Reflective Learning: Developing Critical Reflective Thinking in STEM MBA Students

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Abstract

The primary role of higher education (HE) institutions has been to prepare its students for their future careers in the workplace. Traditionally, this has been accomplished through a mix of theoretical knowledge and practical application. Reflection has been effectively used in business HE institutions to encourage students to seek beyond the descriptive and simple response to deep, critical thinking and, effectively, make better choices. One pertinent area of business management education that needs to emphasize higher-level critical thinking skills involves students who study in the disciplines of Science, Technology, Engineering, or Maths (STEM). While STEM programs focus on discipline specific expertise, MBA programs offer general management knowledge across the disciplines which allows STEM students to be more effective in the workplace. STEM education necessitates effective strategies for preparing young graduates who can successfully meet the real world demands of the global economy and offer creative solutions for any wicked problems they may face. Thus, today's management education, regardless of the industry or eventual work position, has accepted the need for reflection within and outside of the classroom. Reflection was first introduced in a pedagogical context by Dewey early in the 20th century (Van Beveren, Roets, Buysse, & Rutten, 2018). For Dewey, reflection is thinking (Pierson, 1998), but is difficult to assess in regards to its research effects on education and professional development (Rodgers, 2002). Perhaps for this reason, Dewey focused on systematic, rigorous, and disciplined reflection deeply rooted in scientific inquiry (Rodgers, 2002) that was brought about by a moment of doubt (Morrow, 2011). Schön elaborated on this concept of reflection and introduced the expressions reflection-in-action, or thinking while doing the task and reflection-on-action that entails thinking after the event or action is completed (Ferreira, n.d.; Hebert, 2015; Hickson, 2011; Johnston & Fells, 2017; Kamerdeen, 2015; Leitch & Day, 2000; Rodgers, 2002; Tanggaard, 2007; Thompson & Pascal, 2012; Van Beveren et al., 2018; Yanow & Tsoukas, 2009). Reflection-in-action is based on routinized action, an encounter of surprise, and reflection leading to new action and is often an improvised response which allows the participant to reflect while in the midst of the action without interrupting what one is doing (Yanow & Tsoukas, 2009). This is most commonly referred to as 'thinking on your feet'. A person who is capable of this quick thinking was defined by Schön as a 'reflective practitioner' who reflects on understanding actions, subsequently, questioning and restructuring them, to make more effective future action choices (Ash & Clayton, 2004; Morrow, 2009; Roberts, n.d.; Ryan, 2012; Xiao, Namukasa, & Caldeira, n.d.). In today's educational system, it is important for students to transfer problems across educational and workplace contexts (Tanggaard, 2007) and address real-world problems (Ferreira, n.d.). Real life problems are often complex and multi-faceted. They entail combining the data or description the student has gathered (Rodgers, 2002) with their existing beliefs, heuristics, theory, knowledge, or experience to decipher what the data or description is actually saying (Hebert, 2015). Learning then is transformed by the experiences in which the student participates

