21ST CENTURY PEDAGOGY:
A CLASSROOM PERSPECTIVE ON CRITICAL THINKING

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Abstract

The current study aims to gain a classroom perspective on one of the core 21st century skills: critical thinking. Teachers from London, England and Toronto, Ontario (N=24) were surveyed and interviewed (N=10) and asked about their conceptualizations of critical thinking and their classroom practices. Teachers surveyed believe that critical thinking is a skill, that it can be taught, and that it should be infused throughout the curriculum. Furthermore, they require more time, resources, and training to encourage these skills effectively. The interviews revealed that although teachers have varied definitions, they share common practices to encourage critical thinking such as group work and class discussion, the use of open-ended questions, and the encouragement of questioning and multiple perspectives from students. Given teachers' concerns about testing and curriculum restraints, it is recommended that a greater focus be put on training teaching strategies, rather than on assessment or curriculum content.

Keywords: critical thinking, 21st century skills, education policy, teachers' perspectives, mixed methodology

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Now, on to the next adventure!

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21st Century Pedagogy: A Classroom Perspective on Critical Thinking

Although we are only just over a decade into the 21st century, the last 13 years have seen immense societal changes. Easy access to the Internet and the introduction of social media has revolutionized how we communicate with one another and report major events. Our knowledge and understanding of diseases and disorders is continuously growing as we work towards cures and treatments, and our curiosity about our cosmos is resulting in greater exploration of our solar system, and beyond. As our society continues to change and evolve at an exponential rate, future citizens will be required to keep up with the fast-paced advancements in technology, science, and medicine. It is therefore not an uncommon view that we must prepare our next generation to be exceptional at adapting quickly and to equip them with higher level thinking skills (e.g., Summers, 2012, Friedman, 2013).

In the current academic and policy literature, these necessary skills are referred to as '21st century skills.' These 21st century skills go beyond rote memory and basic writing and arithmetic and often involve factors such as critical thinking, creativity and innovation, collaboration, and technological competency (C21 Canada, 2012; Action Canada, 2013; Fullan, 2013). Although the importance of literacy and numeracy has not been forgotten, the purpose of encouraging these skills is to "to build capacity in areas that promote a resilient society capable of effectively adapting to rapid change" (Action Canada, 2013, p.

3). As a result, we are currently seeing a shift in education policy and research, where a greater focus is being put on providing students with 21st century skills in order to succeed in this entirely unknown future.

A number of major organizations and institutions in Canada have addressed the importance of developing these skills in the upcoming generations of students (C21 Canada, 2012; Action Canada, 2013). For instance, in 2013, Action Canada [1] released the report, "Future Tense: Adapting Canadian Education Systems for the 21St Century." The document outlines a policy analysis of the steps a number of provincial governments are taking to ensure the inclusion of 21st century skills in their education system, specifically Alberta, British Columbia, New Brunswick, Ontario, and Quebec. Action Canada selected four core competencies to examine: Creativity, entrepreneurship and innovation; Critical thinking; Computer and digital literacy; and Character. They found that each province greatly differed in their discussion of 21st century skills in policies, as well as in their plan for application these competencies in the classroom. They suggest that a 21st Century Learning Secretariat be created as part of the Council of Ministers of Education in order to establish a national framework, which could

[1] The Action Canada Foundation (Action Canada), a registered charity funded in part by the Government of Canada, is a national fellowship program whose purpose is to "[enhance] fellows' leadership skills, [broaden] their understanding of Canada and its policy choices, and [build] an exceptional network of leaders for our future" (Action Canada, 2013, p.1) and does so by involving fellows in large-scale research reports related to major issues affecting Canadians.

be used across provincial education systems.

In their analysis of the Ontario education system, they found that there was a greater emphasis on critical thinking and character, and less focus on computer and digital technologies; and creativity, entrepreneurship and innovation. One of the policy documents cited was Michael Fullan's, Special Advisor to the Premier of Ontario, 2013 report entitled 'Great to Excellent: Launching the Next stage of Ontario's Education Agenda." In this document, Fullan (2013) discusses the accomplishments of the Ontario education system from 2003-2012, and the steps forward to continue improvement. With massive increases in graduation rates and higher levels of student achievement in literacy and numeracy, Fullan outlines the next phase in the improvement of the education system, which "entails both sustaining improvement on current priorities and focused innovation for our next level of achievement" (Fullan, 2013, p. 6). As part of this growth plan and following the 21st century skill trend, Fullan proposes six key qualities to be encouraged in order to ensure the wellbeing of students and society, which he calls the '6 C's': character, citizenship, communication, critical thinking and problem solving, collaboration and teamwork, and creativity and imagination (Fullan).

One of the major criticisms Action Canada makes of Fullan's (2013) report is that, "While all the competencies of interest for the purposes of this report are highlighted in Fullan's paper, it remains descriptive and the

implementation relies on a great deal of knowledge and expertise assumed to already be present in the system." (Action Canada, 2013, p 9). For instance Fullan's (2013) description of 'critical thinking and problem solving' is: "think critically to design and manage projects, solve problems, make effective decisions using a variety of digital tools and resources" (p. 9). One of the biggest challenges with the 21st century skills is that they are fluid concepts and often overlap. Fullan (2013) does not claim to have complete explanations of each of these competencies and states that:

> As we delve into the meaning of these concepts, it is important to stress that we should not launch into an abstract discussion. In the next period of development, these core priorities must be defined, operationalized in practice, measured to mark success and to clarify progress and next steps, and widely shared in terms of spreading what works (Fullan, 2013, p. 8).

Nevertheless, creating a policy reform without a clear understanding of what it is you are trying to accomplish is a dangerous game. With a growing interest in 21st century skills, such as critical thinking, and its inclusion in major policy documents in Ontario and across Canada, it is imperative that we gain a sense of what is mean by these terms, and more importantly, what they would look like in a classroom. Teachers have great insight as to what 21st century learning looks like in the classroom (Action Canada, 2013). Rather than prescribing new methods and teaching practices, especially when concepts are

unclear, we should begin to include those who are present in the classroom and who have a first hand understanding of students' learning. In beginning to work towards practice-informed research, the purpose of the current study is to gain a classroom perspective on a pivotal 21st Century skill: Critical Thinking.

Critical Thinking Frameworks

Critical thinking is a difficult term to define. Many scholars in education, philosophy and psychology have written extensively on critical thinking and numerous conceptualizations exist (e.g., Brodin, 2007). However, the definitions of critical thinking vary greatly and scholars will often disagree on fundamental aspects of the concept. For instance, Ennis (1987) defines critical thinking as "reasonable reflective thinking that is focused on deciding what to believe or do" (Ennis, 1987, p. 10). He believes that critical thinking is a set of dispositions and skills and these skills are generalizable. McPeck (1981) however, defines critical thinking as "the appropriate use of reflective skepticism... this is necessarily linked with specific areas of expertise and knowledge" (p. 19). He sees critical thinking as a discipline-specific skill and that thinking cannot be dissociated from its context. He explains,

> It is important to realize that the criterion for regarding scepticism as judicious, as opposed to incorrect or frivolous, must be determined by the norms and standards of the subject area in question. Learning to think critically is in large measure learning to know when to question

something, and what sorts of questions to ask. Not just any question will do" (p. 7)

Halpern (2003), on the other hand, believes that critical thinking is "The use of those cognitive skills or strategies that increase the probability of a desirable outcome. It is purposeful, reasonable, and goal directed" (Halpern, 2003, p. 38). She believes that critical thinking encompasses a number of skills such as problem solving, decision-making, and creativity, and that these skills can be transferred across domains. Kuhn (1999) adds another dimension to her theory and includes a developmental component to critical thinking. Using empirical developmental data, she has broken down critical thinking into three forms of 'second-order cognition (meta-knowing)': metacognitive knowing ("what do I know and how do I know it?" p. 17), metastrategic knowing (being aware of and using cognitive strategies to achieve goals, p.17) and epistemological knowing ("individual's broader understanding of knowledge and knowing", p. 17). All of these develop at different times and ultimately make up critical thinking (Kuhn). Kuhn believes that developmental research can enrich the study of critical thinking and is essential for its implementation in educational settings. Each of these definitions is unique and often difficult to even compare. Some major theoretical questions are common among these frameworks (e.g., is critical thinking a skill or a disposition or both? can it be taught? can it be transferred to differing situations? etc.) and have yet to be answered. The first aspect of the

current study is to gain a teacher's perspective on some of these major theoretical issues.

Although each of the aforementioned authors and theories are well known in the academic literature, there are other frameworks for critical thinking that are more often used in the education setting. For instance, Bloom's Taxonomy is "a framework for classifying statements of what we expect or intend students to learn as a result of instruction" (Krathwohl, 2002, p. 212). It is made up of 6 categories: Knowledge, Comprehension, Application, Analysis, Synthesis, and Evaluation. The categories are ordered from simple to complex and it represents a "cumulative hierarchy" – one must master each simpler category before you can master the next more complex one. The 'application', 'analysis', 'synthesis' and 'evaluation' aspects of the taxonomy are often seen to make up 'critical thinking' or more complex thinking. Thus, once a student has mastered basic knowledge and comprehends a topic, the aim is to have students think more deeply about the material (e.g., applying it to other situations or settings, evaluating its relevance etc.)

Although the taxonomy has its drawbacks (Furst, 1981), it has been incredibly influential in education. For instance, teachers using the current Ontario curriculum (from grade 1 through grade 12) are encouraged to tap into four categories of knowledge and skills: Knowledge and Understanding (subject specific content), Thinking and Inquiry (creative and critical thinking),

Communication (relaying knowledge), and Application (making connections) (Ontario Ministry of Education, 2010). These four components are parallel to the 6 categories found in Bloom's taxonomy. The 'higher-level' thinking is covered by the 'Application' and 'Thinking and Inquiry' sections of the curriculum. Although the Ontario curriculum includes this higher-level aspect (i.e., Thinking and Inquiry) to learning, there is no formal testing or instruction of critical thinking for students. No 'critical thinking' courses are offered at the K-12 level for students, and any testing done at the provincial level focus on more basic skills. For instance, the Education Quality Accountability Office (EQAO) testing, province-wide testing required of all Grades 3, 6, 9, and 10, focuses on achievement in reading, writing and mathematics (EQAO, 2013). As a result, it is up to teachers in Ontario to plan lessons and assignments that encourage critical thinking skills in their students.

More direct instruction of critical thinking does exist in other education systems. For instance, in England, a critical thinking A-level [2] (Advanced level)

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[2] In England, the curriculum is divided into 5 Key stages. National Curriculum Assessments are standardized tests that occur at the end of Key stages 1, 2 and 3. In Key stage 4, or General Certificate of Secondary Education (GCSE) (Year 10 and 11, equivalent to Grade 9 and 10 in Ontario), students complete year-end exams. A-levels (advanced levels) are qualifications that students in England, Northern Ireland and Wales are required to complete in order to enter University. In year 12 and 13 (equivalent to grade 11 and 12 in Ontario), students specialize in 3 to 5 topics (e.g. physics, literature, economics, critical thinking, etc.), where they study these topics and complete exams, which are created and assessed by the external exam boards (e.g. OCR).

course and the accompanying OCR (Oxford, Cambridge & RSA Examinations) exams (OCR, 2013) are offered at some schools for students in their last 2 years of secondary school (Key stage 5, or Year 12 and 13). Students complete a set curriculum, which is meant to teach critical thinking skills (as defined by the OCR), and prepare for exams, which test their ability to think critically.

The OCR defines critical thinking as "the analytical thinking which underlies all rational discourse and enquiry. It is characterised by a meticulous and rigorous approach. As an academic discipline, it is unique in that it explicitly focuses on the processes involved in being rational" (OCR, 2013, p.4). The A-level is broken down into 4 units where students cover specific aspects of critical thinking. In their first year (year 12) they start with Unit 1 - Introduction to Critical Thinking (which covers language of reasoning and credibility), and Unit 2 – Assessing and Developing Argument (which covers analysis, evaluation and developing arguments). In their second year (year 13) they cover Unit 3: Ethical Reasoning and Decision Making (which includes ethical theories, recognizing and applying principles, and dilemmas and decision making) and finally Unit 4 – Critical Reasoning (which includes analyzing, evaluating and developing of complex arguments) (OCR, 2013). Students take an exam after each unit covering those topics. According to the OCR specifications, this course gives students opportunities to analyze their own beliefs in different contexts, evaluate assumptions and reasoning, synthesize information and generate arguments, and

to transfer these skills and make connections (OCR, 2013). Thus, the direct instruction and practice of these critical thinking skills is meant to teach students how to think critically and to be able to transfer those skills outside of their learning.

Current Study

Although this direct instruction only exists for students in the last two years of their secondary education, an intense focus on critical thinking is available to students in the English education system. Unlike in England, to my knowledge, no schools in Ontario offer critical thinking courses at the K-12 level and there is no widespread formal testing of critical thinking that exists in the classroom. Because schools in England have the option to specialize in critical thinking and take specific courses and complete exams to gain these skills, it is possible that critical thinking in the earlier years is taught or encouraged differently than in Ontario. However it is also possible that because the critical thinking course is not a requirement for all students, teachers in the earlier courses may also make an effort to encourage the skill in their students. In order to uncover how the existence of formal critical thinking instruction may influence the conceptualization of the term, the current project will be working with a sample of teachers from Toronto, Ontario, Canada as well as a sample of teachers from London, England to gain a cross-cultural examination of critical thinking in the classroom.

Howe (2004) conducted a cross-cultural study examining Canadian and Japanese secondary teachers' conceptions of critical thinking. Howe found significant cross-cultural differences, specifically, that Canadian teachers focused on cognitive domains of critical thinking, whereas Japanese teachers focused on the affective domain. Furthermore, he found that in both Japan and Canada, critical thinking was seen as an implicit teaching practice. Howe used both quantitative and qualitative measures: a card-sort task involving a number of different terms related to critical thinking, and a survey. He found that teachers all had unique definitions of critical thinking, but that some common elements existed. Similarly to Howe's study, the current research project will involve quantitative (survey) and qualitative (interview) measures and will discuss conceptions of critical thinking with secondary school teachers in Canada and abroad (England).

Additionally, Choy and Cheah (2009) examined perceptions of critical thinking in a sample of 30 teachers from institutions of higher learning in Malaysia. Participants completed an open-ended questionnaire aimed at understanding their perceptions of critical thinking, their perceptions of their students' abilities to think critically, and what role the teachers believed they played in encouraging critical thinking in their teaching. The researchers found that although the teachers did vary in their definitions of critical thinking, most conceptualized critical thinking as a method of thinking that would make learning

a positive experience for students. In addition, all the respondents believed that teaching critical thinking would result in positive outcomes and half of their sample believed these skills needed to be taught. However, Choy and Cheah found that many of the teachers in their sample had a narrow understanding of critical thinking and many of the examples they provided of their students' abilities did not correspond with the definitions of critical thinking in the academic literature.

