

# Critical Thinking and Participation in an Online Collaborative Inquiry

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**Abstract:** Critical thinking is regarded central to progressive discourse. This paper presents a case study of a humanities course in a secondary school where the teacher places emphasis on critical thinking elements in the curriculum design and is also adopting collaborative inquiry in his teaching. This paper adopts a mixed approach to teach critical thinking which provides a separate mini-lesson on certain critical thinking skills and an immersive environment to foster critical thinking. Two critical thinking tests are employed to measure different aspects of students' critical thinking, critical thinking skills and dispositions. The scores of critical thinking tests are reported and their relationship with students' participation in the online discourse is explored.

**Keywords:** CSCL, critical thinking, dispositions, collaborative inquiry

## Introduction

Computer-supported Collaborative Learning (CSCL) environments have shown great potential to promote students' critical thinking [1]. Particularly, there is a growing interest in studying critical thinking which takes place in an asynchronous, text-based educational environment [2]. However, limited empirical evidence is known about the relationship between students' critical thinking skills and dispositions, and their participation in the online inquiry. Since discourse is the critical conduit through which collaborative learners share ideas and create new knowledge [3], this paper focuses on the discourse created by a threaded discussion forum thirty-two students from a secondary school humanities class in Hong Kong. The learning module being investigated lasts for about three months during which students are formed in groups and work on a project of building a tourist attraction in Hong Kong. Through a series of inquiry tasks, such as background research, proposal writing, online discussion and model making, students learn and understand more about the module topic on Materialism and Idealism as theories that explain development of civilizations. The paper aims to investigate whether students with better critical thinking skills or critical thinking dispositions can better engage in online collaborative activities than their counterparts.

## 1. Literature Review

### 1.1 CSCL

Computer-supported Collaborative Learning (CSCL) is emerging as an important area of studying the interdisciplinary field of learning sciences [4]. CSCL refers to situations where two or more people learn collaboratively together using computers. The networked platform offers great potential for students and teachers to implement collaborative inquiry in their

classrooms. Knowledge Forum® (KF) is designed for collaborative knowledge building, which is designed in the 1980s as the second generation of CSILE (Computer Supported Intentional Learning Environment). It is used to foster students to co-construct knowledge and facilitate students to work towards the advancement of their collective knowledge as a community. With the shared discourse network, students' ideas and theories are displayed by graphics or notes as conceptual artifacts. Many functions are designed to facilitate knowledge building for users. For example, students can create notes, build on others' notes, use metacognitive prompts (i.e. scaffolds), revise notes, co-author notes, write rise-above summary notes, and so on. Educators who employed KF generally prefer to give students some authentic problems for discussion, such as global warming, energy crisis [5, 6].

## *1.2 Critical Thinking*

The philosophical tradition of critical thinking can ascend to ancient times of Socrates [7]. The modern history of critical thinking, can be traced back to John Dewey coining the term of "reflective thinking" in 1930s. Based on Dewey's ideas, many theorists contribute to the development of critical thinking in the ensuing years [8-11]. Ennis is one of the most influential researcher in this field. According to Ennis [12], critical thinking is "reasonable reflective thinking that is focused on deciding what to believe or do" (p. 45). It is worth noting that earlier work on critical thinking mainly put emphasis on a set of thinking skills [8]. In fact, besides possession of the relevant skills, one needs to be disposed to use those skills in appropriate situations [13]. The term disposition is defined following Dewey's [14] notion of habit of mind, which refers to "habitual ways of behaving" [15]. Besides skills and dispositions, McPeck [11] contends that specialized knowledge within the field is requisite to critical thinking. So critical thinking has three important components: skill, disposition, and content knowledge.

## **2. Design and Method**

This paper analyzes the online discourse of thirty-two 8<sup>th</sup> graders in a secondary school in Hong Kong. The participating school is also participating in the project "Professional Development Network for Knowledge Building in Schools" (KBTN; <http://kbtn.cite.hku.hk>). The project is supported by the Centre for Information Technology in Education, Faculty in Education, University of Hong Kong. Both the teacher and his students have no experiences with knowledge building and KF. The participating school has strong emphasis on collaborative inquiry as well as critical thinking in its curriculum design. To better foster students' critical thinking, a mixed approach [16, 17] is adopted which consists a separate mini-lesson aimed at teaching certain critical thinking skills about the subject matter, and an online asynchronous platform for engaging students in a critical inquiry.

### *2.1 Measurement of Critical Thinking*

Two instruments are being administrated to participants on critical thinking. The descriptions of the two tests are as follows:

1. The adapted Cornell Critical Thinking Test, Level X (CCT-X)

The test has 49 items in multiple-choice format, which places an emphasis on the evaluative aspects of critical thinking. CCT-X [18] presents a detective story on a new planet. The

test-takers are required making judgment on the reliability of given statements. Several critical thinking skills are involved in CCT-X: induction, deduction, observation, credibility and assumption.

## 2. The Inventory of Belief and Critical Thinking Disposition (IBCTD)

Yeh's [19] inventory is adopted here to reflect how frequently the participants are disposed to be (a) systematic and analytic; (b) open-minded and empathetic; (c) intellectual; inquisitive, and (d) holistic and reflective.

