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An integrated critical thinking framework for the 21st century

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ABSTRACT

Critical thinking is a metacognitive process that, through purposeful, reflective judgement, increases the chances of producing a logical conclusion to an argument or solution to a problem. Instruction in critical thinking is becoming exceedingly important because it allows individuals to gain a more complex understanding of information they encounter and promotes good decision-making and problem-solving in real-world applications (Butler et al., 2012; Halpern, 2003; Ku, 2009). Due to what can be considered an exponential increase in the creation of new information every year (Darling-Hammond, 2008; Jukes & McCain, 2002), critical thinking skills are needed more than ever in order to aid individuals in becoming more adaptable, flexible and better able to cope with this rapidly evolving information. This review investigates existing theoretical frameworks of thinking skills and educational objectives, as well as cognitive models situated in empirical research; and aims to develop an integrated framework of learning outcomes based on the integration of these extant frameworks with recent conceptualisations of critical thinking.

1. Introduction

Critical thinking is often described as a metacognitive process, consisting of a number of sub-skills (e.g. analysis, evaluation and inference) that, when used appropriately, increases the chances of producing a logical conclusion to an argument or solution to a problem. The teaching of critical thinking (CT) skills has been identified as an area that needs to be developed (Association of American Colleges and Universities, 2005; Australian Council for Educational Research, 2002). CT skills are vital in educational settings because they allow individuals to go beyond simply retaining information, to actually gaining a more complex understanding of the information being presented to them (Dwyer, Hogan, & Stewart, 2012; Halpern, 2003). CT skills are also important in social and interpersonal contexts where good decision-making and problem-solving are needed on a daily basis (Ku, 2009). Research suggests that good critical thinkers make better decisions and judgements in complex situations (Gambrill, 2006), engage less in cognitive bias and heuristic thinking (Facione & Facione, 2001; McGuinness, 2013) and are more likely to get better grades, become more informed and more active citizens, and are often more employable as well (Barton & McCully, 2007; Holmes & Clizbe, 1997; National Academy of Sciences, 2005).

CT courses have been taught at University in varying academic domains including law, philosophy, psychology, sociology and nursing, all with the goal of improving CT performance. Such CT courses have also been informed by varying conceptualisations of CT (e.g. Ennis, 1987; Facione, 1990b; Halpern, 2003; Paul, 1993). Though research indicates that CT can be improved in various academic domains (e.g. Abrami et al., 2008; Alvarez-Ortiz, 2007; Gadzella, Ginther, & Bryant, 1996; Hitchcock, 2004; Reed & Kromrey, 2001; Rimiene, 2002; Solon, 2007), these varying conceptualisations can make it difficult

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for researchers and teachers to understand or agree on the key components of good CT. These difficulties may impede the ability of researchers and teachers to construct an integrated theoretical account of not only how best to train CT skills but also how best to measure CT skills. Notably, the relationship between the concepts of CT that are taught and those that are assessed is often unclear; and a large majority of studies in this area include no theory to help elucidate these relationships (Dwyer, 2011).

Despite potential difficulties in assessing CT, both Abrami et al.'s (2008) and Alvarez-Ortiz's (2007) meta-analyses indicate that making CT learning objectives explicit to students is crucial in improving CT ability. That is, in order to improve CT ability, students must be aware of what it is they are supposed to be learning; and likewise; their teachers must also be aware what it is they are supposed to be teaching. Arguably, however, this is not often the case. According to one university lecturer interviewed in Lloyd and Bahr's (2010, p. 13) qualitative research, "we expect students to do it [think critically], but now you are questioning me on my understanding of it, I wonder if I actually understand it myself." Lloyd and Bahr's research further revealed that while 37% of academics instructing or assessing CT in university courses at least acknowledge the dispositional and self-regulatory aspects of CT, only 47% described CT in terms of involving processes or skills.

