International Journal of Educational Research 70 (2015) 68–79

Contents lists available at ScienceDirect

International Journal of Educational Research

journal homepage: www.elsevier.com/locate/ijedures

Effects of the constructivist learning environment on students' critical thinking ability: Cognitive and motivational variables as mediators

Yee Wan Kwan [a,*], Angela F.L. Wong [b,1]

[a] Department of Education Studies, Hong Kong Baptist University, Kowloon Tong, Kowloon, Hong Kong
[b] National Institute of Education Learning Sciences and Technologies Academic Group, National Institute of Education, 1 Nanyang Walk, Singapore 637616, Singapore

ARTICLE INFO

Article history:
Received 9 December 2014
Received in revised form 29 January 2015
Accepted 2 February 2015
Available online 21 February 2015

Keywords:
Constructivist learning environment
Critical thinking ability
Motivational beliefs
Cognitive strategies

ABSTRACT

This study aimed to empirically test the direct relationship between the constructivist learning environment and critical thinking ability and the indirect relationship between them when mediated by motivational beliefs and cognitive strategies. Responses from questionnaires were collected from a convenience sample of 967 students studying Liberal Studies or Integrated Humanities in Secondary Three (Grade nine) in Hong Kong. Analyzed by structural equation modeling, both cognitive strategies and goal orientations fully mediated the relationships between the constructivist learning environment and critical thinking ability. The finalized model showed an acceptable fit to the data and that 22% of the variance in critical thinking ability was explained, suggesting the usefulness of the model in predicting critical thinking ability.

1. Introduction

Critical thinking has drawn a lot of attention both in educational research and practice (e.g., Fisher & Scriven, 1997; Halford, 2005; Niu, Behar-Horenstein, & Garvan, 2013; Moon, 2008; Norris & Ennis, 1989). It is observed that there are at least six ways of defining critical thinking, namely logic, skill and ability components, pedagogy, ways of being (a set of dispositions, attitudes and habits), developmental approach, and integrative approach (Bailin, Case, Coombs, & Daniels, 1999; Moon, 2008). The earlier definition of critical thinking in education could be tracked back to Dewey (1933). He referred to critical thinking as "reflective thinking", aiming at obtaining a justified belief through a conscious and voluntary effort. This idea of self-control of one's own thinking has influenced the definitions of critical thinking in education subsequently. For example, Glaser (1941), Ennis (1987), Facione (1990), Paul, Fisher, and Nosich (1993), and Lipman (2003) focused on the reflective and deliberate effort in achieving good thinking in their definitions.

Although a number of theorists and educators had developed their definitions and conceptualizations of critical thinking, studies accounting for factors affecting critical thinking ability are limited (Moseley et al., 2005). The reasons for this might be due to the fact that the practitioners in education have paid their attention to searching for methods to develop critical

* Corresponding author. Tel.: +852 3411 7721; fax: +852 3411 7894.
E-mail addresses: ywkwan@hkbu.edu.hk (Y.W. Kwan), angela.wong@nie.edu.sg (Angela F.L. Wong).
[1] Tel.: +65 6790 3228; fax: +65 6896 8038.

http://dx.doi.org/10.1016/j.ijer.2015.02.006
0883-0355/

thinking instead of investigating the relationships between critical thinking ability and other factors (Halpern, 2001). In fact, most of the thinking interventions reflect the principles of cognitive processing in information processing theory (Higgins et al., 2004), shedding light on the importance of learning environment, motivation, cognitive strategies factors in the information flow which in turn generated various learning outcomes, including critical thinking. For example, Pintrich and Schrauben (1992) pointed out that students' learning in the classroom can be accounted for by their motivational and cognitive factors which are affected by the nature of the instructional methods and academic tasks. Similarly a number of educators (e.g., Brown, Alverson, & Pepa, 2001; Thomas & Anderson, 2014) believed that instructional approaches which emphasized creating a constructivist environment and promoting active learners or a learner-centered culture was able to develop students' critical thinking. Constructivism assumes that people are active learners and can construct knowledge for themselves (Schunk, 2012; Vygotsky, 1978). As each person has individual experiences and different foreknowledge to build on, his or her results of new knowledge or abilities are unique (Hamers & Csapó, 1999). Hence, on the one hand, critical thinking is proposed to be affected by constructivist learning environments, while on the other hand, the assumption that individual experiences and foreknowledge may mediate between learning environment and critical thinking is reasonable.