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(Miettinen, 2000), but this experience can change from one context to another. Two students can look at the same event at the same time, yet see it differently (Ferreira, n.d.). Different cultures may interpret the same stimulus in different ways (Miettinen, 2000) or react to it in seemingly contradictory manners. There may not be one straightforward 'right' answer to a real-world problem but a need to have alternative ways of seeing things (Thompson & Pascal, 2012). Thus, "reflection itself becomes not a means to an end or something to perform, but rather a way of being in the world" (Hebert, 2015, p. 369). Previous literature has examined different models of reflection or levels of reflection that could be implemented in HE institutional settings such as Gibb's model of reflection (Roberts, n.d.), Watson-Glaser's 5- step appraisal of critical thinking (Cavdar & Doe, 2012), and Kolb's active experimentation, concrete experience, reflective observation, and abstract conceptualization (Morrow; 2009; Roberts, n.d.). In this paper, Baker's 4-step model of reflection (identification, description, significance, and implications) was used as the foundation of the MBA STEM student reflection papers (Kennison, n.d.). Baker's model of reflection was chosen for this study as it is most often utilized in medical and scientific settings where the importance of evaluating and taking each decision can have dramatic effects on a larger community; this is a potential challenge STEM students may face in their respective workplaces as well. Reflection is social and flourishes in communities of practice. Traditionally, the concept of reflection was seen as an individual learning experience which neglected the emotional dimension of learning (Rodgers, 2002; Thompson & Pascal, 2012). However, participants need to engage and discuss shared problems or activities (Lin, Hmelo, Kinzer, & Secules, 1999) to interact and accommodate new experiences and actors to make new connections (Tsoukas & Chia, 2002). For this reason, reflection has been accepted as a collective and social practice (Johnston & Fells, 2017). One crucial aspect of the collective side of reflection derives from its innate ability to encourage groups of people with common goals to join together as communities of learners/learning communities (Cavdar & Doe, 2012), educative community of critical thinking/community of experts/community of inquiry (Golding, 2011), knowledge-building communities, or, most commonly referred to as communities of practice (Hibbert, 2013; Roth & Lee, 2006). Previous literature explored the concept of communities that are particularly relevant to STEM students such as the 'peer review community' that is based on a high degree of clarity, concision, collaboration and communication which is critical in STEM disciplines (Reed, Pearlman, Millard & Carillo, 2014; Reynolds, Thaiss, Katkin, & Thompson, 2012). Another pertinent community is the 'faculty learning community (FLC)' that has been created to improve student learning and faculty professional development through discovery, mapping, and developing to identify communication gaps and devise assignments that address them. Reflective assignments, particularly written assignments, offer one possibility of addressing these gaps. The success of writing is community based between STEM faculty and students (Reynolds et al., 2012) where peers offer meaningful discourse on the work and provide feedback that engages students in active critical thinking (Cavdar & Doe, 2012; Morrow, 2009; Morrow, 2011; Reed et al., 2014). This dialogue or inner conversation that reflection encourages is dynamic and complex; it enhances higher level critical thinking and promotes autonomy and empowerment (Abrami, Bernard, Borkhovski, Waddington, Wade, & Persson, 2015; Kennison, n.d.). Through written reflections, students consider multiple perspectives and question norms or prior learning to explain how they would react to similar experiences in the future (Kennison, n.d.; Roberts, n.d.) by making connections between course topics and their own lives and justifying any answers they may put forth (Beigman Klebanov, Burstein, Harackiewicz, Priniski, & Mulholland, 2017; Morrow, 2011). These written reflections can include but are not limited to, learning logs, diaries, or journals (Morrow, 2009; Pierson, 1998). Written reflection moves students away from memorizing facts to a deeper understanding of concepts and scientific ways of thinking that improves student learning

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and engagement (Reynolds et al., 2012). For STEM students, this type of written reflection represents a shift from 'knowledge telling' to 'knowledge transforming' (Reynolds et al., 2012) in a clear, concise, well-organized manner supported by empirical evidence (Jovanovic et al., 2017). When students find a task useful and relevant beyond the immediate situation, they are more engaged, work harder, and perform better (Beigman Klebanov et al., 2017), thus, written reflective assignments that can be applied to and in real life are likely to produce more authentic reflections (Jovanovic et al., 2017). Through written reflection based on thought-encouraging questions and a thinking-encouraging approach, students can become critical thinkers (Golding, 2011) who create co-reflective learning space with faculty that offers authentic intellectual challenges and allows them to find their own voices (Morrow, 2011). Nonetheless, there are some challenges with written reflection such as the risk that not all students are that profound nor honest; they may write what they think the teacher wants to hear or be afraid of losing face in front of their colleagues. Further, students may become self-conscious critics and be lost in isolated thinking or self-absorption (Morrow, 2009; Morrow, 2011). Students may struggle to incorporate evidence in their arguments (Cavdar & Doe, 2012), thus risking superficial responses that lack any indication of higher-level critical thinking skills and have no impact on learning or future practice (Ryan, 2012). There is a certain level of discomfort in sharing reflective writing with others (Pierson, 1998) as emotional matters and sensitivities are directly related to reflection (Roberts, n.d.). An educator cannot command a student to reflect or simply trust that reflection has taken place (Ash & Clayton, 2004). Rather, students need a supportive, non-threatening environment (Ryan, 2012) where they are allowed to make mistakes (Kennison, n.d.).

Keywords: higher education, STEM education, critical reflective thinking, eflective learning

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