Both of these studies illustrate how teachers' notions of critical thinking may very greatly and that teachers may refer to something other than critical thinking when discussing the term. Thus, it is important to gain teachers' understanding of critical thinking and how they incorporate those conceptions into their classroom teaching and assessments; the way in which teachers understand critical thinking will shape how they are encouraging critical thinking in their classrooms. Uncovering the similarities and differences and how they relate to current conceptions to critical thinking, and how they differ, can help build a richer understanding of critical thinking.

Choy and Cheah (2009) focused on educators from institutions of higher learning in their exploration of teachers' conceptualizations of critical thinking. Similarly to Howe (2004), the current study will include teachers from secondary schools, as well as middle schools (Grade 7-12 in Toronto, Year 7-13 in London) in order to understand the development of these skills prior to start of higher-

education. In addition, the current study will involve both quantitative and qualitative methods so as to gain a richer understanding of how teachers conceptualize critical thinking. The quantitative data from surveys will help identify the general understanding and perceptions teachers have of critical thinking and gain their perspective on some of theoretical questions in the academic literature. The qualitative portion of the study with be comprised of semi-structured interviews, which will be partially based on the questions used in Choy and Cheah's (2009) study and will be further informed by my survey data and existing academic literature. The aim of the interviews is to better understand how teachers conceptualize critical thinking in the classroom, and how they encourage it in their students.

The current study has been designed with the goal of informing future education policy and research. Though largely exploratory, the study aims to gain a practical perspective on critical thinking. In talking to teachers and understanding their experiences, we can learn how critical thinking can be most effectively included in the classroom. As seen in Howe (2004) and Choy and Cheah's (2009) studies, and because there is much debate even among experts in the academic literature regarding the definition of critical thinking, it is expected that teachers' understanding of critical thinking will vary within the sample of teachers. Although some similarities may exist, it is hypothesized that overall, teachers will have unique definitions of critical thinking. Furthermore, it is

expected that the conceptualization of teachers in London may vary in different ways from those in Toronto, given that a specific conceptualization of critical thinking as a course exists in their education system.

By understanding teachers' definitions of critical thinking, we can begin to build a richer conceptualization of what critical thinking looks like in the classroom. As Siegel (1988, as cited in Brodin, 2007) explains,

> Despite widespread recent interest in critical thinking education, there is no clear agreement concerning the referent term. But if that notion is to carry significant weight in our educational thinking and practice, it is essential that it be delineated with some precision, so that we will know what we are talking about when we talk of desirability of critical thinking, or of educational efforts aimed at improving students' critical thinking ability (p. 137).

Although Siegel wrote this in 1988, in 2013 this statement still holds. The widely varying definitions of critical thinking make it difficult to understand what critical thinking actually consists of. It is important to keep in mind however, that a clear and concise definition may not be possible without destroying the concept itself. However, since none of the existing definitions are necessarily wrong or better than the others, it is useful to examine each of these theories and to see if, and where, these theories may be most appropriate and to gain an understanding of this term in an educational context. If considering the educational implications of

critical thinking, gaining a teachers' perspective on this concept is imperative for a complete understanding of what it is.

Method

Before discussing the details of the methods of the current project, it is important to understand the motivations behind the measures and methodology. As a psychology student, I have been trained to conduct quantitative research. I chose to create a quantitative survey to begin collecting data on the topic of critical thinking in education. However, I felt that the questionnaires would not be sensitive enough to pick up on nuances and details that I believe my research questions required. I decided to also use some qualitative measures, specifically interviews, in order to gain richer data. However, mixed-methods research often creates a situation where research paradigms conflict (i.e., contradictory epistemological and ontological assumptions).

Greene and Caracelli (2003) discuss different ways of reconciling the paradigm conflicts of mixed-methods research. For the current research project, I will be taking the pragmatic stance to mixed methods, where paradigms are "not critically important in the making of inquiry decisions, rather, what matters most is responsiveness of the demands of the inquiry context" (Greene & Caracelli, p. 96). As Green and Caracelli explain, "the pragmatic mixed methods inquirer attends to the demands of the particular inquiry context and makes inquiry decisions so as to provide the information needed and maximize desired

consequences – 'to get the job done'" (p. 101). Using this framework, research results are always evaluated in terms of their consequences and utility and thus methods of evaluation will depend on what knowledge one is trying to gain or access. This way, both qualitative and quantitative methods are compatible and can be used and combined in different ways depending on research aims.

Thus, I used this approach, as it is my belief that it resulted in more useful and richer data than using one method alone. The quantitative data from the surveys helped identify the general understanding and perceptions that teachers have towards critical thinking and to gain a classroom perspective on some major theoretical issues. Semi-structured interviews, which were partially informed by survey data, addressed more complex topics and situations (e.g. "Can you walk me through an assignment where students had to think critically?") and allowed me to gain a more in-depth understanding of teachers' classroom practices.

A guiding purpose of the current research project is to work with teachers and to gain their perspective on critical thinking and how they encourage it in their classrooms. I am interested in understanding teachers' perspectives because I believe that practitioners have knowledge that researchers and policy makers (those outside the classroom) do not. In the case of critical thinking research, there is little agreement in the academic literature on what "critical thinking" entails. Since changes are currently being made to education policies regarding critical thinking, I believe the voice of the teachers should be included in the

creation of the construct of critical thinking in the context of the classroom. This way, we can ensure that the policies are practical, effective and appropriate for a classroom setting.

Survey

Participants. Ten year 8-13 teachers in London, England (1 male, 9 female) with ages ranging from 21 to 62 (M = 31, SD = 13.7) and fourteen grade 7-12 teachers from Toronto, Canada (6 male, 7 female) with ages ranging from 24 to 60 (M = 37, SD = 10.6) completed a survey in either an electronic online version or paper and pen version (see Appendix A for Toronto survey and Appendix B for London survey). The sample consisted of middle and high school teachers, all of whom were teaching or had taught various grades.

In Toronto, participant recruitment began with contacting 15 randomly selected intermediate and middle schools across Toronto. A list of TDSB (Toronto District School Board) schools was retrieved from the school board website (TDSB, 2012). From this list, all schools teaching grades 6 and above (and anything in between, for instance grades 7-8, 6-9 etc.) were compiled (N=57). These schools were chosen in order to match schools in London, where secondary schools begin at year 7 (equivalent to grade 6) and go until year 11 (equivalent to grade 10) or year 13 (equivalent to grade 12). Furthermore, alternative and arts schools were deleted from the sample. From this list, 15 schools were chosen by randomly selecting a starting point, and choosing every

5th school. Recruitment using a random sample of teachers did not yield enough responses and therefore a convenience sample was also contacted. Participants were recruited primarily through email, however links to the survey were also posted online on Facebook groups in Toronto (e.g. York Faculty of Education). In addition, teachers were personally contacted by the researcher or the researcher's colleagues and were asked to pass on the study information (snowball technique) through email or Facebook, and physical copies of the surveys with postage were also distributed to these contacts. Furthermore, the sample was extended to include high school teachers to increase the participant pool and in order to better match London teachers. Fewer surveys than expected were collected in Toronto, partially do to the political climate in 2012-2013 and work-to-rule striking occurring in Ontario.

In London, because of time limitations, there was no random selection of teachers, and a convenience sample was used and the snowball technique was employed to gain more survey responses. Paper copies of the survey were distributed at a Teach First professional development session and teachers and other colleagues were emailed and asked to complete the survey or pass on the study information. Four completed surveys were lost in mail when sent from London to Toronto and were therefore not included in the final sample. Finally, participants were not compensated for completing the survey, but were thanked for their time and given the researcher's contact information if they had any

questions.

Materials. The survey portion of the study was included to gather general demographic information as well as to gain some insight on how teachers conceptualization relate to critical thinking theory. The survey was designed for this study through reviewing topics in the literature and creating questions that tapped into these themes. The survey in total took approximately 15 minutes to complete. The London and Toronto surveys were nearly identical, however some terminology was changed (e.g. 'year' level vs. 'grade' level) and demographic questions (e.g., type of teacher training completed) were altered in order to accurately describe each city's education system. In addition, the survey questions were piloted to test the clarity and appropriateness of the questions as well as the length of the survey.

The survey consisted of three sections: perceptions of critical thinking (section 1), identifying critical thinking (section 2), and demographics (section 3). The aim of section 1 was to understand the perceptions teachers had of various aspects of critical thinking. Major themes and discussions were taken from the critical thinking literature to compose this section (e.g., whether critical thinking is a skill or disposition) as well as practical questions, which could be relevant to future education policy (e.g. whether critical thinking should be formally assessed). The survey began with an open-ended question asking teachers to define critical thinking. It was placed before any other questions so that the

following survey questions would not influence the participants' response (though this could not be ensured for those completing the survey in paper form). The aim was to understand the teachers' current understanding of the concept. Question 2 was based on major discussions in the literature, for instance whether critical thinking is a skill or disposition, whether critical thinking is subject specific or a general skill, and whether there are any other factors that would influence critical thinking ability (e.g., age or cognitive ability; Ennis, 1987; Halpern, 2003; McPeck, 1981).

Question 3 aimed to understand whether there was a specific definition or conceptualization of critical thinking that teachers were familiar with or preferred, and questions 4 asked whether they would change anything about the definition they chose. Four different conceptualization of critical thinking were taken from major researchers in this area including Ennis (1987), Halpern (2003), McPeck (1981) and Kuhn (1999). Questions 5-8 examined the inclusion of critical thinking in the classroom and lessons, the age that students should start being encouraged to think critically, teachers' preparation to teach critical thinking, and assessing critical thinking. Several of these questions were elaborated on in the interviews—for instance, assessment and preparation to teach critical thinking.

Section 2 aimed to measure what teachers identified as critical thinking. Teachers were asked to read through a set of questions and indicate whether or not they thought each question was a measure of critical thinking. A list of 20

items were chosen: 15 were based on Ontario curriculum documents, existing critical thinking tests, and academic literature, and 5 questions were intended to be obvious foils created by the experimenter. The foils were very basic questions that were not meant to involve any higher-level thinking. The 15 critical thinking items was compiled from three sources: 5 items from Stanovich, West, & Toplak's (2011) review of rational thinking and its assessment, 5 items from the Watson-Glaser Test (Drawing inferences, Recognizing assumptions, Argument evaluation, Deductive reasoning, Logical interpretation) (1980), and 5 from the grade 7 Ontario Math Curriculum (2005). The items from Stanovich, West, and Toplak overlapped with elements of critical thinking from academic literature (Halpern, 2003). Finally, the questions taken from the Ontario Math curriculum were also meant to be less obvious foils and may be considered "critical thinking questions" depending on the conceptualization of the critical thinking the participant possesses.

Section 3 was a set of demographic questions which includes questions about their age and gender, their teacher training and education, their current and past teaching positions, and finally, whether they would be willing to participate in a follow up interview.

Procedure. Participants completed the survey either online, or in a paper and pen format. Informed consent was collected before completing the survey (Appendix C for the Toronto survey consent form and Appendix D for the

London survey consent form). For online surveys, participants were asked to indicate consent by checking a box before continuing on to the remainder of the survey. For the paper and pen surveys, participants were asked to sign the consent form. The survey took approximately 15 minutes to complete and consisted of both closed and open-ended questions. A debriefing form was presented to the participants after completion of the survey and participants were reminded to contact the researchers with any further questions. Participants were also asked to indicate whether they are willing to participate in the interview portion of the study and asked to provide their contact information.

Interview

Participants. Five year 8-13 teachers in London (1 male, 4 female) and five grade 7-12 teachers from Toronto (2 male, 3 female) participated in the interview potion of the study. For both Toronto and London samples, all participants that completed the survey and indicated that they were willing to participate in an interview were contacted. Interviewees were compensated with a $50 (£35) Amazon gift card for their participation. Table 1 displays basic descriptors of the interviewees as well as their pseudonyms.

Materials. The interview portion of the study was conducted in order to gain a richer and deeper understanding of how teachers define and identify critical thinking by elaborating on some of the questions found in the survey. Teachers were also asked to provide specific examples (e.g. to bring in an assignment or

Table 1
Interviewee Descriptor Details by City

City	Interviewee Pseudonym	Subjects	Grade/Year
London	Christine	Geography	8, 9, 10, 11, 13
	Alexi	English	7, 8, 13
	Melissa	Citizenship (Social Studies)	7, 8, 9, 10, 11
	Peter	Critical Thinking, General Studies, History, Philosophy, Extended Project Qualification (EPQ)	13
	Rose	History, Religious Education	7, 8, 9, 10, 11
Toronto	Helen	International Baccalaureate, Math, Physical Education and Health	6, 7
	Joan	Core subjects (Language, Math, History, Geography)	8
	Kevin	History, Psychology/Sociology (Social Studies), English	11, 12
	Sandra	Science, Math, Physical Education and Health, Careers and Civics	9, 10
	Andrew	History, Math, Music, Credit Recovery	9, 10, 11, 12

Note: Subjects listed are those the interviewee was currently teaching or previously taught and discussed in interview

activity) of critical thinking in their classroom. The semi-structured, face-to-face interviews consisted of approximately 20 questions and took roughly 30 minutes to 1 hour to complete. About half of the interviews were conducted in cafes as the interviewees' convenience, and the remainder was held in classrooms or offices.

The questions were created for this research study and were partially based on the questions used in Choy and Cheah's (2009) study (e.g. "From your perspective, what is critical thinking?" p. 200; see Appendix E for a list of final interview questions) and also reflected some of the main discussions in the literature. In addition, as well as being another core 21st century skill, the relationship between creativity and critical thinking has been discussed by some academics (e.g. Fairweather & Cramond, 2010), and therefore a question regarding creativity and critical thinking was also included in the interview portion of my study.

Pilot interviews were conducted to test the clarity and appropriateness of the questions as well as the length of the interview. All participants were asked the same set of questions, though order did vary. Furthermore, given the semi-structures nature of the interview, each interview was unique and included a few additional, unplanned questions. Prior to the interview, each participant was asked to prepare an assignment or activity they believed encouraged critical thinking and discussed it in the interview.

Procedure. A sample of 10 teachers (5 from Toronto, 5 from London)

who participated in the survey portion of the study were contacted via email. When setting up mutual convenient location and date for the interview, interviewees were asked to bring an assignment or activity they believed encouraged critical thinking in their students. The one-on-one interviews ranged in length from about 30 minutes to one hour and took place in a variety of locations including classrooms and coffee shops. Informed consent specific to the interview was gathered before the interview (see Appendix F for Toronto consent form, and Appendix G for London consent form) and interviews were recorded and transcribed. Participants were debriefed and any additional questions were answered. In addition, a follow up email was sent to all interviewees thanking them for their time.