Various educators and researchers (e.g., Boekaerts, 1996, 2010; Pintrich & Schrauben, 1992; Sternberg & Kaufman, 1998; Williams, Oliver, Allin, Winn, & Booher, 2003) found that students' individual cognitive factors like motivational beliefs, and cognitive and metacognitive strategies are important in students' critical thinking or cognitive abilities. Niu et al.'s (2013) conducted a meta-analysis of the effects of critical thinking teaching and suggested to consider the characteristics of students when developing their critical thinking. This study extended previous researches and filled the research gaps by testing the direct and indirect effects of constructivist learning environment on critical thinking ability when mediated by motivational beliefs and cognitive strategies. The need for investigating factors involving students' critical thinking is gaining importance (Ingle, 2007; Pintrich & Schrauben, 1992) because an understanding of the predictors of critical thinking ability can have implications for research and educational practice. In the following sections, definitions of these various predictor variables and prior research on the relationships between the predictors and critical thinking ability are reviewed.

1.1. Predicting critical thinking of students

After a critical examination of 42 thinking skills models, Moseley et al. (2005) found that most of the frameworks, models, and taxonomies were focused on the outcomes, components, and developmental steps of thinking. Models that explicitly explain the elements involved in the development of thinking are scarce (Halpern, 2001; Moseley et al., 2005). Though the information processing theory is vague in terms of suggesting concrete variables, it can serve as a starting point for studies investigating theoretical basis of factors developing critical thinking.

The information processing theory believes that good information processing itself is good thinking (Gredler, 2009; Schunk, 2012; Sternberg, 2003). All cognitive processes are governed by information processing, which includes acquiring information, coding information for storage, and retrieving information from memory (Gredler, 2009; Schunk, 2012). There are two assumptions: (1) the memory system is an active, organized processor of information, and (2) prior knowledge plays an important role in learning (Gredler, 2009). In this theory, the information processing of a human mind is represented by three stages of the human memory system, being responsible for transferring information from one stage to the next and then storing it in the memory permanently (Driscoll, 2005).

In summary, different information processes are involved in each stage of memory. These processes are attention/perception (short-term storage), pattern recognition and encoding (working memory), storage (long-term memory), and retrieval (long-term and working memory), demonstrating learners' thinking processes (Gredler, 2009). Inappropriate cognitive processes cause incorrect and inefficient thinking (Boekaerts, 1988; Pintrich & Schrauben, 1992). Enhancement of cognitive and metacognitive processes can improve one's competence in thinking, and provide the rationale behind a number of the thinking programs (Hamers & Csapó, 1999; Higgins et al., 2004; Moseley et al., 2005).

In line with the findings that thinking could be improved by deliberate educational experiences (e.g., Higgins et al., 2004; Moseley et al., 2005), the definition by Ennis (1987) has been one of the widely accepted and influential definitions. Ennis defined critical thinking as "reasonable and reflective thinking that is focused upon deciding what to believe or do" (Ennis, Millman, & Tomko, 1985, p. 1). He suggested 12 abilities of critical thinking, grouped them into four areas, namely clarity, basis, inference, and interaction, and highlighted conscious effort, controllable and developable nature of critical thinking. His theory contributed a comprehensive framework for educators to design relevant curriculum objectives for school subjects such as Liberal Studies (LS) which is aimed at fostering critical thinking under the Hong Kong education reform (Curriculum Development Council & the Hong Kong Examinations and Assessment Authority, 2007). Ennis's definition of critical thinking and its corresponding instrument, the Cornell Critical Thinking Test, Level X (CCTT-X, Ennis et al., 1985) is aligned with the expected outcomes of critical thinking in the Liberal Studies curriculum. Indeed, teachers of LS are expected to implement constructivist teaching approaches or provide student-directed learning environments to achieve curriculum aims and develop students' critical thinking (Curriculum Development Council & the Hong Kong Examinations and Assessment Authority, 2007). Therefore, the operational definition of critical thinking for this study adopted his definition and the instrument CCTT-X to assess students' critical thinking ability. Ennis's CCTT-X has been widely used in educational research internationally (e.g., Brunt, 2005) as well as with Hong Kong secondary school students (Yip, 1998).

In short, the information processing theory could serve as a theoretical guide for researchers to investigate factors that explains critical thinking ability. It shed light on the importance of learning environment factors, paying attention to