

Teachers' Understandings of Critical and Higher Order Thinking and What This Means for Their Teaching and Assessments

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Critical and higher order thinking is essential to education, but it is not clear what teachers understand this to mean and what role this has in their instruction. We interviewed 38 teachers in Kindergarten to Grade 9 classrooms from 14 schools in Newfoundland and Labrador, Canada, to obtain their understandings of critical and higher order thinking in social studies and science, and how this affects instruction and assessment. The teachers believed that higher order thinking was important for all students, and attempted to teach thinking; however, they were less sure of how they might assess thinking. The teachers indicated uncertainty about what higher order thinking means, and believed they were not well prepared to teach or assess higher order thinking.

L'esprit critique et les habiletés supérieures de la pensée sont des éléments essentiels de l'éducation; pourtant, il n'est pas clair si les enseignants comprennent ces concepts ou le rôle que jouent ceux-ci dans leur enseignement. Nous avons interrogé 38 enseignants de la maternelle à la 9e année et provenant de 14 écoles à Terre-Neuve-et-Labrador, au Canada, de sorte à apprendre comment ils concevaient l'esprit critique et les habiletés supérieures de la pensée en études sociales et en science, et dans quelle mesure leur perception affectait l'enseignement et l'évaluation. Les enseignants croyaient que les habiletés supérieures de la pensée étaient importantes pour tous les élèves et ils tentaient d'enseigner la réflexion ; toutefois, ils étaient moins certains quant à la façon d'évaluer celle-ci. Les enseignants ont manifesté une incertitude quant à la définition des habiletés supérieures de la pensée et estimaient qu'ils n'étaient pas bien préparés pour les enseigner ou les évaluer.

Critical and higher order thinking is thought to be essential to learning for all students in the twenty-first century (Darling-Hammond et al., 2008; Pellegrino, Chudowsky, & Glaser, 2001; Resnick, 2001). Critical and higher order thinking is often identified in curriculum documents, and clearly so for social studies and science in Canada (e.g., FitzPatrick & Schulz, 2010, 2015). However, there is little evidence that critical and higher order thinking is being systematically taught and assessed in our schools. We interviewed 38 teachers who taught social studies and/or science, Kindergarten (K) through Grade 9, to determine the aspects of thinking they value, teach, and assess in their classrooms, with our focus on critical and higher order thinking.

Theoretical Framework

Critical and higher order thinking has a long, complicated history, and it is not our intent to present a conclusive definition of what this type of thinking entails. Moseley et al.'s review of 55 thinking frameworks provides a sense of the complexity of thinking and diversity of approaches: "People think and learn in social and cultural contexts and experience an interplay of cognitive, emotional, motivational and social energies" (Moseley et al., 2005, p. 2). We were interested in teachers' practicable understandings of critical and higher order thinking, and what they think and do regarding critical and higher order thinking for students in their classrooms.

Critical and Higher Order Thinking

Critical thinking is a complex act that includes such cognitive processes as reasoning and judgement as well as dispositions of intellectual empathy, fair-mindedness, and persistence (e.g., Facione, 1992/2015; Abrami, et al., 2015; Ennis, 1987; Paul & Elder, 2006). Terms such as higher order thinking, critical thinking, good thinking, metacognitive thinking, productive thinking, creative thinking, thoughtful thinking, complex thinking, deep thinking, and logical thinking are widespread in the literature and are often used interchangeably (Giancarlo-Gittens, 2009; Moon, 2008; Moseley et al., 2004, 2005).

There are many definitions for critical thinking. Siegel (1988) defined critical thinking as being "appropriately moved by reason" (p. 32), and Lipman (2003) described critical thinking as responsible thinking that results in good judgement. One definition that has stood the test of time is that given by Ennis (1987): "reasonable, reflective thinking that is focused on deciding what to believe or do" (p. 10). The American Philosophical Association (1990) defined critical thinking as "purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation, and inference, as well as explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations upon which that judgment is based" (as cited in Facione, 1992/ 2015, p. 22).

A strong connection has been made between critical and higher order thinking in that the higher cognitive levels of Bloom's taxonomy (1956) and Anderson and Krathwohl's revision (2001)—analyze, evaluate, synthesize, and create—are seen to involve critical thinking (Ennis, 2003; Nitko & Brookhart, 2011; Paul & Elder, 2006). According to Anderson and Krathwohl, evaluating "lies at the core of what has been called critical thinking" (p. 84). Facione (1992/2015) listed inference, explanation, evaluation, self-regulation, interpretation, and analysis as core critical thinking skills. We have used the terms of critical thinking and higher order thinking interchangeably in this paper, as do many others in the area of critical and higher order thinking (e.g., Schraw & Robinson, 2011; Sobocan, Groarke, Johnson, & Ellet, 2009; Zohar, 2004).

Critical thinking, although usually associated with the cognitive domain, is thought to include both cognitive and affective traits (Ennis, 1987, 1996; Facione, 1992/2015; Lipman, 1987, 2003; Siegel, 1988, 1997). Bailin and Battersby (2010) described the spirit of inquiry and noted the role of open-mindedness, fair-mindedness, curiosity, and the respectful treatment of others as part of critical thinking. However, for this paper, we include only the cognitive aspects of critical thinking (particularly aspects of inference, explanation, evaluation, self-regulation, interpretation, and analysis), and of higher order thinking (analyze, evaluate, synthesize, and create).

Teaching and Assessing Critical and Higher Order Thinking

It is a principle of education that students need to learn to become good thinkers (Anstey & Bull, 2006; Dewey, 1933; Norris & Ennis, 1989; Pithers & Soden, 2000; Resnick, 1987; Underbakke, Borg, & Peterson, 1993; Wilson, 2000). Darling-Hammond et al. (2008) were emphatic that schools in the twenty-first century must provide learning that “enables critical thinking, flexible problem solving, and transfer of skills and use of knowledge in new situations” (p. 2). Elder (2003) emphasized that children need to be taught to think critically as “the mind of the child doesn’t naturally develop the requisite skills, abilities, and dispositions essential to making good decisions, [or] reasoning through complex problems” (p. 4). Further, Elder (2003) argued that all students need to learn the skills of critical thinking.

