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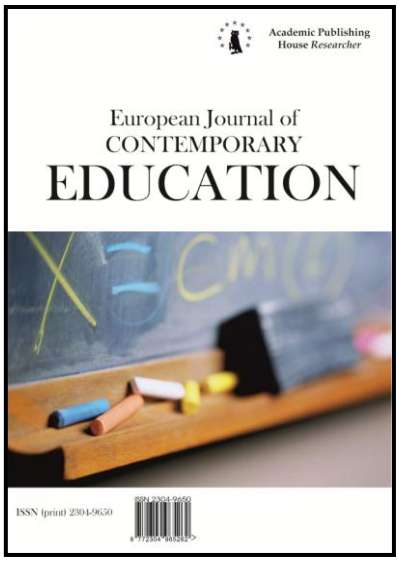

The Use of Interactive Environments to Promote Self-Regulation in Online Learning: A Literature Review

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Abstract

Distance education in the 21st century often relies on educational technology as the primary delivery of teaching to learners. In distance education, the source of the information and the learner do not share the same physical setting; therefore, the information is delivered by a variety of methods. The new emerging tools that are used in online learning have changed the view of pedagogical perspective in distance education. Although online learning shares some elements with traditional classroom environments, the shared elements often take very different forms, and each type of learning environment has distinct limitations and affordances. Because current practices often compare or assess the effectiveness of online learning by comparing it with traditional instruction methods, educators and researchers often find it important to consider the methods and strategies that are used in classroom settings when designing online learning environments. Online environments should provide opportunities for students to master necessary tasks by using appropriate strategies, such as self-regulation. Self-regulation is one of the predictors of student performance in both traditional and modern learning environments. In an online platform, when students use strategies that are related to self-regulation, they can regulate their personal functioning and benefit from the online learning environment by changing their behaviors accordingly. Thus, it is important to explore and embed new interactive functions to the online learning environments and lead learners to use self-regulatory behaviors in those learning environments. This article discusses the importance of self-regulation in online environments, and provides recommendations for best practices in the design and implementation of interactive online learning environments with the self-regulated learning approach.

Keywords: Distance education, online learning, self-regulation, interactive environments.

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Introduction

Learning environments continue to evolve especially with advances in technology, with online learning environments being one such advance that has become increasingly common in the 21st century. As the cost of technology decreased without necessarily compromising its quality, the access of wide user groups to new technologies increased. The Internet and computer-mediated communication have broadened our conceptualizations of learning environments and distance education to online learning environments. While online learning affords learners' autonomy or choice in their education, it also requires learners to be self-regulated or self-directed in their learning. To be successful in online learning environments, learners need to remain motivated, engaged, and persistent without the physical presence and reinforcements of instructors or peers that are afforded by traditional learning environments. One of the primary concerns in online education is how to design online learning environments for effective teaching and learning, particularly in light of keeping learners motivated, engaged, and persistent (i.e., self-directed or self-regulated) in online learning environments. Importantly, design and development of effective online learning tools that keep learners motivated and self-regulated in their learning need to be informed by learning theories and research-based principles and practices on self-regulation.

This article provides an overview on the concepts of Distance Education, Online Learning, and Self-Regulation. We review research on self-regulation in online environments and highlight recommendations for best practices in the design and implementation of interactive online learning environments with the self-regulated learning approach. The main goal of this article is to clarify the role of self-regulatory behaviors in learning, and discuss how to transfer these behaviors to online learning environments by providing various supporting interactive functions to learners.

Distance Education

Distance education in the 21st century often relies on educational technology as the primary delivery of teaching to learners. In distance education, the source of the information and the learner do not share the same physical setting; therefore, the information is delivered by a variety of methods (Carswell & Venkatesh, 2002; Keegan, 1986). According to McIsaac and Blocher (1998), the goals of distance education are "to provide degree granting programmes, to battle illiteracy in developing countries, to provide training opportunities for economic development, and to offer curriculum enrichment in non-traditional education settings" (p. 43).

Development of distance education has been linked to improvements in technology, and different delivery methods have been used including "Print materials, broadcast radio, broadcast television, computer conferencing, electronic mail, interactive video, satellite telecommunications and multimedia computer technology" (McIsaac & Blocher, 1998, p.43). Emerging technologies play key roles in distance education, particularly for making the education accessible by learners at any time and from any place (Beldarrain, 2006).