## 2.2 Participatory analysis of the online discourse

In addition to the instruments mentioned above, the online discourse provides a means to examine participation of students. First, some basic quantitative statistics can be generated as other online forums, such as number of notes created, number of build-ons. Second, there are some additional statistics could be calculated by ATK indices for KF discourse data [20], including (a) percentage of notes that are linked to other notes, (b) Percentage of notes with keywords, (c) percentage of notes in the database read, (d) number of notes with scaffolds (e.g., My theory, I need to understand), and (e) number of revisions per note. Keywords help to give a hint on what topics may be covered. Revision of notes implies that the author try to polish his/her ideas. Further, as a crude analysis, the automatic coding can be used to scan the messages in online discussions by recognizing discourse markers such as argumentative markers and question markers [21-23]. Descriptions on two types of discourse markers are presented in Table 1.

Table 1. Discourse markers of and its related speech acts

Communicative Function	Speech Act	Discourse markers, i. e.
Argument	Claim	I think, I (totally) agree, we should...
	Disagreement	I don't think, I don't agree, I do not agree...
	Reason	because, since
	Elaboration	moreover, such as
	Condition	if
	Contrast	but, although, however, even, otherwise...
Question	Consequence	then, thus, so, therefore
	Explanation questions	how, why
	Factual questions	what, where, who/whom, Is/Are there

## 3. Results & Analysis

The descriptive statistics from ATK indicate an extensive use of the database: There are 1017 written notes on KF, contributed by 32 students in the class. The average number of the forum notes is 31.78 in the learning module. The results of correlation analyses indicate that no significant correlation is found between students' participation in KF and the score of the CCT-X pre-test and its subscales. It is clearly shown in Table 2 that there is a significantly positive correlation between both the pre- and post-test score of IBCTD and most of the ATK indices. In particular, while the correlation was not significant with the total score on IBCTD pre-test ( $r = 0.23, p > .05$ ), number of scaffolds had strong correlation with the total score on IBCTD post-test ( $r = 0.45, p < .05$ ). As compared to the pre-test score, the correlation between the post-test score of IBCTD and ATK indexes seemed more evident, which was very likely due to the specific design of the humanities learning module.

Table 2. Zero-order Correlations between Students' ATK Indexes and the Score of IBCTD

	# of Note Created	# of Notes with Keyword	# of Revision	# of Build-ons	# of Keyword	# of Scaffold	# of Notes Read	% of Notes Linked	% of Notes Read
Pre-test	.39*	.41*	.44*	.37*	.43*	.23	.35	.47**	.36*
Post-test	.43*	.37*	.49**	.39*	.38*	.45*	.14	.58**	.11

Note. # = Number; \*  $p < .05$ ; \*\*  $p < .01$

To better understand the relationship between students' critical thinking and their participation in the online inquiry, students are divided into four groups: students with higher score (top 40%) in both CCT-X and IBCTD, students with lower score in CCT-X and IBCTD (bottom 40%), students who has higher score in CCT-X but lower score in IBCTD, and their counterparts. Each discrepant group may contain 4 to 6 students. Among the four groups, we are particularly interested in the students within these two groups: HSLD and LSHD. The purpose is to investigate how students with either greater skills or disposition at critical thinking, perform on the online discourse.

In terms of argument markers, it is found that students with high skills but low dispositions generate more *disagreement*, *reasoning*, and *consequence* than those in LSHD group. In contrast, students in LSHD group tend to use more *conditions* than HSLD group. However, only a few notes are created with elaboration markers for both groups, which may be one of the reasons for that they cannot become good critical thinkers. Questions per note are also investigated because good questions can reflect the participants' critical thinking level. Explanation-seeking questions are considered to indicate a higher level of explanation of students' ideas. It is discovered that students in the LSHD group are particularly active in asking "How" and "Why" questions than their counterparts. This result suggests that students with higher dispositions are more likely to engage in deeper level of explanation.

#### 4. Discussion

While some critical thinking programs value critical thinking skills as an important aspect of critical thinking, we argue that both skills and dispositions are indispensable for a student to become a good critical thinker. To some extent, to cultivate a disposition toward critical thinking could be more difficult and arduous work. This paper investigates a case in a humanities classroom where the teacher values the importance of critical thinking and employs the knowledge building approach to engage students in a collaborative inquiry. The mixed method is adopted, which incorporates direct teaching in critical thinking skills and provides students with an immersive online learning environment to cultivate their dispositions in critical thinking.

It is found that a set of ATK indices, such as number of notes written, and number of notes read, has positive relationship with the students' prior disposition toward critical thinking. In addition, two groups of students with HSLD and LSHD are investigated. It should be noted that the classification is referential (based on relatively high/low scores of the test compared with others) rather than is diagnostic (based on a test itself). It is found that students in HSLD have better performance in using argument markers such as reasoning and consequence than their counterparts. Those students in LSHD tend to use more conditions when expressing their ideas. But students in both HSLD and LSHD groups fail to demonstrate their ability to give elaborations in their notes. In terms of questioning, the statistics shows that students with higher dispositions are likely to ask more deepened level questions per note.

This study has both theoretical and practical implications for researchers and practitioners. Theoretically, it explores the relationship between critical thinking skills, dispositions and participation in the online discourse. Practically, the paper suggests that both skills and dispositions should be explicitly taught and incorporated together. Also if the results are validated in future studies, the teachers can better engage learners with different critical thinking level in the online discussions. In addition, since critical discourse always takes place when critical thinking is carried on by a group of people, content analysis could be used to gain an in-depth understanding of the dynamics of the online discussion in future.

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