Explicit teaching of thinking is believed to be necessary, and researchers have argued that one cannot assume students will automatically become critical thinkers (Costa & Kallick, 2000; Elder, 2003; Lipman, 2003; Paul, 1991; Siegel, 1988). Evidence indicates that thinking can be developed by direct instruction, as summarized by Abrami et al. (2008, 2015) in their meta-analyses (also Ennis, 1987; Moseley et al., 2004, 2005; Siegel, 1988, 1997). Pithers and Soden (2000) reviewed the research on thinking and concluded that not all teachers teach thinking and that “learning to think well needs to be acknowledged explicitly as an aim” (p. 246). Barak, Ben-Chaim, and Zoller (2007) concluded that for high school students, “if teachers purposely and persistently practice higher order thinking strategies for example, dealing in class with real-world problems, encouraging open-ended class discussions, and fostering inquiry-oriented experiments, there is a good chance for a consequent development of critical thinking capabilities” (p. 353).

Resnick (2001) maintained that “students who have not been taught a demanding, challenging, thinking curriculum do poorly on tests of reasoning or problem solving, confirming many people’s original suspicions that they lack the talent for high-level thinking” (p. 3). Bailin and Battersby (2010) argued that teaching critical thinking is necessary to enable students to “make reasoned judgements in real life contexts” (p. x). And, Marzano (1998) in a meta-analysis on instruction, emphasized teachers’ understanding of the cognitive system for effective teaching. Thus, the teacher is central to students learning higher order thinking.

Science and social studies are subjects that provide a broad set of learning outcomes and include both content and process objectives. Norris and Phillips (2003) and others (Adey & Shayer, 1994; Corliss & Linn, 2011; Gil-Perez & Vilches, 2005; Zohar, 2004) believe that students should be taught to think critically about science at the same time as they are learning the content of the subject. King, Newmann, and Carmichael (2009) and Case (2008) both made a similar argument in social studies. Paul and Elder (2006) maintained that students learn content by thinking about the content, and Case (2005) asserted that an important objective of schooling should be to engage students in thinking critically within the content of the subject areas.

However, Beyer and Davis (2008) and others (e.g., Moon, 2008) have expressed concern about the lack of critical thinking that is being taught to students in the K-12 system. Zohar (2004) and Braaten and Windschitl (2011) noted that science education with younger students consists mainly of the teaching of facts, and Case and Daniels (2008) and others (e.g., Paul, Binker, Jensen, & Kreklan, 1997) expressed concern about the strong emphasis on recall questions in social studies instruction and assessment. Hattie (2009) discussed the predominance of surface learning where teachers give information and students recall the information for tests, and then Hattie and Yates (2014) reinforced this notion with the “recitation method” (p. 44) of classroom instruction that is still prevalent in classrooms, where the emphasis on recalling facts can be

detrimental to the teaching of more complex thinking that requires students to think critically.

Lederman and Neiss (2000), along with others (Lane & Stone, 2006; Zohar, 2004), have noted that classroom science assessments generally consist of asking students to recall information, but it is strongly advocated that assessments should test higher order as well as lower order thinking (Brookhart, 2010, 2014; Corliss & Linn, 2011; Pelligrino, Chudowsky, & Glaser, 2001). The same arguments apply to social studies assessments (Anderson & Krathwohl, 2001; Ercikan & Seixas, 2011; Marzano & Kendall, 2007, 2008). Beyer (2001) discussed the essential role that critical thinking should play in social studies instruction and the “bad news” that higher order thinking is missing from social studies instruction and assessment in many schools.

Beyer (2001) and Case (2005) identified barriers to teaching and assessing students to think critically. These include teachers believing that thinking is separate from instructional content, and content is taught first with critical thinking only being taught if there is time, and teachers often believe there is no time. Also, teachers expect mastery of lower order thinking before they teach higher order thinking, so they concentrate on lower order thinking and often do not get around to teaching or assessing higher order thinking. Other barriers are that some teachers are not comfortable with what critical and higher order thinking means in their subject areas and not all teachers believe critical thinking is possible for students who are low academic achievers (Marin & Halpern, 2011).

Considerable research has been done on higher order thinking at high school and post-secondary levels (e.g., Abrami, 2008, 2015), but very little at primary and elementary levels. But higher order thinking is important in the early grades as well as in later years. We found in an earlier study of grade 5 to 8 social studies and science curricula for four provinces in Canada that higher order thinking was represented in these curriculum guides, although perhaps not to the extent that we would recommend or as clearly as we would like (FitzPatrick & Schulz, 2010; 2015). For example, when analyzing two units of science in Canadian curriculum documents for seven provinces, “there were fewer outcomes and assessments at the highest levels of the [Anderson and Krathwohl] taxonomy in all jurisdictions,” but the “proportions varied across jurisdiction” (FitzPatrick & Schulz, 2015, p. 148). These results led us to question whether it was “reasonable to expect teachers to teach higher order thinking if it is not made clear in curriculum documents and teachers are not given guidance” (FitzPatrick & Schulz, 2015, p. 151).

Method

We interviewed teachers from Kindergarten through Grade 9 to explore their beliefs and classroom practices in teaching and assessing thinking. We chose science and social studies as a reference for the teachers because these subjects identify a broad set of learning outcomes, include content and process objectives, and provide the opportunity for teachers to develop higher order thinking with their students. The focus of the interviews was on teacher perceptions of critical and higher order thinking, how critical and higher order thinking was part of their social studies and science instruction, and how critical and higher order thinking was assessed in their classrooms.

Sampling

We used purposeful sampling (Creswell, 2012; Yin, 2011) to select teachers from schools in Newfoundland and Labrador, Canada. For each grade level, four or more schools were selected so that at least one school represented students with high academic achievement and from areas

with predominantly middle-class and working families, and one school with low academic achievement and predominantly lower socio-economic and non-working backgrounds. The remaining schools that were selected represented the full range of academic achievement and were in areas with predominantly middle-class families. Principals asked for volunteer teachers from their schools, and we obtained at least three teachers for each grade level who had considerable experience in teaching science and/or social studies, for a total of 38 teachers (See Table 1).

All teachers had considerable teaching experience. Six had 5-10 years, only one had less than 5 years, and the others had more than 10 years of experience. Thirty-four teachers were women.

Interviews

We began with semi-structured interviews with individual teachers. We posed general questions, but provided ample opportunity to explore teacher responses and comments—“depth” interviews (Kvale & Brinkman, 2009; Rubin & Rubin, 2005). The second interviews were focus groups to confirm or modify our understandings from the first interviews, to ask follow-up questions, and to further explore topics identified in the first interviews. Conducting focus groups provided opportunity for interaction among the teachers as they explored and discussed the concepts (Barbour, 2007; Krueger & Casey, 2009). All interviews and focus groups were audiorecorded.

We began the first interview with a brief introduction to the study and to ourselves, and then proceeded with: “We’ll start with a general question. When you consider thinking skills that you feel students need to be able to use what comes to mind?” This was followed by questions that addressed aspects of thinking: “What has influenced your views of thinking? How do you decide which thinking skills are important?” (See Appendix A).

