Factors affecting creative problem solving in the blended learning environment: a review of the literature

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Abstract

The aim of this study was to investigate factors affecting creative problem solving in a blended learning environment from the selected papers. The content analysis was used for analysing 20 research studies. The study revealed that 1) understanding the challenges, 2) generating ideas, 3) preparing for action, 4) planning own approach were main factors in creative problem solving process; and 1) learning activities, 2) learning resources, 3) feedback, 4) learning interaction, and 5) evaluation were five main factors in blended learning environment. Nine factors were proposed as a framework to design blended learning to enhance creative problem solving performance.

1. Introduction

At present, an ability to solve problems creatively is one key performance (Trilling & Fadel, 2009) because new problems happen everyday. A problem solving skill consists of convergent and divergent thinking for creating the solutions (Newman, 1995). Besides, the skill involves causal reasoning, structure, and system knowledge (Jonassen, 2004). It is promoted by creative problem solving (CPS) process that has been refined for more than 60 years by many researchers. Alex Osborn (1957) first presented seven steps in CPS process, namely orientation, preparation, analysis, hypothesis, incubation, synthesis, and verification. Isaksen, Treffinger, and Firestien (1982) turned
Osborn’s CPS process into a linear form. The process went through several changes and as for the current model, Isaksen, Treffinger, and Firestien (1982) proposed CPS V6.1 which includes 4 main components and 8 detailed steps. This version has been applied and tested in education contexts and has been demonstrated in traditional classroom, blended, and online learning contexts.

As a result of technology revolution, technology has brought about changes in education. A great number of universities have transformed traditional undergraduate classroom into online and blended learning environment (Allen, Seaman, & Garrett, 2007). With the application of CPS and technology in education, the instructors have used diverse tools (e.g. e-mail, discussion board, chat room, social network, and others) and several techniques (e.g. brainstorming, reflection, wh-question, synectics, and others) to develop learners’ ability to solve problems creatively (Treffinger et al., 2003; Proctor, 2010). Although CPS process has been studied, their results did not show the specific CPS factors that affect creative problem solving performance in blended learning context. Consequently, the aim of this study is to examine the factors affecting CPS in blended learning environment for finding the important factors to design and monitor learning context.

1.1. Creative problem solving

Creative problem solving (CPS) is the association between problem solving process and creative thinking (Kirton, 2003). CPS was developed in 1952 by Osborn (1957) who presented 7 processes of CPS which were 1) orientation 2) preparation 3) analysis 4) hypothesis 5) incubation 6) synthesis and 7) verification. Many researchers used CPS Osborn version for developing creative thinking or other abilities (Kuo, Chen, & Hwang, 2014; Buisine, Besacier, Aoussat, & Vernier, 2012; Chant, Moes, & Ross, 2009). As a result, CPS process has been improved many times and adapted to various educational contexts. CPS process that was modified by Isaksen, Dorval, and Treffinger is the latest version (CPS V6.1) of the CPS process (Treffinger et al., 2003). This version was tested in many research studies which focused on developing creative thinking, improving problem solving abilities, or enhancing divergent thinking in various student levels (Tseng et al., 2013; Vidal, 2010; Chen & Cheng, 2009). The latest CPS process consisted of 4 main steps and 8 minor steps which were 1) understanding the challenge: constructing opportunities, exploring data, and framing problems 2) generating ideas: generating ideas 3) preparing for action: developing solutions and building acceptance and 4) planning your approach: appraising tasks and designing process (Treffinger et al., 2003).