Based on technologies and procedures used in distance education, there are two communication methods of delivery: synchronous and asynchronous. Researchers have discussed the advantages of choosing one method over another (see Branon & Essex, 2001; Carswell & Venkatesh, 2002; Johnson, 2006; Offir, Lev, & Bezalel, 2008). In synchronous learning, learners are supposed to follow and interact with instruction in a specified time, whereas in asynchronous learning, learners are free to choose when to access the educational materials. Educational institutions have moved toward the use of online delivery systems (Akdemir & Koszalka, 2008) after computer and internet technology became more accessible, and these online delivery systems provide numerous opportunities for using synchronous and asynchronous delivery systems (Beldarrain, 2006).

Online Learning

With the rapid growth of digital technology, students in the 21st century have changed in numerous ways. They are surrounded with digital devices in their daily life, and they do not need to expend extra effort to get used to them because "technology is assumed to be a natural part of the environment" (Oblinger, 2003, p. 38). In addition, dissemination of online learning environments in the 21th century has given more learning opportunities to learners and more responsibilities to course instructors. That is why "technology tools may also change the roles of learners as well as instructors" (Beldarrain, 2006, p. 143). The new emerging tools that are used in online learning

have changed the view of pedagogical perspective in distance education as well. Additionally, teachers have taken the role of teaching students how to direct their own learning (Cerezo et al., 2010).

Wide learning groups have been interested in online learning in the first decade of 21st century, because of its potential to serve learners by offering learning with flexible times and reasonable costs (Howell, Williams, & Lindsay, 2003). Because learners come from diverse backgrounds (Rovai & Downey, 2010), and their availabilities vary, they take advantage of comprehensive online learning opportunities with affordable cost.

There are many definitions of online learning in the literature and they describe the practice of online learning as a way of instruction via computer or mobile devices with Internet connections. Ally (2004) broadened his view of online learning and defined it as

> "the use of the Internet to access learning materials; to interact with the content, instructor, and other learners; and to obtain support during the learning process, in order to acquire knowledge, to construct personal meaning, and to grow from the learning experience" (p. 5).

When designing online learning courses, there are several points that should be considered. For example, Oblinger and Hawkins (2006) stated, "Developing and delivering effective online courses requires pedagogy and technology expertise . . . it [online instruction] requires deliberate instructional design that hinges on linking learning objectives to specific learning activities and measurable outcomes" (p. 14). It is not always likely for an instructor to have these two skills (pedagogy and technology) together. That is why, most of the time, responsibilities of online courses need to be shared between an instructor who is pedagogically skilled and a person with technical skills. Otherwise, students will be reading papers and visiting websites that are provided online by the instructors, which is not a satisfactory way of online instruction (Dağhan & Akkoyunlu, 2016).

Although online learning shares some elements with traditional classroom environments, the shared elements often take very different forms, and each type of learning environment has distinct limitations and affordances. For example, interaction is a very important part of the instruction process and it is challenging to facilitate the same type of dynamic, collective interaction online (Childers & Berner, 2000; Oblinger & Hawkins, 2006). On the other hand, there are many benefits of online learning environments including flexibility of access regardless of time and place Ally (2004), and these environments can be used effectively after eliminating the potential barriers (see Galusha, 1997; Muilenburg & Berge, 2001

Self-Regulation

According to Zimmerman (1989), self-regulated learners "personally initiate and direct their own efforts to acquire knowledge and skill rather than relying on teachers, parents, or other agents of instructions" (p.329). In modern educational systems, students may need to be more mindful in exerting self-regulation in their learning, because education practices are trending from teacher-centered toward student-centered learning and instruction. With the shift towards greater emphasis on learner-centered education, students need to become more personally responsible and self-directed in their own learning. When students have meta-cognitive, motivational, and behavioral control in their learning process, they can be described as a self-regulated learner (Zimmerman, 1989). In a society saturated by information, media, and technology, Liew, Chang, Kelly, and Yalvac (2010) proposed that self-regulated and self-directed learning need to be viewed as the bedrock of 21st century skills for all learners.

Self-regulation has a strong relationship with Bandura's (1986, 2001) social cognitive theory. In social cognitive theory (Bandura, 1986), human behavior is viewed as motivated and regulated by the ongoing influence of self-influence or self-regulatory mechanisms. Zimmerman's (1989) model of self-regulated academic learning was based on Bandura's (1986) triadic theory of social cognition, consisting of reciprocal interactions between the person, behavior, and environment

Zimmerman stated in his triadic model that personal process, the environment, and behavior are three factors of self-regulation. Self-regulated learners should be aware of the learning environment and try to use appropriate strategies and activities to support their self-regulation.