We used responsive interviewing (Rubin & Rubin, 2005), which included ongoing analysis, modifying questions, and preparing follow up prompts throughout the interview to complement the more-structured questions. Both researchers attended the interviews. Initial interviews took 30-45 minutes each, and focus groups took 60-80 minutes each.

Table 1.

Numbers of Teachers Representing Students with Various Backgrounds

	Primary				Elementary				Intermediate	Overall
Grade level:	K	1	2	3	Total	4	5	6	Total	7 / 8 / 9
School SES:										
Lower	1	1	1	1	4	2	2	2	6	2
Higher		1		1	2	1	1	1	3	2
Full range	3	2	2	2	9	2	2	2	6	4
Total	4	4	3	4	15	5	5	5	15	8
Teacher Gender:										
Women					15				12	7
Men					0				3	1
Total					15				15	8

Both authors listened to the recordings of the first and second interviews several times, along with one of the research assistants. All recordings were transcribed to allow for detailed review and interpretation (Kvale & Brinkman, 2009; Rubin & Rubin, 2005). There were over 33 hours of interview time, which yielded approximately 600 pages of transcription.

We used member checking to strengthen the validity of our understandings and to serve as a stimulus for participation in the follow up focus group (Creswell, 2012; Merriam, 2008; Saldana, 2009). We drafted a summary of each interview, which we sent to the individual teachers prior to each focus group. Teachers were asked to review, comment on, modify, and endorse their summaries. All teachers initialled their summaries when they were satisfied with them—four teachers made suggestions that we incorporated into the focus group questions; the others indicated that the summaries were fine. Teacher comments such as, “reading these findings has made me realize that perhaps we, as teachers need to better understand the connection between the two—knowledge and higher order thinking,” and “not sure ‘easier’ is the right word—less complex?” gave us reasonable assurance that we had understood what the teachers were telling us, and that the teachers had understood our interpretations.

The focus groups consisted of teachers within a school. Most were conducted with two or three teachers. The teachers readily accommodated this arrangement and appeared to welcome the possibility of hearing the other teachers and conducting the interview more as a discussion. Due to teacher time constraints it was necessary to interview several teachers individually for their second interview.

The questions and prompts in the focus group or second interview were more structured than those in the first. Some of the issues discussed in the focus groups arose from analyzing the initial interviews. For example, we did not originally ask teachers about reading, but several teachers in the first interviews identified student reading ability as being related to higher order thinking. We then used theoretical sampling (Corbin & Strauss, 2008) to ask all teachers about this and other new concepts (See Appendix B). We began with a question on critical thinking, which was mentioned by several teachers in the initial interviews: “Could you tell us more about what critical thinking means to you?” We presented a number of terms to prompt further comments, such as reasoning, reflection, metacognition, and critical literacy and scientific literacy.

The following two questions indicate how questions in the focus groups reflected ideas from the first interview and level of specificity:

[We talked in our interviews about teaching thinking to all students and we’re looking for some expansion on that topic.] Is critical thinking or higher order thinking for all students? Could you talk more about that?

And,

[Knowledge, both content knowledge of the subject and background knowledge of the student, has come up in these interviews.] What role does knowledge play in children’s thinking?

The second interview allowed us to compare data from parallel data sets (Barbour, 2007), as well as gain insights into several of the concepts that had surfaced from some of the first interviews. The focus groups provided the opportunity for teachers to discuss concepts and issues, as in the following example from two grade 6 teachers who were discussing how much higher order thinking to include in tests:

Teacher A: Okay I'm testing whether they can adapt that information to a new situation, then I'm really going to find out do they know it or if they don't. But what happens if they really don't know it? Then I'm going to have to go back and re-teach that whole unit because, and I don't have the time to do that, how am I supposed to do that?

Teacher B: You don't want to be disappointed because I can tell you, if you did do that, they wouldn't be able to do that.

Teacher A: Yeah, I know, I gave it today, I know ...

These teachers were struggling with the idea of students being expected to think at a higher level in tests, even though they believed in the importance of higher order thinking. The focus groups allowed for teachers to delve into issues more deeply than they were able to in their individual interviews.

We summarized the focus groups and second interviews, and these were also forwarded to the teachers for review and modifications. This was done through e-mail, and only three teachers indicated changes to our summaries. Again, this gave us basis for believing that we understood and had represented the thinking of the teachers we interviewed.

Analysis

Our first coding was done with the data from teachers in Grades 4 through 6. As we continued our interviewing with teachers from kindergarten to Grade 3, and then teachers from Grades 7 through 9, we refined our themes as additional concepts emerged.

Each author independently coded the interview data. The first cycle of coding was both structural and holistic, and the second cycle was pattern coding based on procedures outlined by Saldana (2009). The coding was concept driven, using codes we developed from the literature and our knowledge, as well as data driven, using codes we developed from the interviews (Kvale & Brinkman, 2009). We used Nvivo (version 8) in the second cycle coding to check how many participants mentioned particular concepts and if some concepts were more pertinent to, or valued by, teachers at certain grade levels. We also used it to determine how the frequency or infrequency of certain words contributed to the development of themes. This was one part of comparing themes across interviews and focus groups. A second part examined the variation and complexity of the data across individual interviews (Rubin & Rubin, 2005).

After each interview and focus group we discussed and compared our observations, understandings, and interpretations (Patton, 2002). For example, each of us had a different interpretation from listening to the interviews of whether the teachers thought girls or boys were stronger writers. We ran a frequency check with Nvivo to see exactly what teachers said about writing and to determine how many teachers thought there was a difference between boys and girls. The teacher statements and numbers helped us develop the theme on gender.

Each interview was summarized to identify key concepts; this was done by one researcher and confirmed by the other. These summaries were also used to further develop and confirm the concepts and themes.

Results

We developed five themes from the interviews and focus groups (See Table 2). We have included

Table 2.