Results and Discussion

Survey

Twenty-four surveys (10 in London, 14 in Toronto) were included in the final analysis. A few statistical analyses were run on the survey data in order to determine if any significant cross-city differences existed. First, *t*-tests were conducted where Likert scale answers were converted into numerical values (1= strongly agree to 6 = strongly disagree) and means for each answer were compared for both cities. Save one question, no significant differences were found between the samples and analyses are not reported. Next, all answers were categorized into "agree" (strongly agree, agree, somewhat agree) and "disagree"

(strongly disagree, disagree, somewhat disagree) and another *t*-test was conducted on answers. Again, all but one question was not significant and analyses are not reported. Lastly, a Chi-squared goodness of fit test was conducted with the binary 'agree' and 'disagree' answers, and found no significant differences between the groups and once again, analyses are not reported. Since differences were not statistically significant, the survey data will be presented together, rather than by city. One participant did not provide demographic data and did not complete the identification of critical thinking section, however their survey responses were still included in the remainder of the analysis.

Demographics. Twenty-three participants provided demographic data. The sample was made up of 7 males and 16 females, with ages ranging from 21 to 62 (M = 34.6 years, SD = 12.1). Participants' teaching experience ranged from 1 to 41 years (M = 10.8 years, SD = 11.2), and every teacher was currently teaching, or had experienced teaching, students in grade 6-12 (year 7-13 in England). The sample was made up of teachers who taught a range of subjects, including Math, Science, English, and Social Sciences (Geography, History, etc.), and some taught more than one subject.

Definition of critical thinking. The first question on the survey asked participants to define critical thinking ("From your perspective, what is critical thinking?"). A qualitative analysis of this data was conducted, where responses were read through several times, and commonalities and patterns were identified.

Although responses varied greatly in content and complexity, several themes were revealed. Firstly, many respondents discussed critical thinking as 'questioning.' Participants discussed questioning in terms of questioning one's current knowledge, asking probing questions, questioning concepts and ideas, and so on. For instance, one teacher explains that critical thinking is "...Questioning where our beliefs have come from and how they influence our opinions/creation of knowledge." Related to this, many teachers also discussed critical thinking as 'perspective taking,' or understanding and considering multiple perspectives. One teacher states, "Critical thinking is challenging, as it forces students to look at a single idea from multiple perspectives and to ask layered questions in response to the answers they generate."

Furthermore, some respondents also discussed critical thinking in terms of analyzing and evaluating information and drawing conclusions. As one teacher explains, "Critical thinking is the process of analyzing 'on the lines' [sic] information and drawing conclusions based on it, questioning its validity, or synthesizing new approaches or concepts that are related to it." Teachers' responses ranged from very simple (e.g. "I think critical thinking is being able to see beyond the surface.") to fairly complex, which may relate to what degree teachers thought about critical thinking, and how clear their conceptualization was.

Participants were also asked to rank a set of 4 definitions paraphrased

from the academic literature (Halpern, 2003; Ennis, 1987; Kuhn, 1999; McPeck, 1991) from the one they most agreed with to least. Table 2 shows how each definition was ranked. Participants agreed least with the definition based on McPeck's conceptualization, ranking it often in 4th. Halpern's definition was often ranked in either 1st or 3rd place, and the definitions based on Kuhn and Ennis were fairly dispersed, but often ranked 1st and 2nd.

There is little agreement among teachers on academic definitions and conceptualizations of critical thinking. Although each of these definitions had unique elements, no single definition was perfect for all teachers. Both Kuhn (1999) and Ennis' (1987) definition, which were often ranked 1st or 2nd, contained an element of reflective thinking/thinking about thinking. Teachers may have been drawn to these two definitions for that reason. Furthermore, McPeck's (1991) definitions was the only one which directly stated that critical thinking was knowledge specific and did not transfer, which may be the reason it was after ranked 4th. It is important to understand teachers' opinions on critical thinking in academic literature. Since none of these definitions outshone the others, providing teachers with definitions may not very helpful or useful. Critical thinking being as difficult as it is to define, teachers may require more flexibility or autonomy when identifying these skills.

This question was not discussed in the interview portion of study, but it may have been useful to gain clarification on what aspect of the definition

Table 2
Ranking by Teachers of Critical Thinking Definitions from Academic Sources (Frequencies)

Definitions	Rank 1	2	3	4	n
Halpern: "Critical thinking is the use of cognitive skills that increase the probability of a desirable outcome. Critical thinking is purposeful, reasonable, and goal directed and encompasses a number of skills including problem solving and decision-making. Critical thinking can be transferred across domains and can be generalized to any situation."	7	2	11	3	23
Ennis: "Critical thinking is reasonable reflective thinking that is focused on deciding what to believe. It is made up of dispositions and skills. Critical thinking can be generalized to any situation and is not specific to any domain or subject."	6	9	6	2	23
Kuhn: "Critical thinking is way of 'thinking about our thinking'. The way we think about our thinking develops and over time we gain more knowledge and strategies to think critically."	8	9	4	2	23
McPeck: "Critical thinking is an appropriate use of reflective skepticism. Critical thinking is linked with specific areas of expertise and knowledge and cannot be generalized to all subjects or situations."	2	3	2	16	23

Note: Rank 1 signifies the most agreement, and rank 4 signifies the least agreement.

participants agreed with and which aspects they disliked. Although participants were provided with written space to comment on the definitions, not all participants took advantage of this and many of those who did, did not go into much detail or were unclear. Future research may examine in more depth teachers' opinions on current critical thinking frameworks and the way they would adapt them to fit a classroom setting.

Conceptualization of critical thinking. Participants were asked a series of questions related to their conceptualization of critical thinking, which tapped into several major questions discussed in the academic literature. Table 3 summarizes teachers' responses to each other questions in this section.

The responses to these questions shed some light on teachers' perspectives on some of the debates in critical thinking theory. Of the 24 participants, all but one agreed that critical thinking is a skill. When asked whether critical thinking was a disposition, or innate ability, there was significantly more diversity in answers, where some teachers did agree and others did not. In addition, there was general agreement among teachers that critical thinking is something that can be taught and most agreed all students are capable of thinking critically.

Furthermore, overall, teachers believed that age and cognitive ability could affect a student's ability to think critically. Although almost all teachers agreed that critical thinking should be infused throughout the curriculum, there was less agreement as to whether specific course for critical thinking, or whether

Table 3
Teacher Responses Regarding their Conceptualization of Critical Thinking (Frequencies)

Questions	Strongly Agree	Agree	Somewhat Agree	Somewhat Disagree	Disagree	Strongly Disagree	n
I believe critical thinking is a skill (learnable)	13	10	-	1	-	-	24
I believe critical thinking is a disposition (innate ability)	1	5	8	4	3	3	24
I believe critical thinking is something that can be taught	9	14	-	1	-	-	24
I believe all students are capable of thinking critically	7	11	3	1	1	-	23
I believe that a student's age can affect their ability to thinking critically	7	9	6	1	1	-	24
I believe that a student's cognitive ability can affect their ability to think critically	8	10	3	2	-	1	24

I believe there should be a specific class, course, or set of lessons dedicated to teaching critical thinking skills	3	5	10	3	1	2	24
I believe critical thinking should be infused throughout the curriculum	21	1	1	1	-	-	24
I believe critical thinking should be taught in a manner that is specific to every subject (e.g., learning how to think critically in science, learning how to think critically in math, learning how to think critically in English, etc.)	6	3	9	2	4	-	24

Note: Each column displays the number of teachers that responded at each degree of agreement

critical thinking should be taught specific to every subject. In conclusion, when discussing critical thinking in education and examining major issues in the academic literature, it is useful to identify teachers' perspectives. In a classroom environment, critical thinking can be thought of as a skill that can be taught and should be infused throughout the curriculum.

Critical thinking in the classroom. A few very basic questions were asked about teachers' current critical thinking practices. Responses to this section can be seen in Table 4.

Not surprisingly all of the surveyed teachers agreed that encouraging critical thinking skills in their students was important to them. Furthermore, most teachers actively tried to encourage critical thinking in their students in their lessons and assignments. This was discussed more in depth in the interviews and specific strategies as well as challenges will be discussed in the interview results section.

Teacher preparedness. Teachers were asked to comment on their preparedness to teach critical thinking. Table 5 displays their responses to this section of the survey.

Although most teachers report feeling prepared to teach critical thinking, find it easy to develop assignments and activities, and feel confident they understand what it is to be a critical thinker, some teachers do wish they have more time and resources. The biggest disparity in answers was whether teachers

Table 4
Teacher Responses Regarding Their Inclusion of Critical Thinking in the Classroom (Frequencies)

Questions	Strongly Agree	Agree	Somewhat Agree	Somewhat Disagree	Disagree	Strongly Disagree	n
Encouraging critical thinking skills in my students is important to me	15	8	1	-	-	-	24
I actively try to create lessons that will encourage critical thinking in my students	9	12	2	1	-	-	24
I often include questions that will require critical thinking skills in assignments	12	8	4	-	-	-	24

Note: Each column displays the number of teachers that responded at each degree of agreement

Table 5

Teacher Responses Regarding How Prepared They Feel to Encourage Critical Thinking (Frequencies)

Questions	Strongly Agree	Agree	Somewhat Agree	Somewhat Disagree	Disagree	Strongly Disagree	n
I feel prepared to help my students develop critical thinking skills	9	7	7	1	-	-	24
I am confident that I understand what it means to be a critical thinker	9	4	9	1	1	-	24
I am given enough resources to effectively teach critical thinking skills	3	6	4	4	7	-	24
I wish I had more time to include critical thinking skills in my lessons	6	6	6	5	1	-	24
I learned how to teach/encourage critical thinking in my teacher training	-	5	6	4	4	5	24

I wish I had more preparation in my teacher training to teach critical thinking	7	7	6	1	1	2	24
I learned how to teach/encourage critical thinking in professional development (PD) sessions	1	4	7	6	3	3	24
I find it easy to develop activities/assignments that encourage critical thinking	4	8	7	4	1	-	24
When I was a student, critical thinking was emphasized	1	2	7	5	3	6	24

Note: Each column displays the number of teachers that responded at each degree of agreement

had learned how to teach or encourage critical thinking in teacher training or professional development sessions: it is almost split in half in terms of agreement. Since there was no significant difference in agreement between cities, this cannot be explained by different systems of teacher training. It is possible that critical thinking was never addressed directly in teacher training or professional development for some teachers, but that some teachers applied other related strategies to their practice. Future research could examine what is actually being taught for teaching critical thinking, how and what teachers took from their training, and how it could be improved in the future.

Related to this, in their examination of 21st Century skill policy, Action Canada (2013) surveyed teachers in the provinces included in the analysis on the four core competencies highlighted in the report, because "[t]eachers are well-positioned to assess the extent to which provincial curricula and classroom practices promote 21st century learning" (Action Canada, p. 10). Based on the results of the online survey, they discovered a positive association between teacher education (e.g. graduate studies, professional development, etc.) and indicators of 21st century learning in the classroom. Action Canada therefor recommended a focus on teacher education and professional development in order to ensure that students are being encouraged to develop 21st century skills. The results of the current study support Action Canada's result since most wish they had more preparation in their teacher training to encourage critical thinking. Thus,

there should be a focus on preparing teachers, and more importantly, giving them the time and resources to do so.

Assessment of critical thinking. Teachers were asked a few questions regarding the assessment of critical thinking: Table 6 summarizes teachers' responses.

Although teachers reported mixed responses as to whether critical thinking could be tested using a standardized test, most believed that it should not be tested in this way. In addition, there were mixed answers as to whether teachers formally assess critical thinking and whether their students are aware of them doing so. Thus, if critical thinking is to be measured, it should not be tested in the same way literacy or numeracy is. Since not all teachers assess critical thinking, it may be that it is not necessary to do so, or perhaps it is too difficult or complicated. Researchers planning on examining critical thinking assessment could attempt too better understand teachers' current assessment practices as well as their thoughts and opinions of how critical thinking could be measured effectively and practically.

Identification of critical thinking. The final portion of the survey examined the ability of teachers to identify examples of critical thinking. Table 7 shows the responses for each question, divided by their source.

Table 6
Teacher Responses Regarding Assessment of Critical Thinking (Frequencies)

Questions	Strongly Agree	Agree	Somewhat Agree	Somewhat Disagree	Disagree	Strongly Disagree	n
I believe it is possible to test critical thinking skills using a standardized test	2	3	8	3	3	4	24
I believe critical thinking skills should be tested using a standardized test	1	1	3	3	8	4	24
I formally assess my students' critical thinking skills	3	8	4	5	3	1	24
Students are aware that I assess their critical thinking skills	4	6	6	4	2	2	24

Note: Each column displays the number of teachers that responded at each degree of agreement

Table 7
Responses Regarding the Identification of Critical Thinking in Percent

	Yes	No	Unsure
1. When playing slot machines, people win something about 1 in every 10 times. Lori, however, has just won on her first three plays. What are her chances of winning the next time she plays?	22%	70%	9%
2. After the first 2 weeks of the major league baseball season, newspapers begin to print the top 10 batting averages. Typically, after 2 weeks, the leading batter often has an average of about .450. However, no batter in major league history has ever averaged .450 at the end of the season. Why do you think this is?	70%	26%	4%
3. If you were trying to convince someone else that your view on a theory is right, what evidence would you give to try to show this?	83%	9%	9%
4. Jack is looking at Ann, but Ann is looking at George. Jack is married, but George is not. Is a married person looking at an unmarried person? A) Yes, B) No, C) Cannot be determined.	39%	48%	13%
5. A recent report in a magazine for parents and teachers showed that adolescents who smoke cigarettes also tend to get low grades in school. As the number of cigarettes smoked each day increased, grade point averages decreased. One suggestion made in this report was that we could improve school achievement by preventing adolescents from smoking. Based on this information, would you support this idea as a way of improving the school achievement of adolescents who smoke?	78%	9%	13%
6. "In the long run, the discovery of additional uses for nuclear energy will prove a blessing to humanity." Based on the previous sentence, indicate whether the following statement is an assumption: Additional and beneficial ways of using nuclear energy will be discovered.	70%	22%	9%

