed of four thinking modes that increase in complexity according to six epistemological perspectives, illustrating the development of DCT from its weakest to its strongest expression.

In the study's second analysis, the model is used as an analysis grid. As such, it draws a global portrait of the epistemology of class groups in an Ontario school from preschool to grade 5. From this portrait, the authors observed trends in the groups' developmental process of DCT. These trends were interpreted with the concepts of fading and appropriation/transformation which are found in the scaffolding metaphor, which the authors applied to the cognitive development of classrooms of pupils.

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