Themes with Specific Ideas

Theme	Specific Ideas for each Theme
Teachers think it is important to consciously teach thinking.	Thinking should be taught: <ul style="list-style-type: none"> • within subject areas • so that students can become independent thinking citizens.
Teachers are uncertain if all students can learn to think at a higher level.	All students should be exposed to higher order thinking, but not all students may achieve success. Teachers have questions about the thinking abilities of students with low academic abilities, language and reading difficulties, and/or low socio-economic status.
Teachers adjust the cognitive levels and processes for paper and pencil classroom assessments based on students' everyday work.	Paper and pencil tests are sometimes based on what teachers think the students can do. Paper and pencil assessments include predominantly lower order thinking tasks and questions. Higher order questions are usually at the end of the assessment. Not all students are expected to show the same level of thinking for higher order questions. Some students are given less complex assessment prompts. Assessment is not always aligned with instructional activities for higher order thinking.
Teachers' understandings about higher order thinking are complex: teachers are uncertain about how to teach and assess thinking and how to include it along with content demands.	Teachers have difficulty clarifying what they think higher order thinking means. Teachers have doubts about how to teach and assess thinking. Assessment of thinking is not always systematic. Teaching and assessing thinking is linked to report card expectations. Not all teachers include thinking with grading in social studies and science. Learning outcomes and amount of content to be taught dominate teaching.
Teachers do not see definite differences in thinking between girls and boys.	Girls and boys are able to express their thoughts orally. Girls and boys are able to express their thoughts in writing. Student thinking, both orally and in writing, is affected by the topic and the subject. Teachers usually qualified generalizations with exceptions. Teachers have difficulty clarifying their thoughts about how girls and boys think alike or differently.

details and examples to illustrate the teachers' thoughts and beliefs. Teachers used the terms higher order, higher level, and critical thinking interchangeably in their comments, and this is reflected in the teacher quotes we selected.

Teachers Think it is Important to Consciously Teach Thinking

All teachers agreed that teaching thinking was important in addition to teaching subject content because students should become independent, thinking citizens. A Grade 4 teacher stated: "Every

child will benefit—the end of our school system, isn't it to come out with a thinking conscious global citizen? If you're not teaching children to think, we're doing a great disservice." A Grade 7-9 social studies teacher responded: "When you get out in the real world you're going to be lost if you can't think for yourself." And a Grade 3 teacher expressed: "It is important to try to get students to be independent and think for themselves." The belief expressed by the Grade 3 teacher is representative of all the teachers we interviewed.

Teachers acknowledged that a conscious effort must be made to teach thinking. K-3 teachers thought subject content was necessary to teach in order for many children to have something to think about, as children come to school with varying background experiences and knowledge. A kindergarten teacher said that the school-oriented knowledge many students have is dependent upon what they are taught in school. However, teachers in Grades 4-9 thought that as students progressed through the grades, it was too easy to become caught up with the amount of subject content students are supposed to master, and that more effort should be devoted to teaching higher order thinking. In particular, teachers in Grades 7-9 thought that higher order thinking must be directly addressed within the content areas.

All teachers in Grades K-3 and many in Grades 4-6 considered teacher modelling of higher order thinking to be essential. A Grade 1 teacher was emphatic: "Critical thinking has to be taught and it needs a lot of modelling." Modelling, as explained by these teachers, included demonstrating to students what is expected in an answer, working with students to learn to construct model answers, and showing students how to do activities, such as science experiments. Modelling was not mentioned by Grade 7-9 teachers.

Teachers are Uncertain if All Students Can Learn to Think at a Higher Level

The teachers agreed that all students should be taught thinking, and that all students benefited from the exposure. Some K-3 teachers, even though they said higher order thinking was a reasonable expectation for all, expressed uncertainty about all students being ready for it. Many teachers from K-9 conveyed the belief that some children will always have more in-depth thinking and more insights than others. They did not think all students would be successful at higher order thinking, but that all students could improve. A Grade 3 teacher talked about the diversity in her classroom and stated: "It's my job to make sure children are thinking at their level and raise them up, and keeping those others up too."

A Grade 5 teacher expressed his concern: "When I think of the higher level thinking skills I don't really think I'm going to get all my students there. Some of your lower end students, their answers are still going to be just literal, whatever is there." This view was reiterated by a Grades 7-9 social studies teacher:

You're always going to have students in that room who may never get to your higher level thinking, but that doesn't mean that they can't benefit from hearing it, discussion, and so on; but, they may never be able to come up with something that's higher level thinking on their own.

Students with low academic ability were a concern for all teachers from Grades K-9, but not all teachers shared the same viewpoint. One Grade 4 teacher said, "I think for the weaker child it's imperative that we try and teach them some critical thinking skills, I think they're so very vulnerable." Another Grade 4 teacher insisted:

I don't think they all can. I think for some, where learning is a challenge, I think that we put a demand on them that may be too great, I'm not saying that they can't be challenged but they need to be challenged where they're to ...

The teachers seemed to think deeply about the degree to which low achieving students could improve their higher order thinking. There was no consensus among the teachers, but there was concern and a belief that all students should be at least exposed to higher order thinking.

Teachers in schools with high numbers of students from low socio-economic backgrounds had other concerns about higher order thinking, such as lack of background knowledge, and language and cognitive abilities. A Grade 5 teacher commented:

With our kids, a lot of our parents are not educated, there's not a lot of talking going on, not a lot of stimulation and discovering things and exposing them to a lot of different things in the world, just going to the supermarket and looking at different produce, you got kids that when you talk about some of the produce they don't know what it is because they never talk about it, parents don't know what it is, they don't interact with their kids enough.

The lack of school related prior knowledge that students bring to school was a concern for teachers in these schools.

Some of these teachers indicated that language is often weak for students from low socio-economic backgrounds. They talked about students not having the language to answer questions or explain their thinking, even when they had some familiarity with the topic. The teachers spent time teaching and modelling terminology for specific subjects. A Grade 3 teacher stated: "It is to give them the tools to communicate their thinking." One Grade 4 teacher worriedly questioned:

The other thing we as a staff have been challenged with is how much can we expect from our children in that way? Can they really do it cognitively? They're not able to go there. Maybe we're asking them to do too much, for example, inferencing, you know it's a big thing, thinking at a higher level, being able to respond at a higher level, delve into what they're doing, making connections with it, you know beyond what the printed word actually says, well, you know, maybe they're not able to do it.

In this school these types of discussions often dominated staff meetings.

Students with reading difficulties were mentioned by teachers from all grades and from all schools. Although we did not initially ask about reading, teachers volunteered that some students who had difficulty with reading were not showing evidence of higher order thinking. A Grade 1 teacher's words expressed what was frequently heard from teachers of K-9:

I do find that the ones who tend to be stronger readers and writers tend to be more critical thinkers. It's not that some of the children who are struggling with math or language arts don't have critical ideas, it's just sometimes I think you need to get at them a little differently.

Teachers gave many examples of how they try to give students opportunities to represent their understandings in multiple ways.

Teachers Adjust the Cognitive Levels and Processes for Paper and Pencil Classroom Assessments Based on Students' Everyday Work

In K-3, paper and pencil tests played a minor role and were almost non-existent in social studies and science. K-3 teachers also indicated that higher order thinking was often not considered when assessing and grading in social studies and science, and they only assessed higher order thinking when they had time to assess orally. At these grades, the teachers felt that understanding the concepts and increasing knowledge in these subject areas was of primary importance.