1.2. Blended learning environment

Within the last decade, the most interesting instruction was blended learning (BL), a combination between face to face (F2F) and online teaching (Allan, 2007; Horton, 2006; Roger, 2007; Voos, 2003). In a blended learning context, instructors determine learning objectives, assign learning tasks, interact with students, give feedback, and evaluate students’ achievement (Alshwiah, 2009). However, instructors or instructional designers should understand the learning context and use designing steps which were 1) analyzing learner characteristics, learning objectives, and learning environments, 2) designing activities and resources, and 3) assessing instruction (Huang, Ma, & Zhang, 2008). In addition to being a facilitator, instructors should enhance their learners by considering learners’ styles and providing course guidance, learning activities, interaction, and feedback (Liang and Creasy, 2004). Previous studies have demonstrated factors in blended learning as follows. First, learning activities consist of giving assignments, identifying learning objectives, and determining learners to participate in courses (Allan, 2007; Alshwiah, 2009; Chen & Cheng, 2009; Huang et al., 2008; Kashefi et al., 2011; Kirk & Pitches, 2013; Lee, 2010; Orhan, 2008; Zhao & Yuan, 2010). Second, learning resources are the documents or media that are presented in hard copy or electronic types (Allan, 2007; Alshwiah, 2009; Chen & Cheng, 2009; Huang et al., 2008; Kashefi et al., 2011; Lee, 2010; Orhan, 2008; Zhao & Yuan, 2010). Third, feedback is the comment from instructors for improving learners’ products through online context (Bach, Haynes, & Smith, 2007; Huang et al., 2008; Lee, 2010; Orhan, 2008; Zhao & Yuan, 2010). Fourth, interactions include a learner-instructor interaction and learner-learner interaction which were the discussion session for brainstorming, sharing knowledge through online tools such as e-mail, chat room, or discussion board (Allan, 2007; Alshwiah, 2009; Bach et al., 2007; Huang et al., 2008; Kashefi et al., 2011; Kirk & Pitches, 2013; Lee, 2010; Orhan, 2008; Zhao & Yuan, 2010). Fifth, evaluation is the process that instructors measure
and assess their learners’ achievement by examining learners’ works, projects, portfolio, or participation (Alshwiah, 2009; Bach et al., 2007; Chen & Cheng, 2009; Huang et al., 2008; Kirk & Pitches, 2013; Lee, 2010, Orhan, 2008; Stacey & Gerbic, 2007; Zhao & Yuan, 2010).

2. Research methodology

The literature search was conducted through the following databases: Elsevier, Wiley, ERIC, Taylor and Francis, and Springer. The key search terms were creative problem solving, blended learning, and online learning. We focused on the studies published between 2004 and February 2014. The search yielded over 110 research studies on CPS. Thus, we applied the following criteria to narrow down the search:

1. Studies were conducted with undergraduate studies in a university or employees in an organization.
2. Studies applied CPS process.
3. Studies involved online or traditional classroom and blended learning.

In total, there were 20 research studies that matched our selection criteria. These studies were then analyzed for the CPS and blended learning environment factors that affected the creative problem solving performance. We coded the research studies for the following categories: researchers and year of publication, objective, samples, methodologies, treatment, and finding. In addition to these categories, the findings from research results and treatment in our pool of research studies were analyzed and compared (see Table 1) for considering and structuring the effective factors (see Figure 1).

4. Results

4.1 Characteristics

Most studies in our body of literatures were experimental (n=16) while the rest was a combination of qualitative research (n=2), factor analysis (n=1), and survey (n=1). In addition, most studies (n=6) were published in 2013; the rest was published between 2014 (n=2), 2012 (n=2), 2011 (n=4), 2010 (n=4), and 2009 (n=2). Slightly more than half of the papers (n=11) focused on improving learners’ performance while seven studies tested factors that promoted specific thinking skills (i.e., ideas generating, ideas evaluation, and creative thinking).

4.2 Factors promoting CPS

The data from research studies showed that students’ performance could be improved by applying CPS process (Chen & Cheng, 2009; Kuo et al., 2014; Tseng et al., 2013; Vidal, 2010) by brainstorming, reflecting thinking, and constructing concept maps (Tseng et al., 2013). We uncovered nine factors that could effectively promote CPS in online/blended classroom. These factors were expected that they affected creative problem solving abilities, which were important performances of finding the appropriate solution in works or daily life problem. Consequently, we summarized nine factors and presented them in the cross checking table (see Table 1).

As can be seen in Table 1, the CPS process that affected creative problem solving performance in blended learning context consisted of 1) understanding the challenge, 2) generating ideas, 3) preparing for action, 4) planning your approach, 5) learning activities, 6) learning resources, 7) feedback, 8) interaction, and 9) evaluation. Of the nine factors, the first four are CPS process whereas the rest belongs to blended learning. To prove whether these indicators could increase creative problem solving performance, instructors should utilize an assessment tool for evaluating creative problem solving performance in blended learning context. According to creative problem solving performance evaluation, we chose the creative solution diagnosis scale (CSDS) purposively due to the assessment criteria attributes that identified the solution in indicators (Cropley & Kaufman, 2012). Consequently, these factors could be structured as the CPS in blended learning context model (see figure 1).
Table 1  Indicator of CPS in blended learning environment

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5. Conclusion and Discussion

The aim of this study was to examine the CPS factors affecting creative problem solving abilities in blended learning environment. Creative problem solving (CPS) is one of the interesting problem solving types that should be integrated in teaching (Chen & Cheng, 2009). Furthermore, CPS which was developed over 50 years ago could still be applied in the present education because of modification into the situation. Treffinger et al. (2003) proposed the CPS version 6.1—the current iteration of the CPS process—which included 4 main steps and 8 minor steps as follow 1) understanding the challenge: constructing opportunities, exploring data, and framing problems 2) generating ideas: generating ideas 3) preparing for action: developing solutions and building acceptance and 4) planning your approach: appraising tasks and designing process.