7. Indicate whether the conclusion follows from the statement: No person who thinks scientifically places faith in the predictions of astrologers. Nevertheless, there are many people who rely on horoscopes provided by astrologers. Conclusion: Therefore, people who lack confidence in horoscopes think scientifically.	61%	30%	9%
8. Is the following argument strong or weak: Would a strong labor party promote the general welfare of the people of the United States? No; a strong labor party would make it unattractive for private investors to risk their money in business ventures, thus causing sustained large-scale unemployment.	74%	22%	4%
9. Indicate whether the conclusion follows from the statement: The history of the last 2000 years shows that wars have steadily become more frequent and more destructive. The last century has the worst record thus far on both these counts. Conclusion: Mankind has not advanced much in the ability to keep peace.	70%	22%	9%
10. Mr. Brown, who lives in the town of Salem, was brought before the Salem municipal court for the sixth time in the past month on charge of keeping his pool hall open after 1 a.m. He again admitted his guilt and was fined the maximum, $500, as in each earlier instance. State whether the following statement is True, Probably True, Insufficient Data, Probably False, or False: On some nights it was to Mr. Brown's advantage to keep his pool hall open after 1 a.m., even at the risk of paying a $500 fine.	48%	30%	22%
11. The Neuman Company is designing a new container for its marbles. The container must have a volume of 200cm3. Sketch three possible containers, and explain which one you would recommend.	68%	32%	-
12. Investigate the surface area of towers made from a single column of connecting cubes, and	61%	30%	9%

predict the surface area of a tower that is 50 cubes high. Explain your reasoning.			
13. Use a set of data whose distribution across its range looks symmetrical, and change some of the values so that the distribution no longer looks symmetrical. Does the change affect the median more than the mean? Explain your thinking.	52%	43%	4%
14. Explain why area is expressed in square units [unit2] and volume is expressed in cubic units [unit3].	35%	48%	17%
15. For the pattern 1, 3, 5, 7, 9,…, investigate and compare different ways of finding the 50th term	56%	43%	-
16. Identify the verb, noun, and subject in the following sentence: "Joanne plays in the garden"	4%	96%	-
17. Identify and describe each major component of the water cycle.	-	96%	4%
18. A snake lays eggs and is cold blooded – is it a reptile or is it a mammal?	13%	87%	-
19. Does the following sentence use a metaphor or a simile? "She danced across the room like a butterfly in the wind." Explain how you know.	22%	74%	4%
20. Explain the necessary steps you should take when washing your hands.	13%	78%	4%

Note: Questions 1-5 were retrieved from Stanovich, West, and Toplak's (2011) paper, questions 6-10 were retrieved from the Watson-Glazer Test of Critical thinking (1980) questions 11-15 were retrieved from the Ontario math curriculum (2005), and questions 16-20 were created by the researcher as foils. Additionally, not all percentages equal to 100%.

None of the items in this section were identified as critical thinking questions by all respondents. When examining the answers more closely, it is clear there are some patterns that arise. Firstly, although the questions taken from Stanovich, West, and Toplak (2011) paper were not all considered to be critical thinking, nearly all the questions taken from the Watson-Glaser test (1980) of critical thinking were identified as critical thinking questions. Because Stanovich, West, and Toplak largely focused on reasoning and rationality, it is possible that the teachers' surveyed did not consider this to be synonymous with critical thinking.

The questions taken from the Ontario curriculum were also mostly considered to be questions of critical thinking, however, with less agreement. These questions were ambiguous, however a few of them did contain words such as "investigate" and "explain" which is often associated with higher-level thinking. Lastly, the questions intended on being foils worked as such: most teachers did not identify foil items as critical thinking questions. Therefore, teachers varying conceptualizations may affect what they consider to encourage critical thinking. Future research should examine how teachers' conceptualization transfers to classroom practice and the identification of critical thinking in students. This could be done through classroom observation or document analysis.

Interviews

As with the survey results, few major differences were found between Toronto and London teachers in the interview analysis. Thus, all interview data will be

reported together, and any notable city differences will be discussed when relevant. All interviews were transcribed and read through several times by the researcher. With questions and topics in mind as an outline (e.g., conceptualization of critical thinking), major themes and patterns were identified and interviews were coded using a qualitative and mixed-methods research data analysis software package (Dedoose). The analysis fell into three categories: definition/conceptualization of critical thinking, critical thinking in the classroom, and other (see table 8 for summary of major themes). Names of participants were changed in order to insure confidentiality and any other identifying details were omitted. Any direct quotes are as participants stated them, however verbal ticks (e.g., "uh") and repeated words were removed for clarity.

Definition/conceptualization of critical thinking. As with survey results, the definitions and conceptualizations of critical thinking varied greatly from interviewee to interviewee. For instance, Rose from London defined critical thinking as:

> Those skills of trying [to] think [...] analytically, to evaluate, to consider arguments, to see how you can counteract those arguments. I would see it as those skills when you're presented with some text that you don't accept it at face value. You are able to think; to infer its meaning. You're able to think around it, think about whether it's accurate, perhaps compare it to other pieces of text, to analyze its accuracy. I think it's about [...] the

Table 8.
Major Themes Drawn from Interviews

Research Questions	Major Themes	Sub-themes
Definition/conceptualization	- Multiple/different points of view and solutions - Reflective thinking and questioning - Bloom's taxonomy - OCR conceptualization of critical thinking - Uncertain of definition	
Critical Thinking in the Classroom	- Teaching critical thinking	> 'Encouraging' versus 'teachings' > Specific strategies > Challenges
	- Assessment	
Other	- Creativity and critical thinking - Factors that influence students' critical thinking - Critical thinking in different disciplines and outside the classroom	

> ability to construct an argument yourself, to balance [...] a range of evidence, to come to conclusions, form judgments.

Andrew from Toronto said critical thinking "is a combination of the ability to take information, analyze, conceptualize, define it, examine it, make inferences, question, make reasonable conclusions, synthesize new information and new ideas and evaluate the strength or weaknesses of information or concepts presented." Kevin from Toronto had a unique conceptualization of critical thinking, and said, "For me, critical thinking is going to have to involve some kind of moral element. That and [...] who profits and who suffers. [...] That to me is the heart of it." Although each of these conceptualizations contained unique elements, some patterns were identified, including: appreciation and consideration of multiple points of view, reflection and questioning, connection to Bloom's taxonomy, and connection to the OCR (critical thinking A-level in England) course outline. Lastly, some participants expressed uncertainty about their definitions and were not entirely clear on what critical thinking was.

Multiple/differing points of view and solutions. More than half of the interviewees (3 in Toronto, 3 in London) directly referred to encouraging multiple or different points of view in their students. For instance, Christine from London explains, "I think critical thinking is basically... you get given something and you are able to see various different opinions and various different viewpoints and various different ways of actually visualizing this or thinking about this particular

topic or question or whatever it is." Similarly, Helen from Toronto believes that critical thinking is about encouraging different solutions and answers to a question. She explains that when she thinks of critical thinking, "there's [sic] always two sides to the story, not just one way. We teach that through, for specifically with math, teaching kids different ways of problem solving, so there's not only one way of solving this issue, there's many ways."

Later, Helen went on to explain,

> Our school's done a lot on bullying. We've talked about, from the bully's perspective: why are they doing what they're doing? And then from the victim's perspective: what's happening to them as a result of what's happening? So it's just the connection, and being able to see all the different viewpoints, and to make that assessment as true and clear as possible.

The ability of appreciating multiple points of views and creating different solutions are common elements in many of the interviewees' conceptualizations of critical thinking. However, this feature is not often seen in the academic theories. This may be because the ability to consider multiple points of view is not something easily measured and it is something teachers may look for implicitly and try to encourage among their students when completing collaborative activities.

Reflective thinking and questioning. Most teachers in both cities

discussed students' ability to reflect on their own thinking and question themselves and others as essential parts of critical thinking. In some cases, this involved understanding their sources of information and how they knew what they knew. For instance, Peter in London said critical thinking is "not taking something at face value. It's asking questions about the logic of the argument that you've been given, or asking about provenance and reliability. It's about 'How do we know?' and 'How do we know we know?'" Melissa from London believed it was important for students to outline how they had gotten to their answer and steps that they took to get there. She explains critical thinking is

> backwards thought, the 'how did you get to that claim?' To encourage people to explore answers and explore their ideas or, it's the backwards, the fundamental 'where did you get that answer? where did it come from? what are the influences? what if we took this away? what if we took that away?'

Sandra from Toronto explains that critical thinking is "more like a life skill…to me it's like the question 'why?'… it could be as simple as 'Oh, [these are] the facts. Well, why does that happen?'" It is clear that for some teachers, a major factor of critical thinking is the ability to ask questions about their knowledge. Their focus is on the ability to be "critical" of their knowledge and thought process and to be aware how they came to their conclusions. This feature of critical thinking is relatively common in the academic literature (e.g. Ennis, 1987;

Kuhn, 1999), and though it too may be difficult to assess, it seems to be one aspect that researchers as well as teachers largely agree on.

Bloom's taxonomy. Several teachers (all 5 in Toronto, 3 in London) described critical thinking using terms from Bloom's taxonomy, specifically: application, analysis, synthesis, and evaluation. For instance, when Joan from Toronto was asked to define critical thinking, she explained that to her, critical thinking is:

> That deep understanding of something. So being able to know something so well that you can evaluate and analyze what's underneath it and be able to apply that knowledge in other circumstances. So being able to take a problem apart and look at the pieces of it, because you understand so well that you can solve it from any different area and analyze things. It's deep thinking.

She discusses critical thinking in terms of evaluating, analyzing, as well as applying knowledge. Interestingly, Joan also mentioned that

> I've heard it [Bloom's taxonomy] all my life and I've memorized all those words and I'm like 'yeah, so what?' I can know the words but it doesn't help necessarily, you know? Then I feel I'm always having to stop and go 'was that synthesis, or was that analysis or what?' And I'm just – no, I'm never sitting down and doing that… nobody has time to sit and evaluate that.

Although Joan's conceptualization of critical thinking parallels and is influenced by Bloom's taxonomy, she doesn't find it very helpful in practice. Although labels of these terms are meant to make the process easier, she finds she doesn't have time for it.

Christine also uses Bloom's terminology and discussed the framework in her interview. She explains, "My view is that if you are able to link, and analyze, and then create something yourself, you must be able to critically think." Bloom's taxonomy being a widely known framework for learning outcomes, it is not surprising that some teachers would use its terminology in their conceptualization of higher-level thinking skills. Because these terms are prevalent, it is possible they are easier to identify and therefore are more widespread in practice.

OCR conceptualization of critical thinking. Finally, some of the interviewees, both in Toronto and in London, described critical thinking in similar terms to those used by the OCR in the critical thinking A-level course specifications. This largely focuses on analytical thinking, rationality, and logic (OCR, 2013).

Kevin from Toronto, a teacher of the social sciences and English, explains that for critical thinking,

> Logic has to be a part of it, but that's taught through everything. So I mean understanding 2+2=4 is your first step in logical thinking, and in critical thinking. But I think also, the logical steps have to, and it's difficult, you

> have to use those logical steps to criticize your own education, your own schooling, your own indoctrination.

For Kevin, using logic goes beyond argument analysis, and reaches into the realm of social criticism and links to the theme of questioning and reflecting mentioned earlier.

In addition, Peter from London, a former teacher of the critical thinking A-level, also mentions the logic of an argument and reliability of sources and important elements of critical thinking. Rose similarly discussed the idea of having to evaluate and consider arguments, and not accepting things at face value. I think it is important to note that both Peter and Rose are history teachers, which may also add to their similar conceptualization of critical thinking involving the analysis of sources and logic of an argument. Although the current sample did not allow for a more in depth analysis of the subjects being taught and the conceptualization of critical thinking, future researchers could investigate how this factor relates to variation in teachers' definitions. For instance, Greensfield and Elkad-Lehman (2004) examined teacher's reflections of thinking in their disciplines, specifically science and literature and found noticeable differences. Studies examining specifically critical thinking in different disciplines could create a more complete understanding of this complex term, especially in education.

Uncertain about definition. Although each participant did discuss their

understanding of critical thinking when prompted, some participants expressed some uncertainty about their knowledge of what critical thinking is, especially when describing more concrete examples. For instance, after Melissa had finished describing a moment when one of her students had thought critically, she explained, "I don't know if it counts as 'critical thinking,' but he's definitely thinking beyond what I've taught him." Additionally, when Christine was describing what she was hoping to get out of one of her assignments, she said, "Quite hard to explain actually, really hard. I'm kind of muddling my words here thinking, 'Do these things actually make sense to anybody?'" Similarly, when Sandra was explaining some strategies she could use to encourage critical thinking, specifically having students describe their thought process and the steps they take to get to an answer, she stated, "Honestly, I feel like I'm a critical thinker – but I couldn't tell you the steps I go through!"

Although each teacher was happy to explain their perspective and their conceptualization of critical thinking, some teachers became a bit less certain of their understanding of critical thinking when discussing real-life, classroom situations and examples. This uncertainty could affect how teachers identify critical thinking. Depending on what changes are made to education policies regarding critical thinking, if teachers are expected to measure critical thinking, it may be important for teacher to have a clear understanding of what may or may not be considered critical thinking. Even if there is no agreement on the definition

of critical thinking, teachers must at least be consistent in their identification.

Critical thinking in the classroom. One of the most important aspects of this research project was to gain a practical understanding of critical thinking. The purpose of discussing critical thinking with teachers was to gain a classroom perspective and understand how the participants taught or encouraged critical thinking in their students, as well as their assessment of critical thinking.

Teaching critical thinking. A number of major themes came out of the conversations with teachers regarding teaching critical thinking. The difference between 'encouraging' and 'teaching' critical thinking, the specific strategies teachers use to encourage critical thinking in their students, as well as the challenges they face in doing so, are all discussed in the following section.

'Encouraging' versus 'teaching'. One of things most often noted in the interviews was the difference between 'teaching' and 'encouraging' critical thinking. When the distinction was made, 'teaching' would refer to a more formal and direct instruction of critical thinking, for example discussing specific strategies to become a better critical thinking, or teaching critical thinking as a thing in itself. 'Encouraging' critical thinking, however, described a more imbedded and implicit acquiring of critical thinking skills. For instance, when Alexi from London was asked if she thought it was possible to teach critical thinking, she responded, "Well yes, I hope. Well, I think its possible to encourage critical thinking." When she was asked what the difference was, she explained:

> Teaching, I would see as the idea of making a curriculum and creating a course for it and sitting down and saying, 'let's do critical thinking now.' I think its much better to make it part of your lessons and trying to encourage students to use it as a skill.

The idea of incorporating critical thinking into other lessons and imbedding it was not an uncommon view. Andrew believes that critical thinking is "something that needs to be totally imbedded into the curriculum. And I'm not talking about just in high school, I mean from day one all the way through."