In Grades 4-9, paper and pencil assessments were sometimes based on what teachers thought their students could do. Tasks and questions on written assessments often depended upon what teachers knew about their students' everyday work: "It will work with some and it won't work with others, so sometimes we revamp, we got to look at the test each year and look at our group and see, well is this good for this group ..." (Grade 5 teacher). Some teachers said they provided different levels of questioning for individual students on the same concept, and a Grade 7-9 science teacher said: "The questions you ask depend upon who is in your class."

Teachers from Grades 4-9 generally thought that some students were not able to answer higher order questions so they gave more lower level questions in paper and pencil assessments. Typically, these assessments included tasks at the recall and comprehension levels. The questions were usually fill-in-the-blank, selected response, and short answer questions. A Grade 5 teacher stated: "Those who can only do the rote are able to pass and do well and feel good about themselves."

According to the Grade 4-9 teachers, higher order thinking questions were included on most paper and pencil assessments, but usually at the end of a test with a question requiring students to apply their knowledge to a situation that had not been taught in class. One Grade 4 teacher, when discussing the types of questions included on tests, represented what many teachers said:

There would be a new situation but I wouldn't do that for the whole test, that would be a minimum part of the test. I guess, in some sense, you could call them bonus questions. I would put them in, would I expect the whole class to get them, no.

Teachers acknowledged that some students were given less complex questions than others. These students also may have been given the opportunity to respond orally, use jot notes, draw diagrams, or represent in other ways. A Grade 5 teacher remarked: "Yes, their thinking is there, if they could read something and understand it, comprehend it at their reading level, they could take it from there, critically, reasoning, or whatever, now that mightn't be at a real high level either."

Teachers in Grades 7-9 said that many students, even high achieving students, found application questions hard. A Grade 7-9 social studies teacher said that when students are given questions where they have to transfer their knowledge, she often hears: "But I can't find it; it's not in the book; it's not there; there's no sentence that says...." One Grade 5 teacher pointed out: "Some students do fairly well, and others just lose it because they can't apply, they can't bring that information that they learned to a higher level or can't generalize it to another situation or to their daily living." Some teachers said they provided a lot of choice and leeway for how students answered these questions. And a Grade 7-9 science teacher noted: "If they're not capable, you wouldn't expect them to complete the same kind of answer you would get from a regular student."

In Grades K-3, complex questions were not generally presented to all students, but sometimes students gave higher order responses that were not anticipated. In Grades 4-6, all students usually were given the same questions, with differing expectations for how students would answer. In Grades 7-9, some teachers followed the same practice as in Grades 4-6; other teachers gave different levels of questions to certain students. A Grade 7-9 social studies teacher explained:

“Oftentimes I throw in at the end, a case study, or sometimes it’s a bonus, and that’s where your higher end comes in lots of times, so the weaker kids don’t necessarily get it.”

Teachers disclosed that they sometimes included higher order thinking in instructional activities that they would not assess. For example, in Grades 7-9, they might have students debate and analyze the advantages and disadvantages of Confederation in a class discussion, but would not use this as an assessment. The higher taxonomic levels, such as Anderson and Krathwohl’s (2001) evaluate and create, were sometimes part of instructional activities, but were not usually part of paper and pencil assessments. K-9 teachers agreed that evidence of higher order thinking distinguished the stronger academic students from the weaker students; however, they were not always sure of how to include higher order thinking in their assessments, and usually did so minimally or not at all.

Teachers discussed the idea that if higher order questions were put on paper and pencil assessments and students could not answer them, then the teacher needed to take the time to re-teach and there was no time for this. Consequently, lower order questions tended to dominate paper and pencil assessments, even though instructional activities sometimes allowed for higher order thinking.

Teachers’ Understandings about Higher Order Thinking are Complex: Teachers are Uncertain about How to Teach and Assess Thinking and How to Include it Along with Content Demands

The teachers used many descriptions to define thinking, including reasoning, problem solving, predicting, comprehending, creating, reflecting, drawing conclusions, making sense, risk-taking, thinking outside the box, thinking for themselves, and making judgements. Some teachers included the terms literal thinking, in-depth thinking, empathy, meta-cognition, and literacy. The teachers spoke of visual literacy, multiple intelligences, and differentiated instruction. Teachers did not give clear descriptions of what higher order meant, but all agreed that higher order thinking went beyond recall of facts. One concept that was repeatedly emphasized at all grades was making connections: students should be able to apply what they are taught to situations both in school and in real life, and to use their real life experiences to help them remember facts and understand concepts.

Some Grade 4-6 teachers used the term critical thinking interchangeably with critical literacy. A Grade 5 teacher bemoaned:

People don’t have a defined idea as to what it means and that’s why I think there’s critical literacy, critical thinking, critical analysis, critical everything and it all gets meshed into one big lump sum of critical, I don’t think it’s been clearly defined so people really and truly understand.

Teachers at all the grade levels were ambivalent about what critical thinking means and how to teach and assess it.

At Grades 7-9, science teachers referred to scientific literacy when talking about critical thinking. They were unsure of what scientific literacy meant and felt they were getting conflicting views from the school district, curriculum guide, and other sources. Scientific literacy seemed to encompass skills from basic reading comprehension of an article with scientific content to more critical issues of validity of scientific conclusions, bias, and scientific habits of mind. The students were required to complete a district assessment in scientific literacy, but the teachers expressed

doubts about the test: "It was just reading comprehension, on something that just happened to have a scientific theme to it. But it wasn't scientific thinking in my mind."

All teachers indicated they had heard of Bloom's taxonomy (Bloom et al., 1956) but had not been taught how to teach thinking or apply Bloom's taxonomy to instruction and assessment. Approximately two-thirds of the teachers indicated that they used the taxonomy directly or indirectly, but familiarity with other thinking taxonomies was not common. Some teachers referred to Howard Gardner's theory of multiple intelligences (e.g., Gardner, 1983) when asked if they were aware of any thinking taxonomies, and a few teachers conflated thinking skills and multiple intelligences.

Most teachers were not certain of what terms such as apply, analyze, evaluate, and create meant for student learning. They often thought of representation as higher order thinking. For example, most thought that getting students to represent their explanations in different formats, such as in a letter or drawing, constituted higher order thinking.