Although the development of CT skills is seen as increasingly important for successfully adapting to the modern world (Halpern, 2003), there has been limited agreement on how to define CT (e.g. Bensley, 1998; Ennis, 1987; Moseley et al., 2005; Paul, 1993) and its relationship with other cognitive processes such as memory and comprehension (Dwyer, 2011; Halpern, 2003). In this paper, we situate CT in a broad framework of thinking skills that identifies and organises six key learning outcomes (i.e. memory, comprehension, analysis, evaluation, inference and reflective judgement). We also describe how other metacognitive processes, including self-regulatory skills and thinking dispositions are central to understanding CT in action, and we highlight the importance of this broad skill-set for adapting to today's ever-changing world.

2. Frameworks for thinking and learning outcomes

Frameworks for thinking processes may be developed for a number of specific reasons, for example, to address educational objectives, instructional design, productive thinking, or cognitive development. In this context, a number of frameworks are considered because the processes they describe as being necessary in educational settings are also necessary for the successful application of critical thinking. Bloom's (1956, p.12) taxonomy of educational objectives was developed to classify "mental acts or thinking [resulting from] educational experiences", and was one of the first frameworks to characterise thinking as an array of both lower-order and higher-order thinking processes – consistent with many modern conceptualisations of critical thinking (e.g. Reeves, 1990). Bloom's taxonomy of educational objectives consists of six hierarchically arranged categories of thought (see Fig. 1), which notably, are consistent with those identified in this review as comprising CT and processes associated with CT.

Romiszowski's (1981) framework for knowledge and skills, which was heavily influenced by Bloom's taxonomy, presents a skill-cycle that not only describes the cognitive processes necessary in educational settings, but also the way in which they interact and develop. For Romiszowski, skills act upon novel, incoming information as well as pre-existing knowledge. During the skill-cycle, an individual perceives, recalls, makes plans and performs based on knowledge of facts, procedures, concepts and principles.

Anderson and Krathwohl's (2001) taxonomy follows Romiszowski's general principle of describing thinking in terms of actions, specifically, by transforming Bloom's thinking processes from noun form to verb form (e.g. renaming evaluation as evaluating). Anderson and Krathwohl also place creation (formerly, synthesis in Bloom's taxonomy) as the pinnacle process in the hierarchy of learning outcomes, and similar to Romiszowski, Anderson and Krathwohl treat knowledge as a separate dimension and highlight a unique form of knowledge – metacognitive knowledge, which refers to strategic knowledge, knowledge about cognitive processes and tasks, and self-knowledge (Anderson & Krathwohl, 2001).

Similarly, Marzano's (2001) taxonomy includes a metacognitive system, which acts as an executive control system focused on goal and process specification, as well as process and disposition monitoring (Marzano, 1998). Marzano's taxonomy is similar to other frameworks in that it includes a knowledge domain and processes (under the broad category of the cognitive system) of knowledge retrieval (i.e. memory/recall), comprehension (i.e. knowledge representation), analysis (i.e. classifying, identifying errors, generalising, matching and specifying) and knowledge utilisation (i.e. decision-making, problem-solving, investigation and experimental enquiry). At the highest level in Marzano's taxonomy is the self-system in which goals are produced. It is in the self-system where motivation, attention, and beliefs help to determine whether or not any given task will be undertaken.

Though the taxonomies presented above are descriptive in terms of identifying thinking processes and the links among them, it is also important to consider the empirical, cognitive psychology research which has investigated key thinking processes. In addition, a possible weakness of the frameworks above is that they do not adequately elaborate on the manner in which one applies higher-order thinking processes (Krathwohl, 2002; Moseley et al., 2005). One feature of *application* that is pertinent in this context is the reflective judgement an individual brings to bear in the application of knowledge, which will also be elaborated upon below as a key feature of CT. Thus, the focus of this paper now turns to a more detailed discussion of each of the six key processes outlined above (i.e. memory, comprehension, analysis, evaluation, inference and reflective judgement).