Interestingly, even though critical thinking does exist as a course in England, all of the London teachers still believe critical thinking should not be taught in isolation and rather should be imbedded throughout the curriculum. Each of the interviewees in London had heard of the critical thinking A-level, but few knew what it consisted of. When Joan was asked about the critical thinking course, she explained:

> To be honest [...] it hasn't got a particularly good reputation. And my understanding, in terms of my understanding of what it is, that it's very much thinking skills, but it doesn't seem to be in any particular context. And I do think that teaching skills as discrete units without imbedding them in any real context doesn't work. So I would argue that critical thinking is much better taught through studying history, than it is through doing Critical Thinking [A-level]. I know it's a slightly different

> interpretation of what those skills are but [...] I've always strongly believed they should be imbedded in some context to make them real, [...] whether it is using critical thinking in studies of economics or politics or science or maths, at least it imbeds in some form of reality that detaches and forms.

A couple of teachers also mentioned that perhaps some students could benefit from a more direct instruction. Although Peter had taught the critical thinking course, he explains "sometimes to make it self-conscious can be a bit, can be quite a dry route, that. I think it needs to be imbedded in practice, and might even be unacknowledged." However, when discussing a more direct instruction of critical thinking skills, he mentioned that "I think that for certain students taking it apart is a useful experience, but not for all of them." Sandra, also agreed that for some students it may be helpful, but explains:

> I don't know if I'd teach it like, 'these are the steps of critical thinking.' I don't think that might be effective. But then, it might be effective for some people. [...] The more effective way to do it would be the open-ended questions, and then to break that down: "How'd you come to that? Why did you get that?" [...] So I guess that would be more like leading than actually teaching the steps of critical thinking.

Similar to the survey results, the interviewees believed that critical thinking should be something infused throughout the curriculum. For most teachers,

having a separate lesson or class for critical thinking is impractical and giving students the opportunity to think critical throughout their school day is more effective. Although some teachers agree that some students may benefit from a more direct instruction of how to think critically, overall the interviewees agree that infusing critical thinking into the curriculum is the best strategy for encouraging critical thinking.

Specific strategies. Because all the interviewees had similar views on how critical thinking should be encouraged in their students, it is not surprising that many of these teachers share common practices and specific strategies to encourage critical thinking in their classroom. Many of the teachers discussed the importance of modeling critical thinking for students. As Peter explains, "I think it does help students to have it modeled, you know? So they can see a good essay, a good argument and they can become aware of the way it's been structured, and you actually deconstruct it on a critical thinking line. I think that's very useful."

All of the teachers used open-ended questions when developing critical thinking skills, many of which used questions that had no right or wrong answer or had multiple correct answers. Furthermore, all the teachers used some form of real world issues (e.g., current news stories, climate change) or ethical dilemmas in their lessons or assignments to encourage critical thinking. For instance, in a history assignment involving the conscription crisis of 1917, to start, Andrew had students work in small groups and discuss some minor ethical dilemmas such as

"I promise to help so and so study but then my friend called me and said 'I have tickets to a concert' that same night. What do you do?" The students have to deliberate and come to a decision on the dilemmas. The next aspect of the assignment is to discuss Borden's conscription dilemma and whether he made the right choice. There is no right are wrong answer to these dilemmas, however it is the thought process and how one came to the decision that is important.

Many teachers had similar assignments that involved thinking through a real-world issue, often with other students. It is a strategy teachers used to imbed critical thinking into their assignments and lessons and encourage aspects of critical thinking (e.g. questioning, appreciating multiple points of view), while still covering aspects of the curriculum. Teachers gave students the opportunities to develop their higher-level learning skills while learning about current issues and considering ethical dilemmas.

Another common strategy was to use class discussions and group work to develop critical thinking in their students, with the goal of opening students to ideas and perspectives outside their own. For some, this involved the teachers themselves bringing in new perspectives. Kevin, for instance, described how he would bring in a "new voice" during a class discussion:

> I got them to reflect, 'we had a great debate on this?' they said 'yeah it was exciting' 'so we covered a lot of issues, right?' and then I handed out a more feminist perspective on this and I read it out loud with them and…

> it deepened the issue to a level that we had never talked about. And then I got them to reflect 'notice how we had a big open debate, but in fact our debate was this narrow, and in fact, the issues are this wide?' [...] and many of them were literally stunned.

For some teachers, critical thinking involves encouraging students to appreciate and consider multiple perspectives, and by encouraging all of their students to provide their point of view, and to listen to others', they are opening them up to new thoughts and ideas. These teachers encourage students to provide different answers to these questions and they promote independent thinking.

Related to this, many teachers helped develop their students' critical thinking skills by using questioning. This would either be by having students question their own thinking, students questioning each other, or the teacher questioning the students. Christine describes how she questions students during her class discussions and explains that with this method:

> You're running what they're saying, but you're trying to twist it and basically prompt them through their language and through their idea to coming up with various different viewpoints [...] and actually because I've been doing this for a year already, they almost expect me to [...] start to question their ideas. [...] I would almost expect a kid to be like 'oh but it's never the answer. So let's think!' [...] So we're getting into that idea of 'don't just take everything you see as black and white.'

Teachers will combine these strategies as well, as Helen explains that encouraging critical thinking involves:

> Bringing attention to certain things. I feel that if you model it as a teacher, for example like if the kids [...are] doing a group assignment and they've come up with an answer, questioning that and saying 'Is that the only way to do that question?' And if they say 'Yes!' then be like, 'Are you sure?' And getting them to share their ideas with each other. Because 9 times out of 10 there is at least more than one way in the group that someone has come up with answering that question.

Here Helen as described how she models critical thinking by questioning her students: She is using class discussion and group work, she provides questions with more than one right answer, or no right or wrong answer, and thus encourages multiple answers. Many of these teachers will use the strategies mentioned to develop critical thinking in their students.

Since more commonalities were found among teachers in the way they encourage critical thinking, rather than how they conceptualize it, it may be more useful to focus on these strategies rather than on exactly defining critical thinking. Creating a common pedagogy for critical thinking and educating teachers on how to create an environment to foster critical thinking skills may be more effective than creating a way to measure or test it. Allowing the concept to be fluid and inexact may be a more successful approach for developing these skills. Although

measurement and tracking improvement is a necessary aspect of any education system, a new approach to documenting change may need to be considered for 21st century skills.

Challenges. Teacher in both cities described some of the challenges they face when trying to encourage critical thinking in their students. Many teachers, in both Toronto and London, explained that sometimes students are resistant to critical thinking because they just want the correct answer. In Toronto, Andrew explains:

> A lot of it is just a predisposition to thinking in that very linear way. I want good marks, I get tested, there's stuff on tests, and that's it. So, [...] when [I] say 'how do you guys feel about such and such?' they'll be like in their minds, you can see it in their face, 'I don't care. Does it matter? [...] Are you going to ask me how I feel on the test? And then are you going to mark me on that? Or how can you mark me on it?' And it's kind of, that's the impression I get.

As Andrew mentions, because of content-focused testing, student are fixating on their grades and are not as motivated to develop thinking skills. In London, this may be even more the case, considering they have yearly testing. Alexi explains:

> The testing, I think is what make so many kids scared at looking at things at a different angle. If its incorporated into part of a course, on something else like English, it provides more opportunity for it to be something they

> use rather than its something to prove or evidence. I think if you don't look at how you can use critical thinking in a lesson, then you're never going to encourage your students to think outside the box and in a real way. Instead, you're just kind of saying 'here's the question - answer [it]'.

She later goes on to explain,

> I think [...] a lot of students in this country are really worried about what they're going to get in their GCSEs [General Certificate of Secondary Education exams] and that means they kind of hone in and just think about what grade are they getting, and what are the tick boxes they can tick to get the grade, which is what I've seen in my GSCE classes in my last school. And both schools I've worked in have started GSCEs in year 9 so that's the turning point, when they get to like 13 they're already thinking about that. So I think it is a bit of a barrier towards their thinking and creativity in that sense.

In addition, many teachers explained that needing to cover the curriculum makes it more challenging to encourage critical thinking. Andrew explains,

> I think a lot of teachers [...] and myself included, you think curriculum, you think expectations, you think content and that almost overrides. And I've gone through that before, I've said: 'wouldn't it be really neat if we could do this?' and then you think 'we barely get through the course as it is, and now you're talking about putting this stuff in?' It's just a logistics

thing.

Sandra also expressed some concern and said,

> I think the difficulty is covering the curriculum while doing the critical thinking, and I'll give you an example. I have news articles that I would like to give out to the kids. Sometimes they relate to what we're teaching, sometimes they're just science articles in the news and it's talking about science that's actually happening in everyday life, and I wish I had more time for that and I think that's valuable! But the curriculum is such that I have these units to cover, I have these expectations to cover, I have to cover a certain number in order to get the credit.

Thus, although these teachers have the best intention to encourage these skills in their students, larger systemic issues make doing so more challenging. In the survey, many teachers stated that they wish they had more time and resources to encourage critical thinking. The interviewees elaborate on this idea, and explain that the pressure of testing and curriculum constraints sometimes makes encouraging critical thinking difficult. It is incredibly important to understand what challenges teachers are currently facing in trying to encourage higher-level thinking skills. If teachers are already having difficulties covering the curriculum, we should not be adding more content (e.g. the '6 Cs' in the new Ontario policy [Fullan, 2013]). Instead, there should be a focus on educating teachers on how to create strategies that will effectively encourage these skills (e.g. collaboration,

creativity, critical thinking of the '6 C's') and also cover the necessary knowledge. For instance, lessons and assignments could involve more open-ended projects where students are required to research and gain foundational knowledge, but also work together, work on unraveling a problem, and creating an innovative solution. What needs to be avoided is creating more stress for teachers to cover content and prove outcomes that are ultimately measured in a superficial way.

Assessment. When asked about assessment of critical thinking, most teachers did not evaluate or assign marks to their students on this aspect of their education. However, some teachers explained that they did informally assess critical thinking, for instance by providing feedback on their assignment. Melissa explains that when marking students' assignments, she responds with questions in order to encourage their thinking: "When I mark their work I mark with questions to allow them to develop it. So what will happen is when they read my marking, I would have put a number next to their work and written a question to go with it and so once they get their work back, they're able to develop their answers with that."

As well as not being as part of the curriculum requirements, one of the reasons that teachers did not formally evaluate critical thinking was because they were unsure how to and believed that it would be very subjective. When Christine was asked if she ever assessed critical thinking, she responded, "I would never, no. [...] And largely because I don't think the kids would know what that is. And

actually, I don't know a 100% what I'd be looking for." Similarly, Kevin explains, "So here I am talking about critical thinking [...] and I got to mark you, and judge you on it. These are the institutional constraints. [...] I think, actually [this] problematizes critical thinking. So like, what kind of critical thinking gets an A?" Andrew also had his doubts about assessing critical thinking:

> I think it should be assessed, but whether or not it would count towards a student's grade, that's an issue of what's in the curriculum again and as teachers you know your hands are basically tied to what's in the curriculum. The other thing is that because of what I'm realizing more and more about critical thinking being an emergent thing, that you have practice repeatedly, it goes without saying that some kids are going to come into it faster than others. I don't know if assessing it for marks for the purposes of assigning a grade are necessary wise or productive idea, right? Saying things like "Oh Jimmy can think outside the box, you can't so you get a 70, and he get's a 90." Maybe not, maybe eventually, but it has to be integrated at a more consistent way at all levels before you can actually, I think, legitimately say "okay this is something we're going to look for."

Although these teachers follow what is required of them from the curriculum, they feel uncomfortable doing anything outside that. Teachers are willing to grade students on their content knowledge (ability to memorize) but they are not as

confident in making a judgment about students' abilities to think critically. If teachers are to build these skills in students, it needs to be addressed formally in curriculum documents.

Some teachers did, however, explain that critical thinking was necessary for achievement and that you would in same way be required to assess students' thinking. When Melissa was asked if she assesses critical thinking, she responded no, but that

> Citizenship [subject] assessment strands allow for critical thinking because our subject is based very much on skill and knowledge. So for example, one of the assessment strands are [sic] balancing rights and responsibilities. [...] in order to achieve based on this assessment strand, they have to consider who's affected, how are they affected, what's the compromise, what are the implications of that compromise and there's something that can be done. So in some ways, my subject does allow me to assess some critical thinking skills, but I don't think it's very explicit and, you know, you either do or you don't.

Christine explains:

> I'm thinking mainly for my subject, if you can't think critically, [...] it's even stated in the mark scheme, if you can't think about different angles and different viewpoints, and you don't think from the point of view of this, [and] you're very narrow in your thinking, then you are restricted in

the marks you get in the paper.

Although these teachers are not confident when it comes to assessing critical thinking skills, sometimes they are required to make those judgments to follow the curriculum expectations. Although creating and imposing a strict definition of critical thinking may not be entirely useful for teachers, providing teachers with some direction is necessary. Teacher training courses could focus on understanding the different forms critical thinking may take and the strategies to encourage higher-level thinking. In addition, some instruction on how to create assignments and lessons that cover curriculum content but that also require students to go beyond rote memorization should also be provided.

When asked if it would be helpful to have guidelines for how to assess critical thinking, many teachers had mixed feelings about it. They recognized that it would be supportive and that it would generate a greater focus on these skills. However, they also understood that critical thinking being the fluid concept that it is, it would be difficult to create something that would not destroy it. Joan explains,

> If there's a formula for critical thinking we're in trouble! If somebody comes and says 'this is how to teach critical thinking' – I think that would be a dangerous thing. I think that too many times as teachers we expect someone to just give us a pattern to follow and then we do that. You know, 'critical thinking – okay we all need to do this.' And then we miss

> the depth, then we miss letting it get out of its boundaries. Like we keep them tied down to one sort of way of looking at things and 'oh nope, sorry, you can't talk about that, because we have to follow this pattern.' And really, when the kids are engaged, you should go with where they're engaged because you're going to get somewhere. But at the same time, one of the problems I think that teachers who are just learning things is there's no skeleton to start on and if you just say to them 'you have to do more critical thinking,' you're not going to get it. But if you say to them 'in your class, spend the first 15 minutes and do this and this and this', and you gave them like something to start with and really inform them and gave them the philosophy of critical thinking, and then gave them the skeleton to start with and really encourage them about adapting it, I think you would get a lot farther in encouraging critical thinking in the classroom. Rather than standing up and saying 'we all need to do critical thinking.'