K-3 teachers, without fail, maintained that higher order thinking was explaining, giving details, and supporting answers. Many cited students describing the strategy they used to add or multiply as an example of explaining. In this instance, students would be choosing from strategies they had been taught. In social studies, an example was Grade 1 students giving a reason for how they knew it was autumn. Again, students would usually give reasons they had been taught, such as the leaves were turning colour, or they were wearing warmer clothing. Using Anderson and Krathwohl's (2001) *Revision of Bloom's taxonomy*, these descriptions would be at the "understand" level of thinking. Based on Marzano and Kendall's taxonomy (2007), they would fit the "comprehension" level of thinking. Both of these are usually thought of as lower order thinking (Krathwohl, 2002; Mayer 2002; Moseley et al. 2004, 2005), particularly as these examples were taught, but the teachers designated them as higher order thinking for Grades K-3 and considered them to be a major goal of teaching.

Teacher and student questioning was mentioned frequently. Questions at the inferential, application, and analysis levels were cited as higher order questions. Some teachers in K-6 were using commercial question charts to try to get students thinking at different levels. Teachers acknowledged that most students struggle with higher order questions, and that as they progress through the grades they often simply locate and repeat information. One Grade 7-9 teacher stated: "They're looking for that sentence in the book." Students' questions were thought to indicate learning. Grade K-6 teachers talked about teaching students how to form different types of questions and a Grade 4 teacher stated: "When a child can ask the question back to you, there's thinking."

Most teachers talked about the necessity of subject content and background knowledge as a pre-requisite for thinking. One Grade 4 teacher said, "You can't get to higher order thinking without knowledge to start off, you start by teaching basic knowledge." A Grade 7-9 social studies teacher talked about the importance of students using their prior knowledge: "Activating prior knowledge so they can make connections that are a little more relevant to them and then also applying it to other situations outside of what we may be talking about at the moment."

While observation was used by all teachers, and checklists and descriptive comments by some, only a few teachers of Kindergarten to Grade 6, and none of Grades 7-9, explained how they went about observing and recording evidence of thinking. Some teachers believed that if thinking were not explicitly indicated in curriculum documents and report cards, then not all teachers would teach or assess higher order thinking. They had mixed opinions about whether their report card indicators included thinking as part of social studies and science, whereas the report card included

reasoning in math, so teachers assessed reasoning in math, although there were varied opinions of what reasoning meant.

Students' marks reflected student thinking for some of the teachers, but not for all. K-3 teachers did not think higher order thinking had much of a role in social studies and science report card marks, while Grade 4-9 teachers indicated it was reflected in some of the higher achieving students' marks, but not necessarily so for other students. The following excerpt is part of a discussion among several Grade 5 teachers:

Teacher A: Except for maybe language arts, language arts would be different because they would be expecting thinking to be there because it says personal and, I think because it's expected, and it's written in language in the 11 objectives that we have, or learning outcomes. It's written on the report card as a descriptor—"ability to personally and critically connect"—because there's an exact descriptor and it's written there it's expected, but it's not expected in science or socials or history or wherever else it is that we teach, it's just not there.

Teacher B: Reasoning is on the math, yeah, but reasoning doesn't happen in language.

Teacher C: Not according to the report card.

Teachers also had differing opinions about whether a student's ability to show reasoning in writing should be reflected in marks in social studies and science. Some teachers thought social studies and science marks should not be influenced by written communication and that students could show reasoning through oral communication and other forms of representation. However, many teachers said that some of their students had difficulty answering higher order questions orally as well: "They can express at their own level, but sometimes they can't, it's still minimal, sometimes they don't have the language to describe it" (Grade 4).

Some of the teachers were becoming involved with differentiated instruction, differentiated assessment, and multiple intelligences. These teachers often gave their students choice in their assessment activities, taking into consideration learning styles and student interests. One Grade 7-9 social studies teacher explained: "They could do the amount of research or the type of research or the type of presentation, they could kind of fit it into their own interest, their own comfort zone, and their own knowledge." However, teachers did not usually plan this with higher order thinking in mind. The choices were more about different ways of teaching and assessing, rather than distinguishing between higher and lower order thinking. Some of the choices given to students may have been higher order, but teachers were not sure if this was so, and assessing higher order thinking was not the purpose of giving choices.

Teachers indicated that many students wanted to know the right answer, and were not willing to take risks. This was evident even at a young age, and a kindergarten teacher stated: "Not many students come to school as risk-takers. Many want to get everything correct." A Grade 4 teacher stated: "They don't like being wrong, they don't like anything wrong on that page." Teachers in Grades 7-9 also mentioned that some of their high achieving students were not risk takers, and were not comfortable "thinking outside the box." They usually wanted to "get it right," and wanted the teachers to specify what they should learn for assessments. A Grade 7-9 teacher sighed: "They want the answer in their hands." Another Grade 7-9 science teacher relayed the same message: "Some students just want to be told the information. They just want you to give it to them, that's fine, I'll study, and they'll do very, very well." Teachers believed that students have a comfort level with learning facts they can recall for quizzes and tests, and many students prefer questions that

require lower level thinking. Accordingly, lower level thinking questions dominated most of their classroom assessments.

Teachers in all grades talked at length about having to follow learning outcomes: they thought they had too much content to cover and they were sometimes overwhelmed by the everyday demands of teaching. One Grade 7-9 science teacher dramatically vented:

... and then somehow having gotten the science across to them now we're supposed to be engaging them in critical, assessing the issues, recognizing different points of view, and recognizing, there just really a) isn't the time and b) as science teachers we're not very comfortable doing that, we haven't got the training for it.

Teachers do Not See Definite Differences in Thinking between Girls and Boys

The teachers were asked about differences in the thinking of girls and boys. Many teachers said they had never given this much thought, and had to think carefully about it during the interview. Class discussions are an integral part of teaching from Kindergarten to Grade 9, so several teachers talked about students participating orally. Six teachers thought boys contributed more than girls in discussions, four teachers thought girls spoke more often, six said there was no difference, and the remaining 22 did not comment about differences between girls and boys. They said it depended upon individual students, and mentioned personality differences such as shyness. A Grade 6 teacher commented:

I think it tends to be more of a personality thing because I have some boys that are very verbal and love to answer questions, and some girls as well, and then other students, both male and female, are very shy and tend not to speak as much. I don't think it's as much of a gender issue.

Three Grade 6 teachers mentioned that as girls became older they noticed that the girls tended to contribute less to class discussions. These three teachers had experience teaching Grades 4-6, and noticed a change as the girls moved through the elementary grades. They attributed the change to social pressures. However, the Grade 7-9 teachers did not see a difference in the amount or quality of speaking between girls and boys. A Grade 7-9 social studies teacher stated: "I've never really looked at boys versus girls, I can't really say if there's a difference or not, nothing stands out."