These activities are also key elements of determining students' motivation and action (Bandura, 1989).

Zimmerman (1989) identified self-regulated strategies to "improve students' self-regulation of their (a) personal functioning, (b) academic behavioral performance, and (c) learning environment" (p. 337). When these strategies are embedded in instruction, they support learners to self-regulate themselves (Ley & Young, 2001). According to Zimmerman's model (2002), self-regulation is not an innate personal characteristic and learners can improve their self-regulation abilities and become more self-regulated especially when they are trained with self-regulation strategies (Wang, Quach, & Rolston, 2009). A growing body of research on self-regulation and self-regulatory strategies show positive relationship with academic performance (see Ablard & Lipschultz, 1998; Dermitzaki, Leondari, & Goudas, 2009; Magno & Lajom, 2008; Purdie & Hattie, 1996; Vermunt, 2005). For instance, Zimmerman and Martinez-Pons (1986) studied eighth grade students and found that high achievers and low achievers differed on their self-regulation, and their self-regulation strategies contributed to their academic performance. Thus, evidence supports the view that using self-regulation strategies in instruction may help to reduce the achievement gap (Young, 1996). With technology increasingly used to facilitate learning, the use of educational technology that considers individual differences in learners' self-regulation may serve as a powerful tool for all learners, especially low academic achievers. Students tend to self-regulate themselves (and continue doing it) when they experience self-efficacy and a sense of achievement and mastery through successful learning experiences (Cleary, 2006; Greene, Costa, Robertson, Pan, & Deekens, 2010; Zimmerman, 1990).

Self-regulation strategies and skills enable individuals to direct their own learning and to "achieve desired academic outcomes on the basis of feedback about learning effectiveness and skill" (Zimmerman, 1990, p. 7). Self-regulation strategies and skills could be targeted and supported in one or more of the factors in Zimmerman's (1989) triadic model of self-regulation (person, behavior, or environment). Designing learning environments that support learners' self-regulation based on the affordances and capacities or needs of the person, behavior, or environment may maximize learning (Ley & Young, 2001). Schunk and Zimmerman (2007) stated that students might have different self-regulation skills; therefore, learning environments could be designed to compensate for and scaffold learners with poor self-regulation while also challenging and advancing learners with good self-regulation.

Self-Regulation Strategies

According to Zimmerman's (1989) triadic model of self-regulation, self-regulation strategies can be classified into three broad domains: personal, behavioral, and environment. Although the three domains of self-regulation strategies are distinct, there is some overlap or shared elements between them. In the design and development of online learning environments, it is helpful to consider ways of support learners' use of self-regulation strategies in each of the three domains.

Personal regulation: It is essential for learners to be self-aware and mindful of their learning processes including knowing why they are learning something and thinking through appropriate learning approaches (e.g., goal orientation and metacognition). Before and during the learning process, metacognitive strategies such as *organizing and transforming, goal setting and planning, rehearsing and memorizing* could be used (Zimmerman, 1989).

Previous studies show that these metacognitive strategies have positive effects on academic performance when they are properly embedded into learning activities. For example, Zimmerman, Bandura, and Martinez-Pons (1992) found goal setting to be an important a self-regulation strategy that has positive effects on learning and academic outcomes. Wolters and Rosenthal (2000) concluded that goal setting and focusing on learning goals were essential to overcome motivational problems and keep learners engaged and persistent on completing assigned tasks. Goal setting is also important for next phase of self-regulation (behavioral functioning) because learners need some timeline and reference points in mind for which to monitor and evaluate their progress (Pintrich, 1999a).

In addition to metacognition, goal orientation also plays a key role in improving self-efficacy, which is also related to student performance (Greene, Miller, Crowson, Duke, & Akey, 2004; Pintrich, 1999a; Schunk, 1991, 2003). Some students are motivated by learning (mastery) goals and some students are motivated by performance goals. Additionally, the way of using these strategies

may change according to the subject area and context (Wang et al., 2009). For instance, a student can draw content maps in biology course as a strategy to organize and transform his knowledge for deep learning and mastery of course information. Another student in the same course might choose to ask the instructor what material will be covered in the exams and decide to only study the tested material to earn a high test score. Students who are aware of their goals for learning can choose the appropriate self-regulation strategies to meet such goals.