Andrew thought it could be helpful to have some guidelines, but also had some reservations:

> Yes, [...] it would be helpful but they would have to be pretty specific and pretty concrete, I would say. And what I mean by that is I find a lot of things in education are very good at a theoretical level and very difficult to make an operational definition for, right? And that's where, I go to all this

> PD [professional development], where it's like, 'oh this is really good stuff, but what do I do with it? What can I do with it?' It's making that step for us as teachers. So yea, having guidelines, but maybe more specific even than guidelines, maybe looking at what other teachers, if other teachers or educators have made rubrics for critical thinking, which I'm sure that they have, but I've never personally looked at, but that might be a place to start. But again, just being weary of assessing it, and giving them a grade because, again, if it's not explicitly written in the curriculum then you can't, you know, give them 'A' - you can't evaluate them on it.

It is important to note that simply providing teachers with a rubric of guideline to teach or assess critical thinking would not be an ideal solution. Teachers do want more information and support on how to encourage critical thinking, but understand that we need to be careful when discussing such a multifaceted concept. Thus, if we want to effectively encourage critical thinking in our students and provide guidance to teachers, it will not be an easy task and will require more than administering a booklet or PDF document. The value in critical thinking is that it is complex and we cannot destroy its significant by simplifying it to a point where it no longer resembles what it is meant to.

Other. A few miscellaneous themes cropped up throughout the interviews in Toronto and London. As well as discussing the definition of critical thinking and its place and form in to the classroom, the relationship between creativity and

critical thinking, factors influencing critical thinking, and critical thinking in different disciplines and outside the classroom will be addressed.

Creativity and critical thinking. When discussing critical thinking, many teachers used terms and phrases that are often associated with creativity, such as "thinking outside the box," "problem solving," or "creating ideas." For example, every teacher in London and 2 teachers in Toronto had at one point used a phrase involving 'thinking outside the box' when referring to critical thinking. As a result, teachers were asked to explain how they thought creativity and critical thinking were related, and what the similarities and differences might be.

Although many teachers were at first stumped by the question, every teacher that was interviewed agreed that creativity and critical thinking were related or linked. Kevin believes that "critical thinking is a form of creativity, because [...] I think you need to be creative to have critical thinking, but not all creativity is critical." Helen explains:

> Definitely [...] they're related. I think that they stem from one another. Well, I think you need to think critically in order to be creative, like where do your get ideas come from? If they're cookie-cutter ideas from everyone else then it's not very creative. But if you can come up with a way to solve something that is something that other people wouldn't think of because you thought of it from another perspective, and obviously it's going to be way more creative than other people. So definitely creativity would fall

hand-in-hand.

Some of teachers also explained how these concepts might differ. Peter explains,

> Well, I think there's [sic] cases where critical thinking could destroy creativity and there's [sic] cases where creativity just becomes amorphous and just too fluid without the structure that critical thinking can give. I think the best of all possible worlds, the two should work together: critical thinking would enable creativity to reach its highest point, but there's an aspect of creativity that sometimes needs to go out of the box, needs to go beyond logic and be insensible thinking, I think that's where I would be concerned. But I think critical thinking is more for being a good citizen, working out what's the right thing to do. If someone wants to build a nuclear power station at the bottom of your street, or should I go to Sky or Virgin for my telephone provider, I think that's where critical thinking comes into it. But I think creativity… there can be something a bit precious about creativity that I think could even be destroyed by critical thinking.

Joan also commented and said,

> I probably would say they're connected. But I think creativity is letting […] the brain just kind of flow and go and having ideas lined up, you know? So that when I'm being creative and poetry-writing I sort of allow the writing to come to me. Whereas I think with critical thinking, I'm

> being much more directive about where I want to go, in that and I'm still - my brain is still very open and alert to what's happening, but I'm more looking specifically around me for things that might be changing rather than letting the world just impact me and letting that come out in my response. So I don't know, it's very - I don't know - intuitive.

Although clearly related concepts, teachers agree that critical thinking and creativity are in some ways different and have distinct features (e.g., creativity is seen as more fluid, whereas critical thinking is more structured; yet they work together). Fairweather and Cramond (2010) in their paper on creativity and critical thinking, discuss how these concepts are related and work together. They explain,

> The key component of creative thought is the generation of ideas, and the key component of critical thought is the judgment of ideas. It should be apparent that one must use some judgment in determining if the new idea is useful or appropriate. Also, in critically analyzing and comparing ideas, the resulting gaps provide impetus for creative thought. The processes are undoubtedly recursive, parallel, coincidental, and idiosyncratic to the situation and the person. We separate them for study and teaching, as we dissect a frog to study its anatomy, but the living frog's system operates interdependently, as do our thoughts. (p. 118).

The authors explain that critical thinking and creativity can, and should be,

encouraged together. They believed these skills are highly interrelated and that similar activities and assignments can be used to encourage both skills simultaneously. Thus, the same strategies that teachers noted in their interviews, such as class discussion and open-ended questions, may be effective for creating an environment where creativity too can be fostered. In creating pedagogy for critical thinking, we may also be creating an environment conducive to developing creativity. We must also keep in mind when trying to define or operationalize these concepts for curriculums and policy documents, that they are connected and may sometime be inseparable, and trying to pry them apart could destroy both.

Factors that influence students' critical thinking skills. Teachers were asked to comment on what they believed might influence their student's critical thinking skills, for instance: age, intelligence, gender, etc. Some teachers were not comfortable making such broad and generic statements, some commenting that it was not a good use of their critical thinking skills. However most teachers did agree that a student's background and home-environment could affect their critical thinking skills. Rose explains that critical thinking is influenced by a student's

> Background… what sorts of homes they come from. If they come from homes where they're encouraged to think to question and argue, I think they come to school with that sort of predisposition […] to think like that.

> I think if they come from homes where they're taught not to question anything just accept things to read things and accept them at face value, then I think there's a barrier developing in them as well at school. I think that's more significant than age, I think as they get older, they obviously have used them to acquire more knowledge and that can enrich the extent to which they can use them and apply them but, there's, you know, it's on a different level I think, they're thinking at.

Sandy also explained:

> A lot of it I feel has to do with the home and just the conversation. Talking about your day, talking about things that are happening in everyday life: 'What did you learn today?', 'Oh, I learned this', 'Oh, isn't that interesting, let's have a discussion about it.' And it's going to be that communication, that discussion, I guess, not necessarily at home. I feel like it happens at home. It could be in after-school programs, it could be in different areas of life, but I think it's outside of the school.

Although only a couple of teachers mentioned age or cognitive ability, most teachers believed that a students' upbringing and home life affected their critical thinking skills. Thus, like with literacy and numeracy, if a child is not taught or encouraged to think critically, they will not develop these skills independently. As school is meant to be the great equalizer, there should be a focus on encouraging critical thinking in the classroom, and in all students.

Critical thinking in different disciplines and outside the classroom.

Teachers were also asked if they believed critical thinking would be similar or different in all subjects, and even what critical thinking may look like outside the classroom. Some teachers had difficultly imagining what a lesson outside their area may consist of, but most teachers saw critical thinking as a transferable skill that would remain constant in all subjects and even outside the classroom. For instance, Helen explained: "I definitely think it would be similar but in the respective[...]subject area, right? So with math, you're thinking about a question from different angles. With language, you're thinking about a topic from different angles, and just analyzing that through the different ways of looking at it." Similarly Christine stated,

> I think [...] the idea is the same, the concept is the same. You're trying to make a student more rounded in their thinking, and more able to understand different ideas at the same time, but I think the way you approach it might be different in different subjects.

Additionally, teachers also agreed that critical thinking would transfer to outside the classroom and, for instance, would make students wiser consumers, media literate, and good citizens. Alexi explains,

> I think if you encourage them to look at things in different ways, then when they're watching TV or if they're like they go and see a film then they might actually start asking questions about it and trying to look a bit

deeper. So yeah, I think it does have an impact on them.

Similarly, Rose explained that critical thinkers are active citizens:

> I think active citizens don't just passively absorb what they're being told in the newspapers and by politicians and actually think about what's being presented to them, and when they disagree with it they act on it, whether that's taking some form of protest, or sign petitions, or even voting.

Although critical thinking is encouraged in the classroom, the ultimate goal is for these skills to be transferred into other situations and aspects of life. With this in mind, it is imperative that we effectively teach students to think critically and create a habit so that 'critical thinking' is a natural reaction to the world around them.

General Discussion

The purpose of the current study was to gain a classroom perspective of critical thinking. A strength of this project was the use of both quantitative and qualitative measures. The survey allowed us to gain the teachers' viewpoint on some of the major themes and questions in the academic literature and theory, whereas the interviews provided a rich and nuanced understanding of what critical thinking looks like in the classroom. Mixed methods research is especially effective for research that aims to bring theory and practice closer together, and for one to inform the other. Studies aiming to do so should consider this approach.

Although we cannot generalize the results to all teachers everywhere, in

surveying and interviewing teachers from London, England, and Toronto, Canada, several theory- and education policy-relevant beliefs were revealed. For instance, from the survey, we learned that a majority of the participants believe that critical thinking is a skill, and more importantly that critical thinking can be taught. In addition, all of the participants believe that critical thinking should be infused throughout the curriculum. Many of these teachers actively include critical thinking in their lessons and assignments; however most do not think critical thinking should be measured using a standardized test. If findings such as these are used to inform discussions around policy and curriculum decisions, they can effectively shape the form 'critical thinking' takes in our classroom. For example, if these teachers' beliefs were taken into consideration, critical thinking skills would not be a separate, measureable goal of teaching (as, for example, literacy is); rather, it would be something that teachers would actively aim to encourage in their students in all aspects of their school day. Teachers would not be given strict rubrics or be forced to conduct evaluations of critical thinking, but instead could be provided with strategies and approaches for how to effectively foster critical thinking.

The interviews conducted in London and Toronto allowed for a more in depth understanding of the form critical thinking currently takes in the classroom. Again, the opinions of these educators are not representative of all teachers, however, their experiences provide a practical understanding of critical thinking

(e.g., strategies used by teachers to encourage critical thinking, types of assignments and lessons created with critical thinking as a goal, challenges teachers face, etc.) as well as an elaboration on some of the themes covered in the surveys. From the interview data, we learned that teachers vary greatly in their conceptualization of critical thinking (e.g., logic and reasoning, creativity and problem solving, questioning, morality, understanding multiple points of view, evaluating and interpreting information, etc.). However, these conceptualizations converge in actual teaching practice, and teachers with different conceptualizations share strategies for encouraging critical thinking skills. Teachers utilized strategies such as group work and class discussion, open-ended questions, inclusion of real-world ethical issues, and the encouragement of students to question and consider or provide multiple points of view. Our current system is one where individual merit is prized and high test scores are the ultimately achievement. However, in order to encourage 21st century skill such as critical thinking and creativity, a focus on more collaborative work and appreciation of different solutions and perspectives is essential. In addition, given the large range of definitions and elements that make up critical thinking, and the contrasting few ways of encouraging them, it may be more practical to focus on pedagogy and providing teachers with effective strategies of encouraging critical thinking, rather that trying to pinpoint what critical thinking is and what exact featured one should be looking for.

Although one of goals of the current study was to gain a cross-cultural perspective of critical thinking in the classroom, few significant differences were found between Toronto and London teachers. This does not mean that differences do not exist between teachers in these two countries; it is more likely due to other factors, such as sample size and sensitivity of the instruments. Although numerous attempts were made to recruit more survey participants, access to year 7-13 teachers in London was limited and all potential participants were contacted. In addition, a portion of the completed surveys was lost in the mail, which diminished an already small sample size. Furthermore, the purpose of the survey was largely exploratory and the scope of the questions was quite broad and ranged from topics such as assessment, definitions, classroom practices and teacher training. In order to better examine Toronto-London perceptions of critical thinking, future researchers should aim for larger sample sizes and more focused questionnaires. A card sort task like that administered by Howe (2004) could also be effective at discovering similarities and differences among the cities' teachers.

Similarly, the interview data did not reveal any between-city differences for London and Toronto teachers. Although some differences between cities were expected in terms of the conceptualization of critical thinking, the major purpose of the interviews was to understand individual teachers' understanding of critical thinking. Each teacher was unique in how they defined critical thinking and its elements, so any city-differences that existed may have been masked by the

variance in the answers. Future researchers could aim to ask more specific questions related to curriculum and education policy in order to better understand if any major differences between London and Toronto teachers exist.

One of the most important findings of the current study was the discussion of challenges that teachers currently face when trying to encourage critical thinking. Largely, these involved systemic issues such as testing and curriculum constraints. Policy makers need to be aware of the barriers that current policies are creating in the development of these essential 21st century skills. An open discussion with teachers is necessary in order to be able to address any current obstacles, and to gain insight on what can be done to create a system where these skills can flourish. Most importantly, since measurement is a necessary component in recording change and progress, policy makers need to strongly consider how they are going to quantity these complex skills. Creating standardized tests is not the solution for fluid and difficult to define concepts such as critical thinking. New strategies need to be created, and policy makers must themselves utilize those critical thinking skills they are so desperately trying to encourage in the upcoming generation of students.

As we enter an educational era with a focus on thinking skills, collaboration, and character development, we must make an effort to effectively infuse these facets into the education system. By creating an open dialogue between practitioners and researchers, we can better understand how critical

thinking can be more effectively taught and encouraged in students in the future, and to inform future policy decisions. It is hoped that the findings of this research will supply researchers, educators, and policy makers with a foundation from which to build upon and create effective strategies and classroom environments to promote these valuable skills. If we trust those who are trained to teach our students and provide them with guidance and training with a focus on best teaching practices, rather than drowning them in new content or assessments, our future generations will be well prepared for the this entirely unknown and fast-paced future to come.

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Appendix A: Toronto Survey

1. From your perspective, what is critical thinking? (250 words or less)

2. Based on your experience, please indicate to what degree you agree or disagree with the following statements (Strongly Agree, Agree, Somewhat Agree, Somewhat Disagree, Disagree, Strongly Disagree, N/A):

☐ I believe critical thinking is a skill (learnable)
☐ I believe critical thinking is a disposition (innate ability)
☐ I believe critical thinking is something that can be taught
☐ I believe all students are capable of thinking critically
☐ I believe that a student's age can affect their ability to think critically
☐ I believe that a student's cognitive ability can affect their ability to think critically
☐ I believe there should be a specific class, course, or set of lessons dedicated to teaching critical thinking skills
☐ I believe critical thinking should be infused throughout the curriculum
☐ I believe critical thinking should be taught in a manner that is specific to every subject (e.g., learning how to think critically in science, learning how to think critically in math, learning how to think critically in English, etc.)