Teachers also spoke about writing and gender. Seven teachers from Grades 4-6 thought girls were stronger writers, but the remaining 31 teachers did not give this same opinion. Some thought there was no difference between the writing of girls and boys. A 7-9 social studies teacher commented: "They are pretty close to equal in written work." Other teachers said the girls sometimes included more details, but the boys could write answers that were just as strong. A 7-9 social studies and science teacher affirmed what many others said:

There are girls who are strong writers and boys who are strong writers, and there are a fair number of them. There are girls who are weak writers and boys who are weak writers. If I'm thinking numerically, I probably have more stronger writers who are female than male, but I do get just as strong answers from some of the males as well, definitely.

In general, the teachers did not see definite differences between the writing of girls and boys.

Most teachers spoke about student knowledge and confidence. They thought that depending

upon the topic girls or boys would contribute more. For example, if the topic was war, boys generally had more background knowledge and showed more interest, consequently contributing more to discussions. If the topic related to lifestyles or social situations, then girls contributed more:

... more so on the topic as opposed to the actual thinking skills, they're all quite capable of higher order, lower level thinking and stuff, but it depends upon the topic you're on, like when you get into the physical things like physics and electricity and motors and all that kind of stuff, that's more what the guys like, and then when you do, believe it or not, the chemistry and some of the biology and stuff, that's more what the girls like.

This science example shows how the topic, even within a subject area, can affect student thinking and interact with the gender of the student.

Those teachers who did say they saw differences between girls and boys usually qualified their opinion by giving examples of how students of the other gender could perform in the same way. A Grade 6 teacher stated: "I would say the girls tend to be able to kind of extend their thinking a bit more, that's what I've seen generally, but that's certainly not the case, there's some boys I've taught that have been really amazing in that area." Teachers said it depended upon the class. One Grade 2 teacher articulated: "The boys will be able to give more detail about something, to me they're more animated when they're talking about a topic that they're interested in. Maybe it's just this year. Maybe next year it will be the girls."

Many times when we asked about differences in thinking between girls and boys, teachers did not specifically talk about thinking. They talked about different interests, behaviours, and attributes of girls and boys: "The boys have more interests in the discovery channel programming than the girls" (Grade 2), "Boys are more active" (Grade 1), "There is a difference in maturity level, more difficult to get boys to focus" (Grade 7-9 science), and "I think boys tend to be a little more risk-takers in their thinking" (Grade 4). Teachers frequently mentioned subject areas that girls and boys preferred, but there was no consensus among teachers. One Grade 5 teacher said: "Boys do like the science more," and a Grade 1 teacher stated: "The girls are as interested in science as the boys." More often the teachers made qualifying statements: "I was going to say language in general, but I find if the boys are into a good novel the boys are as much into it as the girls are" (Grade 6).

For these teachers, gender was not a consideration in how they taught or assessed thinking skills. Some teachers were aware of differences, but looked at gender more globally than as to how it pertained to student thinking or how they taught as teachers. They talked about social skills of girls and boys, with a Grade 4 teacher thinking of her own children:

Certain things you encourage your daughter to do or your son to do, they develop different skills, and therefore even in their socialization I think boys and girls somehow develop, they have different social patterns in ways they've developed just by the different activities and exposure they have.

Some teachers thought girls wanted to please the teacher more than the boys, and that boys were more inclined to say when they were not interested in the topic. There were varying opinions among the teachers, but the most common finding was that there was no definitive difference in the thinking between girls and boys, and that it depended upon the individual student and the topic or subject.

Discussion

Teachers of all grade levels, Kindergarten to 9, indicated that critical and higher order thinking was important for their students. They thought that it was important for all students, even if the teachers did not expect all students to achieve higher order thinking in their learning. This supports the idea that the importance of thinking for our students is well recognized, and is noted by many writers, for example, Darling-Hammond et al. (2008) and Resnick (2001). But it also indicates the difficulty teachers have with higher order thinking for some students, and how best to include higher order thinking in their assessments.

What we believe was abundantly clear from the interviews is that many teachers lack an understanding of critical and higher order thinking—as we have described it above. When asked about the meaning of higher order thinking in the classroom, the teachers gave examples of instructional activities and did not articulate what higher order thinking means. They gave little indication that higher order thinking was systematically taught and assessed in their classrooms, nor was it identified as an explicit goal of the instructional activities. This is cause for concern as a number of writers (e.g., Barak, Ben-Chaim, & Zoller, 2007; Costa & Kallick, 2000; Lipman, 2003; Paul, 1991; Pithers & Soden, 2000) have indicated the importance of directly teaching thinking skills in the classroom. Abrami et al. (2008, 2015) provide general guidelines for instructional “strategies for teaching students to think critically,” although there is debate as to whether this is best done in the subject matter context or more generally (e.g., Ennis, 1992; Marzano & Kendall, 2007). In our research with elementary students, we found that we could increase general critical thinking as well as subject-matter higher order thinking in science and social studies, and with students from varying achievement levels (e.g., FitzPatrick & Schulz, 2011; Schulz & FitzPatrick, 2013, 2014).

Teachers indicated that they need to learn about higher order thinking. This should include recent developments on thinking frameworks, and both general and subject specific thinking skills. They would also benefit from instructional and assessment strategies for higher order thinking and how to meld these with subject matter content. These teachers believed that students need to become problem solvers and “conscious, thinking global citizens,” but that, in general, teachers are not teaching or assessing as much higher order thinking as they think they should. FitzPatrick and Schulz (2012) reported that, in their studies with elementary school teachers, the teachers did improve the higher order thinking of their students.

The curriculum in science and social studies that we studied does specify higher order thinking goals and objectives but the corresponding instructional activities and assessments are often not at the same level (FitzPatrick & Schulz, 2010; 2015). This could potentially contribute to the difficulty for teachers. Curriculum documents should clearly outline the levels of thinking deemed appropriate to the subject matter, and the suggested activities and assessments should be consistent with the intended outcomes in both content and level of thinking. Although teachers assume responsibility for many teaching and assessment decisions, explicit attention to critical and higher order thinking should be an important component of curriculum documents to provide guidance and consistency for teachers and students.

Limitations and Future Research

We identified several limitations. These results pertain primarily to teaching science and social studies. They may not be applicable to other subject areas: for example, several teachers noted

that reasoning is a mandated aspect of the mathematics program. Further study is needed to determine if teachers of Grades 10-12 would respond similarly. This presents additional concerns as students do not all take the same courses, and there are program streams geared to stronger and weaker students in certain subject areas.

The teachers we interviewed are experienced teachers. Also, they volunteered to participate when asked by their principals. Some indicated an interest in higher order thinking. These teachers would not necessarily be representative of all teachers.