While CPS process is one important approach to create various solutions for solving different problems, the online tools play another critical role in instruction because of technology revolution. Many instructors have applied online tools in their classroom. For instance, a discussion board was used to enhance the interaction between learners and instructors anywhere anytime (Kashefi et al., 2011). Although online tools might increase learning performance in classroom, instructors should manage and organize these tools appropriately for improving learners’ skills.

It is worth noting that the body of literature in this study has given us useful recommendations for applying CPS in classroom. In the Understanding the Challenge step, instructors might organize activities by making their students believe in their creative abilities (Morral et al., 2013) and motivate students to construct the creative ideas (Treffinger et al., 2003). Moreover, instructors should give additional resources (Kashefi et al., 2011) for understanding problems, finding out the goals of solving problem, searching out the relevant information (Treffinger et al., 2003). Meanwhile, generating ideas could be improved by group discussion, brainstorming, reflective thinking, and concept map construction for the novel ideas (Carmeli et al., 2013; Tseng et al., 2013; Ray & Romano, 2013; Kashefi et al., 2011; Chen & Cheng, 2009). Group discussion and brainstorming can be achieved through online tools such as a chat room, discussion board, e-mail, forum, or Second Life (Ray & Romano, 2013; Kashefi et al., 2011; Chen & Cheng, 2009). Given these various and unusual ideas for generating ideas, instructors should give
their learners more time to create different ideas (Morral et al., 2013). In the preparing for action step, the instructors could give their learners a chance to examine, improve, and validate ideas into the good solution. Afterwards, the instructors should encourage the learners to examine means to make the selected creative ideas effectively (Treffinger et al., 2003). In the planning your approach step, the instructors might assign the learners to review and make an overall assessment of the creative solutions, and apply the creative solution practically (Treffinger et al., 2003). According to an assessment of the creative solutions in the planning your approach stage, the instructors could apply the online tools such as a discussion board, or polling program for showing ideas, writing the comments, and selecting the quality solution (Ray & Romano, 2013) by examining the benefit of ideas or a wide range of implication of the ideas (Byrne, Shipman, and Mumford, 2010). In addition, the self-assessment and comparing with the experts might increase the creative solution ideas through giving feedback to learners after they had released their ideas (Tseng et al., 2013).

Figure 1 The creative problem solving in blended learning context model

The creative problem solving performance might be improved by examining and generating ideas (Kuo et al., 2014; Jaskari, 2013) through knowledge sharing (Carmeli et al., 2013) which could be organized by online tools such as a discussion board, chat room, voting, or electronic mail (Chen & Cheng, 2009; Nakagawa, 2011; Ray & Romano, 2013; Tseng et al., 2013; Williamson, 2011). In addition, encouragement and providing time for thinking were two factors that could enhance creative problem solving performance (Morral et al., 2013). Although creative problem solving performance could be increased by CPS process, context organization in learning was an important element because both online environment and classroom affected probably creative problem solving performance through tutorials, exercises, assignments, and different examples (Kashefi et al., 2011; Vidal, 2010) which should be the actual problem that learners experience in daily life (Jaskari, 2013; Larach & Cabra, 2010). It might be difficult
to present the actual problems or cases a classroom; thus, instructors may opt for virtual world presentation (Larach & Cabra, 2010).

It is worth noting that this study does not demonstrate a causal link between the factors obtained and the creative problem solving performance. Future lines of research should study the effect of CPS in blended learning context on creative problem solving abilities, utilizing structure equation model to verify the specific factors, which might be advantageous to instruction in higher education. Moreover, the qualitative research should be integrated in future research to investigate the empirical learning context that would enhance creative problem solving performance.

Acknowledgements

The authors wish to gratefully acknowledge the financial support from the Graduate School, Chulalongkorn University, Bangkok, Thailand.

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