3. Please rank the following statements from the one you MOST (1) agree with to the one you LEAST (4) agree with:

☐ Critical thinking is the use of cognitive skills that increase the probability of a desirable outcome. Critical thinking is purposeful, reasonable, and goal directed and encompasses a number of skills including problem solving and decision making. Critical thinking can be transferred across domains and can be generalized to any situation.
☐ Critical thinking is reasonable reflective thinking that is focused on deciding what to believe. It is made up of dispositions and skills. Critical thinking can be generalized to any situation and is not specific to any domain or subject.
☐ Critical thinking is way of 'thinking about our thinking'. The way we think about our thinking develops and over time we gain more knowledge and strategies to think critically.
☐ Critical thinking is an appropriate use of reflective skepticism. Critical thinking is linked with specific areas of expertise and knowledge and cannot be generalized to all subjects or situations.

4. What would you add or remove from the statement you MOST agreed with?

5. Based on your experience, please indicate to what degree you agree or disagree with the following statements (Strongly Agree, Agree, Somewhat Agree, Somewhat Disagree, Disagree, Strongly Disagree, N/A):

□ Encouraging critical thinking skills in my students is important to me
□ I actively try to create lessons that will encourage critical thinking in my students
□ I often include questions that will require critical thinking skills in assignments

6. At what age should students begin to be encouraged to think critically?

7. Based on your experience, please indicate to what degree you agree or disagree with the following statements (Strongly Agree, Agree, Somewhat Agree, Somewhat Disagree, Disagree, Strongly Disagree, N/A):

□ I feel prepared to help my students develop critical thinking skills
□ I am confident that I understand what it means to be a critical thinker
□ I am given enough resources to effectively teach critical thinking skills
□ I wish I had more time to include critical thinking skills in my lessons
□ I learned how to teach/encourage critical thinking in my teacher training
□ I wish I had more preparation in my teacher training to teach critical thinking
□ I learned how to teach/encourage critical thinking in Professional Development sessions
□ I find it easy to develop activities/assignments that encourage critical thinking
□ When I was a student, critical thinking was emphasized

8. Based on your experience, please indicate to what degree you agree or disagree with the following statements (Strongly Agree, Agree, Somewhat Agree, Somewhat Disagree, Disagree, Strongly Disagree, N/A):

□ I believe it is possible to test critical thinking skills using a standardized test
□ I believe critical thinking skills should be tested using a standardized test
□ I formally assess my students' critical thinking skills
□ Students are aware that I assess their critical thinking skills

9. Please read through the list of 20 questions and indicate whether or not you think each question is a measure of critical thinking (Yes, No, Unsure).

1. When playing slot machines, people win something about 1 in every 10 times.

Lori, however, has just won on her first three plays. What are her chances of winning the next time she plays?
2. "In the long run, the discovery of additional uses for nuclear energy will prove a blessing to humanity." Based on the previous sentence, indicate whether the following statement is an assumption: Additional and beneficial ways of using nuclear energy will be discovered.
3. Identify the verb, noun, and subject in the following sentence: "Joanne plays in the garden"
4. The Neuman Company is designing a new container for its marbles. The container must have a volume of 200cm3. Sketch three possible containers, and explain which one you would recommend.
5. Identify and describe each major component of the water cycle.
6. After the first 2 weeks of the major league baseball season, newspapers begin to print the top 10 batting averages. Typically, after 2 weeks, the leasing batter often has an average of about .450. However, no batter in major league history has ever averaged .450 at the end of the season. Why do you think this is?
7. Indicate whether the conclusion follows from the statement: No person who thinks scientifically places faith in the predictions of astrologers. Nevertheless, there are many people who rely on horoscopes provided by astrologers. Conclusion: Therefore, people who lack confidence in horoscopes think scientifically.
8. Investigate the surface area of towers made from a single column of connecting cubes, and predict the surface area of a tower that is 50 cubes high. Explain your reasoning.
9. If you were trying to convince someone else that your view on a theory is right, what evidence would you give to try to show this?
10. A snake lays eggs and is cold blooded – is it a reptile or is it a mammal?
11. Use a set of data whose distribution across its range looks symmetrical, and change some of the values so that the distribution no longer looks symmetrical. Does the change affect the median more than the mean? Explain your thinking.
12. Jack is looking at Ann, but Ann is looking at George. Jack is married, but George is not. Is a married person looking at an unmarried person? A) Yes, B) No, C) Cannot be determined.
13. Is the following argument strong or weak: Would a strong labor party promote the general welfare of the people of the United States? No; a strong labor party would make it unattractive for private investors to risk their money in business ventures, thus causing sustained large scale unemployment.
14. Does the following sentence use a metaphor or a simile? "She danced across the room like a butterfly in the wind." Explain how you know.
15. A recent report in a magazine for parents and teachers showed that adolescents who smoke cigarettes also tend to get low grades in school. As the

number of cigarettes smoked each day increased, grade point averages decreased. One suggestion made in this report was that we could improve school achievement by preventing adolescents from smoking. Based on this information, would you support this idea as a way of improving the school achievement of adolescents who smoke?
16. Explain why area is expressed in square units [unit^2] and volume is expressed in cubic units [unit^3].
17. Explain the necessary steps you should take when washing your hands.
18. Indicate whether the conclusion follows from the statement: The history of the last 2000 years shows that wars have steadily become more frequent and more destructive. The last century has the worst record thus far on both these counts. Conclusion: Mankind has not advanced much in the ability to keep peace.
19. Mr. Brown, who lives in the town of Salem, was brought before the Salem municipal court for the sixth time in the past month on charge of keeping his pool hall open after 1 a.m. He again admitted his guilt and was fined the maximum, $500, as in each earlier instance. State whether the following statement is True, Probably True, Insufficient Data, Probably False, or False: On some nights it was to Mr. Brown's advantage to keep his pool hall open after 1 a.m., even at the risk of paying a $500 fine.
20. For the pattern 1, 3, 5, 7, 9,..., investigate and compare different ways of finding the 50th term.

10. Your Age:

11. Your Gender: (Male/Female/Other)

12. Which of the following have you completed? (Check all that apply)

☐ Bachelor's degree
☐ Graduate or professional degree

13. Have you completed a teaching degree/teacher's college?

☐ Yes
☐ No

14. How many years have you been teaching?

15. How many years have you been teaching at your current school?

16. What are the lowest and highest grades taught at your school?

17. Students at your school are:

☐ Female and Male
☐ All Female
☐ All Male

18. Are you certified to teach special education?

☐ Yes
☐ No

19. Do you currently teach special education?

☐ Yes
☐ No

20. Do you currently teach French Immersion or extended French?

☐ Yes
☐ No

20. What grade(s) do you CURRENTLY teach (check all that apply):

Grade 6
Grade 7
Grade 8
Grade 9
Grade 10
Grade 11
Grade 12
Other (please specify)

21. What grade(s) have you taught PREVIOUSLY (check all that apply):

Preschool
JK
SK
Grade 1
Grade 2
Grade 3

Grade 4
Grade 5
Grade 6
Grade 7
Grade 8
Grade 9
Grade 10
Grade 11
Grade 12
OAC
Other (please specify)

22. Which subject(s) do you CURRENTLY teach (check all that apply):

The Arts
French As a Second Language
Health and Physical Education
The Kindergarten Program
Language
Mathematics
Native Languages
Religion
Science and Technology
Social Studies

23. Which subject(s) have you PREVIOUSLY taught (check all that apply):'

The Arts
French As a Second Language
Health and Physical Education
The Kindergarten Program
Language
Mathematics
Native Languages
Religion
Science and Technology
Social Studies

24. Thank you very much for taking the time to complete this survey!
Your input is greatly appreciated and will help us better understand how educators conceptualize critical thinking. Would you be willing to continue to help us in our

research on critical thinking and participate in a brief follow-up interview?

☐ Yes
☐ No

If yes, please provide us with your name and contact information (email and phone
number).
Name:
Email:
Phone Number:

26. Would you be willing to participate in other online surveys related to education?
☐ Yes
☐ No

27. If you have any additional questions, comments, recommendations etc. please feel free to let us know here:

INFORMATION ABOUT THE CURRENT STUDY

This study is examining critical thinking from a teacher's perspective. Survey and interview data is being collected from teachers in Toronto, Canada and London, England in order to understand how teachers in these cities conceptualize and define critical thinking. The study aims to understand whether teachers within a specific education system (e.g., teachers in Toronto) will differ in their conceptualizations of critical thinking as well as whether teachers in different systems (e.g., teachers in Toronto vs. teachers in London) will define and understand critical thinking differently. Because critical thinking is difficult to define and the term's conceptualizations vary greatly even within the academic literature, it is
expected that teachers within cities, as well as across cities, will differ in their understanding of critical thinking.

The purpose of this research project is to work with educators and to create an open dialogue in order gain a classroom perspective of critical thinking and to understand how this aspect of education can be more effectively taught and encouraged in students. Understanding how teachers perceive the fundamental aspects of critical thinking skills (definition and assessment) will provide a new perspective on the topic, which may help clarify some ambiguities of both definition and practice. It is hoped that this research will supply future researchers

and educators with a strong foundation from which to build upon and create effective strategies to promote these valuable skills.

Your participation in this study has been incredibly helpful and we thank you sincerely. If you would like any more information or have any questions about the study, please contact Katherine Descours at kdescour@yorku.ca. If you are interested in the subject being studied, a few references have been provided below.

Brodin, E. (2007) Critical thinking in scholarship: Meanings, conditions and development Lund
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Choy, C. & Cheah, P. (2009). Teacher perceptions of critical thinking among students and its
influence on higher education. International Journal of Teaching and Learning in Higher Education, 20(2), 198206.

Appendix B: London Survey

1. From your perspective, what is critical thinking? (250 words or less)

2. Based on your experience, please indicate to what degree you agree or disagree with the following statements (Strongly Agree, Agree, Somewhat Agree, Somewhat Disagree, Disagree, Strongly Disagree, N/A):

☐ I believe critical thinking is a skill (learnable)
☐ I believe critical thinking is a disposition (innate ability)
☐ I believe critical thinking is something that can be taught
☐ I believe all students are capable of thinking critically
☐ I believe that a student's age can affect their ability to think critically
☐ I believe that a student's cognitive ability can affect their ability to think critically
☐ I believe there should be a specific class, course, or set of lessons dedicated to teaching critical thinking skills
☐ I believe critical thinking should be infused throughout the curriculum
☐ I believe critical thinking should be taught in a manner that is specific to every subject (e.g., learning how to think critically in science, learning how to think critically in math, learning how to think critically in English, etc.)

3. Please rank the following statements from the one you MOST (1) agree with to the one you LEAST (4) agree with:

☐ Critical thinking is the use of cognitive skills that increase the probability of a desirable outcome. Critical thinking is purposeful, reasonable, and goal directed and encompasses a number of skills including problem solving and decision making. Critical thinking can be transferred across domains and can be generalised to any situation.
☐ Critical thinking is reasonable reflective thinking that is focused on deciding what to believe. It is made up of dispositions and
skills. Critical thinking can be generalised to any situation and is not specific to any domain or subject.
☐ Critical thinking is way of 'thinking about our thinking'. The way we think about our thinking develops and over time we gain more knowledge and strategies to think critically.
☐ Critical thinking is an appropriate use of reflective scepticism. Critical thinking is linked with specific areas of expertise and knowledge and cannot be generalised to all subjects or situations.

4. What would you add or remove from the statement you MOST agreed with?

5. Based on your experience, please indicate to what degree you agree or disagree with the following statements (Strongly Agree, Agree, Somewhat Agree, Somewhat Disagree, Disagree, Strongly Disagree, N/A):

☐ Encouraging critical thinking skills in my students is important to me
☐ I actively try to create lessons that will encourage critical thinking in my students
☐ I often include questions that will require critical thinking skills in assignments

6. At what age should students begin to be encouraged to think critically?

7. Based on your experience, please indicate to what degree you agree or disagree with the following statements (Strongly Agree, Agree, Somewhat Agree, Somewhat Disagree, Disagree, Strongly Disagree, N/A):

☐ I feel prepared to help my students develop critical thinking skills
☐ I am confident that I understand what it means to be a critical thinker
☐ I am given enough resources to effectively teach critical thinking skills
☐ I wish I had more time to include critical thinking skills in my lessons
☐ I learned how to teach/encourage critical thinking in my teacher training
☐ I wish I had more preparation in my teacher training to teach critical thinking
☐ I learned how to teach/encourage critical thinking in Professional Development sessions
☐ I find it easy to develop activities/assignments that encourage critical thinking
☐ When I was a student, critical thinking was emphasised

8. Based on your experience, please indicate to what degree you agree or disagree with the following statements (Strongly Agree, Agree, Somewhat Agree, Somewhat Disagree, Disagree, Strongly Disagree, N/A):

☐ I believe it is possible to test critical thinking skills using a standardised test
☐ I believe critical thinking skills should be tested using a standardised test
☐ I formally assess my students' critical thinking skills
☐ Students are aware that I assess their critical thinking skills

9. Please read through the list of 20 questions and indicate whether or not you think each question is a measure of critical thinking (Yes, No, Unsure).

1. When playing slot machines, people win something about 1 in every 10 times.

Lori, however, has just won on her first three plays. What are her chances of winning the next time she plays?
2. "In the long run, the discovery of additional uses for nuclear energy will prove a blessing to humanity." Based on the previous sentence, indicate whether the following statement is an assumption: Additional and beneficial ways of using nuclear energy will be discovered.
3. Identify the verb, noun, and subject in the following sentence: "Joanne plays in the garden"
4. The Neuman Company is designing a new container for its marbles. The container must have a volume of 200cm3. Sketch three possible containers, and explain which one you would recommend.
5. Identify and describe each major component of the water cycle.
6. After the first 2 weeks of the major league baseball season, newspapers begin to print the top 10 batting averages. Typically, after 2 weeks, the leasing batter often has an average of about .450. However, no batter in major league history has ever averaged .450 at the end of the season. Why do you think this is?
7. Indicate whether the conclusion follows from the statement: No person who thinks scientifically places faith in the predictions of astrologers. Nevertheless, there are many people who rely on horoscopes provided by astrologers. Conclusion: Therefore, people who lack confidence in horoscopes think scientifically.
8. Investigate the surface area of towers made from a single column of connecting cubes, and predict the surface area of a tower that is 50 cubes high. Explain your reasoning.
9. If you were trying to convince someone else that your view on a theory is right, what evidence would you give to try to show this?
10. A snake lays eggs and is cold blooded – is it a reptile or is it a mammal?
11. Use a set of data whose distribution across its range looks symmetrical, and change some of the values so that the distribution no longer looks symmetrical. Does the change affect the median more than the mean? Explain your thinking.
12. Jack is looking at Ann, but Ann is looking at George. Jack is married, but George is not. Is a married person looking at an unmarried person? A) Yes, B) No, C) Cannot be determined.
13. Is the following argument strong or weak: Would a strong labor party promote the general welfare of the people of the United States? No; a strong labor party would make it unattractive for private investors to risk their money in business ventures, thus causing sustained large scale unemployment.
14. Does the following sentence use a metaphor or a simile? "She danced across the room like a butterfly in the wind." Explain how you know.
15. A recent report in a magazine for parents and teachers showed that adolescents who smoke cigarettes also tend to get low grades in school. As the

number of cigarettes smoked each day increased, grade point averages decreased. One suggestion made in this report was that we could improve school achievement by preventing adolescents from smoking. Based on this information, would you support this idea as a way of improving the school achievement of adolescents who smoke?
16. Explain why area is expressed in square units [unit^2] and volume is expressed in cubic units [unit^3].
17. Explain the necessary steps you should take when washing your hands.
18. Indicate whether the conclusion follows from the statement: The history of the last 2000 years shows that wars have steadily become more frequent and more destructive. The last century has the worst record thus far on both these counts. Conclusion: Mankind has not advanced much in the ability to keep peace.
19. Mr. Brown, who lives in the town of Salem, was brought before the Salem municipal court for the sixth time in the past month on charge of keeping his pool hall open after 1 a.m. He again admitted his guilt and was fined the maximum, $500, as in each earlier instance. State whether the following statement is True, Probably True, Insufficient Data, Probably False, or False: On some nights it was to Mr. Brown's advantage to keep his pool hall open after 1 a.m., even at the risk of paying a $500 fine.
20. For the pattern 1, 3, 5, 7, 9,..., investigate and compare different ways of finding the 50th term.