Behavioral functioning: There are behavioral strategies that learners could learn and to use in supporting themselves to become active and self-directed in their learning. Some behavioral self-regulation strategies include *self-evaluation and self-consequences, and keeping records and monitoring*. These behavioral strategies are useful for learners to seek evaluative feedback and apply reinforcement and correction to improve learning and performance (Pintrich, 1999b).

In using various self-regulation strategies, Bandura (1989) emphasized the importance of "self" based activities on personal behavior change as follows: "In acting as agents over themselves, people monitor their actions and enlist cognitive guides and self-incentives to produce desired personal changes" (p. 1181). For self-regulation strategies to be effective, learners need to have a desire to learn and to take some personal responsibility for their learning. For example, high achievers often apply consequences for themselves as a way to evaluate and monitor their own progress (Wolters & Rosenthal, 2000).

Learning Environment: Self-regulated learners influence their own learning through their personal beliefs and behaviors about the environment, but the environment also influences learners' personal beliefs and behaviors (Bandura, 1989). There are some self-regulation strategies that are related to learners' immediate learning environments (Zimmerman, 1989) such as *environmental structuring, seeking information, reviewing, and seeking assistance*. Suitability of the learning environment for these strategies is essential and influences personal and behavioral functioning as discussed in the triadic model. According to Bandura (1989), learners "are just as much agents influencing themselves as they are influencing their environment" (p. 1181). Thus, self-regulated learners know how to seek or extract the resources, help, or information they need from their learning environments in order to achieve their learning goals.

Self-Regulation in Online Learning Environments

Because current practices often compare or assess the effectiveness of online learning by comparing it with traditional instruction methods, educators and researchers often find it important to consider the methods and strategies that are used in classroom settings when designing online learning environments. Online environments should provide opportunities for students to master necessary tasks by using appropriate strategies, such as self-regulation (Santhanam, Sasidharan, & Webster, 2008). Well-designed learning environments facilitate improved self-regulatory skills (Boekaerts, 1999), and are needed for successful learning (Azevedo & Cromley, 2004).

It should also be noted that online course instructors are more likely to have pedagogical and technological problems than face-to-face course teachers (McIsaac & Craft, 2003). Therefore, "online learning materials must be designed properly, with the learners and learning in focus, and that adequate support must be provided." (Ally, 2004, p. 4).

Self-regulation is one of the predictors of student performance in both traditional and modern learning environments. In an online platform, when students use strategies that are related to self-regulation, they can regulate their personal functioning and benefit from the online learning environment by changing their behaviors accordingly. In online learning environments, learners are supposed to control their own learning practice in order to benefit from the instruction; hence, self-regulation strategies can help them in this process (Chang, 2005).

There is a growing body of evidence showing that the environment plays a significant role in supporting self-regulation and academic performance (Ari et al, 2014; Garner, 1990; Ley & Young 2001). Self-regulated learners are neither passive nor helpless, but "are those who demonstrate persistence and are able to adapt or modify their learning strategies or their environment in order to achieve their learning goals" (Liew et al., 2010, p. 63). For learners who may lack strong self-regulation skills, external supports provided by a well-designed learning tool or learning environment that intentionally embeds self-regulation strategies into instruction may support and enhance students' self-regulated learning (Bernacki, Byrnes, & Cromley, 2012). For instance, in an

online environment, optional additional resources (e.g., image, animation, and graphic) can be provided to learners to prompt their use of information seeking strategies (Delen, Liew, & Willson, 2014).

Learning environments that allow students to practice self-regulation skills may teach students to internalize or automatize these skills over time (Schunk & Zimmerman, 2007). According to Zimmerman (1989), "all learners try to self-regulate their academic learning and performance in some way, but there are dramatic differences in methods and self-beliefs among students" (p. 6). Thus, self-regulation strategies for online learning environments need to recognize and meet the self-regulatory needs of diverse learners.