We have identified thinking frameworks that are commonly used in curriculum and in teaching. However, there are other thinking frameworks, many of which were reviewed by Moseley et al. (2004). These authors identified Marzano and Kendall (2001, updated 2007) as also being particularly pertinent to student learning. Further research could be pursued with other frameworks, such as those by Marzano and Kendall, and there is work being done with the SOLO taxonomy (Biggs & Collis, 1982; Biggs & Tang, 2007). Also, we limited our work to the cognitive domain, but the affective domain offers opportunities for research with teachers and students.

Resnick (1987) stated that although higher order thinking is difficult to define, it is much easier to recognize when encountered. A positive result of our research is that while many of the teachers we interviewed were not able to clearly define critical and higher order thinking, they were better able to give examples of activities that required students to think critically. Recognizing critical and higher order thinking is perhaps the first step in enabling teachers to teach and assess the many types and levels of thinking.

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Appendix A. Interview 1

Elementary Interview Questions

Teaching students to think is an integral part of education and we are interested in learning about how thinking is taught. In elementary we know that classroom teachers have many subjects to teach and that demands on teaching content and meeting all other student needs is high. So we are speaking with elementary teachers to get your views, your understandings, of what it means and what it entails to teach thinking to students. We have some open-ended questions we'd like to ask and we welcome any other comments you have on the topic of thinking.

With your permission, we would like to audio-record this interview. Although we will be writing a paper about our findings, no names of teachers or schools will be used. We will also share a summary of the interview for your feedback before we write the paper as we want to ensure we accurately represent your thoughts. At that time, you can modify, edit, or delete any comments, as we hope to present some brief excerpts from the interviews. The recordings will be destroyed after the study is completed.

1. We'll start with a general question. When you consider thinking skills that you feel students need to be able to use what comes to mind?
 - You mentioned _____. Can you describe what _____ means to you? If it helps to give an example, please do so.
 - Repeat this for each category of thinking mentioned
2. What has influenced your views of thinking? How do you decide which thinking skills are important?
 - How have thinking taxonomies been useful to you? (clarification may be necessary for teachers)
3. Social Studies is an area of the curriculum that aims to have students become knowledgeable citizens. How do thinking skills fit into your social studies program? (prompt for examples or more detail if pertinent)
4. What role do thinking skills play in your classroom assessments in Social Studies?
 - What types of questions do you ask on tests? You can give examples if you like.
 - How do you decide upon the types of questions to ask on tests?
 - In your classroom tests or quizzes is it possible to include questions that require students to use their knowledge or skills in novel situations? By this I mean questions where students use what they have learned in class and then have to apply their learning to a situation or context that was not taught in class. I'd like you to talk about this.
 - Is there a different expectation in relation to thinking skills with the other ways you assess in Social Studies? I'd like you to talk about this.
5. Let's talk about science. The science curriculum aims to develop scientific literacy. So how do thinking skills fit into your science program?
6. What role do thinking skills play in your classroom assessments in Science?

- What types of questions do you ask on tests? You can give examples if you like.
 - How do you decide upon the types of questions to ask on tests?
 - In your classroom tests or quizzes how often do you include questions that require students to use their knowledge or skills in novel situations? By this I mean questions where students use what they have learned in class and then have to apply their learning to a situation or context that was not taught in class. I'd like you to talk about this.
 - Is there a different expectation in relation to thinking skills with the other ways you assess in Social Studies? I'd like you to talk about this.
7. Do you think we teach social studies and science as a way of improving children's thinking or do we teach social studies and science for the content, with thinking something we hope for? I'd like you to talk about this.
8. What does thinking mean to you? (What do you think it means to think?)
9. Do you teach and assess all the thinking skills you think are important? Please discuss.
- I'd like you to discuss anything that makes it difficult to teach or assess *higher order thinking* in social studies. (or use whatever language the teacher uses)
 - I'd like you to discuss anything that makes it difficult to teach or assess *higher order thinking* in science. (or use whatever language the teacher uses)
10. Do you think all children benefit from a concentration on teaching thinking?
- Are all children able to handle higher order questioning or is higher order questioning just for the brighter/more capable students?
 - Do you think students will become strong thinkers if we don't teach thinking?
11. Is there a difference between boys and girls when it comes to thinking?
12. Is there a difference in how you incorporate the teaching of thinking in language arts and math compared to science and social studies?

Appendix B. Interview 2

Elementary Focus group

1. Critical thinking was mentioned by several of the teachers we've interviewed. Could you tell us more about what critical thinking means to you?
 - Reasoning
 - Reflection
 - Metacognition
 - Critical literacy
 - What do critical thinkers do?
2. We talked in our interviews about teaching thinking to all students and we're looking for some expansion on that topic. Is critical thinking or higher order thinking for all students? Could you talk more about that?
3. Knowledge, both content knowledge of the subject and background knowledge of the student has come up in these interviews. What role does knowledge play in children's thinking?
 - Making connections with their own worlds
 - Home environment
4. Teachers have talked about observing and listening to students, making notes of their contributions in discussions and group activities. Would you be able to elaborate on what it is you are listening for or what you are looking for when you are observing?
 - How would you keep records of this?
 - What would your recording indicate?
 - How do you use this when writing report cards?
 - How do you manage to get to all children?
 - How do you manage to find out what the quiet children think?
 - In a group or discussion how do you find out what the weaker students think?
 - Do you include higher order questions in assessment?
 - Do you include thinking as part of your criteria when you assign grades on the report card?
5. Several teachers have talked about children wanting to be right, about children being afraid to be wrong. Could you elaborate on that?
 - Children not wanting to be stuck
 - Children not used to or wanting to think
6. Many teachers have talked about questioning, both from the teacher and from the student, as part of thinking. Could you talk a little more about questioning?

- Types of questions
 - Are some higher order than others?
 - Weaker students and higher order questions
7. It's been mentioned that children may feel stifled, that their creativity and imagination may be hindered when we ask the critical questions, the hard ones, because children may get caught up in wanting to be right. What do you think about this notion?
 8. We've talked with teachers about whether they think they are able to include as much thinking as they would like in their teaching, as well as teaching the content. How does this work in your classrooms?
 9. We've talked about differences between boys and girls in their thinking. We've gotten the sense that there are differences, perhaps some stronger than others, and that sometimes the differences may be more individual rather than gender related. Could you talk a bit more about these differences or lack of them?
 10. We've concentrated on social studies and science in our interviews, but you teach other subjects as well. Are there some subjects that lend themselves more to teaching thinking than others? If so, could you elaborate?