10. Your Age:

11. Your Gender: (Male/Female/Other)

12. Which of the following have you completed? (Check all that apply)

☐ Bachelor's degree/First degree
☐ GTP (Graduate Teacher Programme)
☐ PGCE (Postgraduate Certificate in Education)
☐ Teach First
☐ Postgraduate or professional degree
☐ Other (please specify)

13. How many years have you been teaching?

14. How many years have you been teaching at your current school?

15. Your school is:

☐ Primary
☐ Middle
☐ Secondary
☐ All Ages

16. Your school is (check all that apply):

☐ State Funded
☐ Privately Funded
☐ Faith Based
☐ Special Education
☐ Other (please specify)

17. Students at your school are:

☐ Female and Male
☐ All Female
☐ All Male

18. Has your school adopted a specific program/approach/focus on critical thinking?
If so, please elaborate:

☐ Yes
☐ No
☐ Unsure

19. Have you adopted a specific program/approach/focus on critical thinking? If so, please elaborate:

☐ Yes
☐ No
☐ Unsure

20. What grade(s) do you CURRENTLY teach (check all that apply):

Year 7
Year 8
Year 9

Year 10
Year 11
Year 12
Year 13
Other (please specify)

21. What grade(s) have you taught PREVIOUSLY (check all that apply):

Nursery
Reception
Year 1
Year 2
Year 3
Year 4
Year 5
Year 6
Year 7
Year 8
Year 9
Year 10
Year 11
Year 12
Year 13
Other (please specify)

22. Which subject(s) do you CURRENTLY teach (check all that apply):

English
Mathematics
Science
Art & Design
Citizenship
Design & Technology
Geography
History
Information & Communication Technology
Modern Foreign Languages
Music
Physical Education
Other (please specify)

23. Which subject(s) have you PREVIOUSLY taught (check all that apply):'

English
Mathematics
Science
Art & Design
Citizenship
Design & Technology
Geography
History
Information & Communication Technology
Modern Foreign Languages
Music
Physical Education
Other (please specify)

24. Thank you very much for taking the time to complete this survey!

Your input is greatly appreciated and will help us better understand how educators conceptualise Critical Thinking. Would you be willing to continue to help us in our research on Critical Thinking and participate in a brief follow-up interview?

☐ Yes
☐ No

If yes, please provide us with your name and contact information (email and phone
number).
Name:
Email:
Phone Number:

26. Would you be willing to participate in other online surveys related to education?

☐ Yes
☐ No

27. If you have any additional questions, comments, recommendations etc. please feel free to let us know here:

INFORMATION ABOUT THE CURRENT STUDY

This study is examining critical thinking from a teacher's perspective. Survey and interview data is being collected from teachers in Toronto, Canada and London, England in order to understand how teachers in these cities conceptualise and define critical thinking. The study aims to understand whether teachers within a specific education system (e.g., teachers in Toronto) will differ in their conceptualisations of critical thinking as well as whether teachers in different systems (e.g., teachers in Toronto vs. teachers in London) will define and understand critical thinking differently. Because critical thinking is difficult to define and the term's conceptualisations vary greatly even within the academic literature, it is expected that teachers within cities, as well as across cities, will differ in their understanding of critical thinking.

The purpose of this research project is to work with educators and to create an open dialogue in order gain a classroom perspective of critical thinking and to understand how this aspect of education can be more effectively taught and encouraged in students. Understanding how teachers perceive the fundamental aspects of critical thinking skills (definition and assessment) will provide a new perspective on the topic, which may help clarify some ambiguities of both definition and practice. It is hoped that this research will supply future researchers and educators with a strong foundation from which to build upon and create effective strategies to promote these valuable skills.

Your participation in this study has been incredibly helpful and we thank you sincerely. If you would like any more information or have any questions about the study, please contact Katherine Descours at k.descours@ioe.ac.uk. If you are interested in the subject being studied, a few references have been provided below.

Brodin, E. (2007) *Critical thinking in scholarship: Meanings, conditions and Development.* Lund University, Department of Education: Media –Tryck, Sociologen.
PDF: http://lup.lub.lu.se/record/27011/file/27012.pdf

Choy, C. & Cheah, P. (2009). Teacher perceptions of critical thinking among Students and its influence on higher education. *International Journal of Teaching and Learning in Higher Education*, 20(2), 198206.

Appendix C: Toronto Survey Consent Form

Study Title: Critical Thinking in Education – The Teacher's Perspective

Researcher: Katherine Descours, 527 Atkinson Building, York University, 4700 Keele Street, Toronto, Ontario, M3J 1P3. Email: kdescour@yorku.ca

The current study is being conducted by Katherine Descours, a Master's student at York University and is being conducted as part of a program requirement. In this study, critical thinking in education is being investigated. More specifically, the purpose of this study is to learn how teachers conceptualize critical thinking in order to develop a richer understanding of what critical thinking is. In participating in this study, you will be asked to complete a brief (15-20 minute) survey on your perceptions of critical thinking (e.g. "From your perspective, what is critical thinking?").

There are no known risks or benefits in participating in this study and participation is completely voluntary. You may withdraw from the study at any time or refuse to answer any questions that you do not feel comfortable answering. There is no penalty for early withdrawal and your decision to not participate in the study, to stop participating, or to refuse to answer particular questions will have no effect on your relationship with the researchers, York University, the Institute of Education (IOE), or with any other group associated with this project. If you choose to withdraw, all the data you have provided will be destroyed.

All information gathered will be kept completely confidential and will be used for research purposes only. You will be asked for contact information at the end of the survey. You will only be contacted if you have indicated at the end of the survey that you wish to participate further in our research and provide us with your contact information. Your data will remain anonymous in any report or publication and your data will be safely stored in a password protected computer and only the researcher and faculty supervisor will have access to this information. Data will be stored at least 5 years after publication and confidentiality will be provided to the fullest extent possible by law.

If you have any questions at any other time, you may email the researcher at kdescour@yorku.ca or contact the faculty supervisors, Dr Melody Wiseheart at York University at ncepeda@yorku.ca or at 416-736-2100, ext. 33266 or Dr Karen Edge at the Institute of Education, University of London at k.edge@ioe.ac.uk. This project has been reviewed and approved by the York University's Ethics Review Board Human Participants Review Subcommittee, and the Toronto District School Board External Research Review Committee and conforms to the standards of the Canadian Tri-Council Research Ethics

Guidelines. If you have any questions about the ethics review process, or about your rights as a participant in this study, you may contact Ms. Alison Collin-Mrakas, Manager; Research Ethics; 5th floor, York Research Tower; York University (416-736-5914 or acollins@yorku.ca). Thank you in advance for your participation.

Consent to Participate: I, the undersigned, consent to participate in the study "Critical Thinking in Education: The Teacher's Perspective" conducted by Katherine Descours. I understand the nature of this project and wish to participate. I am not waiving any of my legal rights by signing this form. My signature below indicates my consent.

Name of Participant	Signature of Participant
Name of Researcher	Signature of Researcher

Appendix D: London Survey Consent Form

Study Title: Critical Thinking in Education: The Teacher's Perspective

Researcher: Katherine Descours, 522 Atkinson Building, York University, 4700 Keele Street, Toronto, Ontario, M3J 1P3. Email: k.descours@ioe.ac.uk OR kdescour@yorku.ca

The current study is being conducted by Katherine Descours, a Master's student at York University and is being carried out as part of a programme requirement. In this study, critical thinking in education is being investigated. More specifically, the purpose of this study is to learn how teachers conceptualise critical thinking in order to develop a richer understanding of what critical thinking is. In participating in this study, you will be asked to complete a brief (15-20 minute) survey online on your perceptions of critical thinking (e.g. From your perspective, what is critical thinking?).

There are no known risks or benefits in participating in this study and participation is completely voluntary. You may withdraw from the study at any time or refuse to answer any questions that you do not feel comfortable answering. There is no penalty for early withdrawal and your decision to not participate in the study, to stop participating, or to refuse to answer particular questions, will have no effect on your relationship with the researchers, York University, the Institute of Education (IOE), or with any other group associated with this project. If you choose to withdraw, all the data you have provided will be destroyed.

All information gathered will be kept completely confidential and will be used for research purposes only. You will be asked for contact information at the end of the survey. You will only be contacted if you have indicated at the end of the survey that you wish to participate further in our research and provide us with your contact information. Your data will remain anonymous in any report or publication and your data will be safely stored in a password protected computer and only the researcher and faculty supervisor will have access to this information. Data will be stored at least 5 years after publication and confidentiality will be provided to the fullest extent possible by law.

If you have any questions at any other time, you may email the researcher at k.descours@ioe.ac.uk or contact the faculty supervisors, Dr Karen Edge at the Institute of Education, University of London at k.edge@ioe.ac.uk or Dr Melody Wiseheart at York University (Canada) at ncepeda@yorku.ca or at 416-736-2100, ext. 33266. This project has been reviewed and approved by the York University's Ethics Review Board Human Participants Review Subcommittee, and the Toronto District School Board External Research Review Committee and

conforms to the standards of the Canadian Tri-Council Research Ethics Guidelines. If you have any questions about the ethics review process, or about your rights as a participant in this study, you may contact Ms. Alison Collin-Mrakas, Manager; Research Ethics; 5th floor, York Research Tower; York University (416-736-5914 or acollins@yorku.ca). Thank you in advance for your participation.

Consent to Participate: I, the undersigned, consent to participate in the study "Critical Thinking in Education: The Teacher's Perspective" conducted by Katherine Descours. I understand the nature of this project and wish to participate. I am not waiving any of my legal rights by signing this form. My signature below indicates my consent.

Name of Participant	Signature of Participant
Name of Researcher	Signature of Researcher

Appendix E: Interview Questions

1. Tell me about your classroom – describe your class/students/school (what subject etc.)

2. Have you come across the term critical thinking – where?

3. What do you think critical thinking is?

4. Have you done any reading on the topic (books, article etc)?

5. Were you provided any PD courses – did you attend?

6. What are you experiences with critical thinking – were you encouraged to thinking critically as a student?

7. Do you think it's important to encourage critical thinking skills?

8. Do you think it is possible to teach critical thinking skills?

9. If a student is taught critical thinking, do you think it can be transferred to different situations or outside the classroom?

10. What does critical thinking look like in the class rooms outside the classroom?

11. Do you think critical thinking is the same in every subject, so do you think it would be the same in a math lesson and language lesson? How are they different/similar?

12. Can you give me an example of how a student has demonstrated critical thinking during a lesson?

13. Can you walk me through an assignment where students had to think critically?

14. Do you assess critical thinking skills separately? Do you look for it specifically? Do you include it in your rubrics? Should critical thinking skills be formally evaluated?

15. What is the relationship between creativity and critical thinking?

16. What do you think causes individual differences in critical thinking? What do you think affects a students' ability to think critically? (e.g. gender, age etc.)

Appendix F: Toronto Interview Consent Form

Letter of Information and Consent Form

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There are no known risks or benefits in participating in this study and participation is completely voluntary. You may withdraw from the study at any time or refuse to answer any questions that you do not feel comfortable answering. There is no penalty for early withdrawal, you will still be given the promised compensation, and your decision to not participate in the study, to stop participating, or to refuse to answer particular questions, will have no effect on your relationship with the researchers, the Institute of Education, York University, or with any other group associated with this project. If you choose to withdraw, all the data you have provided will be destroyed.

Your interview will be audiotaped and at least partially transcribed however, all information gathered will be kept completely confidential and anonymous and will be used for research purposes only. Your data will be safely stored in a password-protected computer and only the researcher and faculty supervisors will have access to this information. Data will be stored at least 5 years after publication and confidentiality will be provided to the fullest extent possible by law.

If you have any questions at any other time, you may email the researcher at kdescour@yorku.ca or contact the faculty supervisors, Dr Melody Wiseheart at ncepeda@yorku.ca or at 001-416-736-2100, ext. 33266, or Dr Karen Edge at k.egde@ioe.ac.uk. This research has been reviewed by the Human Participants Review Subcommittee, York University's Ethics Review Board and conforms to the standards of the Canadian Tri-Council Research Ethics Guidelines. If you have any questions about the ethics review process, or about your rights as a participant in this study, you may contact Ms. Alison Collin-Mrakas, Manager;

Research Ethics; 5th floor, York Research Tower; York University (416-736-5914 or acollins@yorku.ca). Thank you in advance for your participation.

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(Printed Name of Participant)	(Signature of Participant)	(Date of Signature)

(Printed Name of Principal Investigator)	(Signature of Principal Investigator)	(Date of Signature)

Appendix G: London Interview Consent Form

Letter of Information and Consent Form

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There are no known risks or benefits in participating in this study and participation is completely voluntary. You may withdraw from the study at any time or refuse to answer any questions that you do not feel comfortable answering. There is no penalty for early withdrawal, you will still be given the promised compensation, and your decision to not participate in the study, to stop participating, or to refuse to answer particular questions, will have no effect on your relationship with the researchers, the Institute of Education, York University, or with any other group associated with this project. If you choose to withdraw, all the data you have provided will be destroyed.

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(Printed Name of Participant)	(Signature of Participant)	(Date of Signature)

(Printed Name of Principal Investigator)	(Signature of Principal Investigator)	(Date of Signature)