Usage and scope of self-regulation in online learning environments have changed with improvements in Internet technology. Although in its nascent stage, online learning environments are increasingly being designed to offer learners with self-regulation support and to foster self-direction in students' use of self-regulation strategies and tools. However, it is very important for learners to be able "to select, combine, and coordinate cognitive strategies in an effective way" (Boekaerts, 1999, p. 447). Examining self-regulation in online learning environments also facilitates obtaining more accurate information from students because students' behaviors could be logged or recorded to identify students' use of strategies or functions and their effectiveness (Bernacki et al., 2012; Biesinger & Crippen, 2010.

In the process of transferring instruction through Internet, several learning management systems (LMSs) that are either commercial or open source such as WebCT, Blackboard, and Moodle have been used. Especially, higher education institutions commonly use these LMSs in their online degree programs. In addition, some social media platforms have been also used as an LMS with their unique features (Varol & Ahmed, 2013). That's why their suitability for self-regulation is essential for students. In this regard, Cerezo et al., (2010) reviewed most commonly used LMSs and found that they have several useful functions that support self-regulation. However, students may be unaware of such functions and how these functions support their self-regulation and improve their learning. Therefore, informing and guiding students can increase the benefit of the self-regulation functions during the learning process.

Previous research has investigated the effectiveness of self-regulation strategies in online learning and hypermedia-learning environments from various perspectives. Although there are several researches on hypermedia learning environments, limited research exists on online learning environments in regard to self-regulation. In a study on self-regulation in online learning environments, Chang (2005) examined 28 vocational university students enrolled in a web-based course and focused on their motivation perception and how it changed regarding to self-regulatory activities including recording study time, writing journals, and reflective summaries. Results indicated that using self-regulatory strategies in a web-based instruction increased students' learning motivation after one semester (Chang, 2005).

It is accepted by researchers that learners can improve their self-regulation by using and experiencing activities aimed at training meta-cognitive strategies, executive attention, and emotion regulation. Delfino, Dettori, and Persico (2010) conducted a study with trainee teachers and examined the use of self-regulation activities in an online course. In their study, Delfino and colleagues assigned four different tasks to trainees, which aimed to foster self-regulation. These activities were linked to self-regulatory behaviors including planning, monitoring, and evaluation. The online course was designed properly for course takers and allowed them to accomplish the tasks by using self-regulation strategies. It was reported by Delfino et al. (2010) that online courses could foster learners' self-regulation when relevant activities are embedded into the instruction.

There are some factors that influence the use of self-regulation strategies in online learning environments. For example, Bernacki et al. (2012) studied 160 undergraduate students to investigate the relationship between achievement goals, self-regulation strategy use, and comprehension scores in a hypermedia-learning environment. Students' self-regulation related actions such as note-taking, seek information, and monitoring were recorded. Path model analyses indicated that self-regulation strategy use was a mediating mechanism between achievement goals and academic performance. Specifically, achievement goals predicted self-regulation strategy use, which then predicted the student performance in a hypermedia environment (Bernacki et al., 2012). Thus, it can be stated that use of self-regulation strategies has positive relation with academic performance in online learning environments (Delen et al., 2014).

Student engagement or involvement in the learning process is critical for academic performance, particularly when students are low-achievers and the learning environment is online. In this regard, Lee, Shen, and Tsai (2010) designed an online course that supported self-regulation strategies, and they examined its effects on students' engagement or involvement in learning. At the beginning of the course, students met with the instructors and took advice to develop their self-regulation skills. After one semester long online course, it was found that students increased their involvements in online learning environment by self-regulatory behaviors (Lee, Shen, et al., 2010). This study clearly shows us the need of teaching students the self-regulation strategies and their benefit in online learning environments. In a randomized experiment, Azevedo and Cromley (2004) randomly assigned 131 undergraduate students to one of two conditions (training condition or a control condition). In the training condition, students were trained 30 minutes on the use of self-regulation strategies and control group did not get any training. Then, students were given a science course in a hypermedia environment to learn about the circulatory system. Study results indicated that students who were trained to use self-regulation strategies learned more on complex topics in the hypermedia environment than students without training (Azevedo & Cromley, 2004).

In another study that explored whether self-regulation strategies could be taught, and whether self-regulation strategy use could improve students' learning in online learning environments, Santhanam et al., 2008 found that when learners are taught how to use self-regulatory learning strategies, they tend to apply them more in their learning. The authors suggested that self-regulation is critical to successful learning and performance in online learning environments, and embedded self-regulation strategies could foster learners' self-regulation learning strategies and this enhance learning outcome.

Conclusion

Based on the body of research reviewed in this article, it is clear that learners need to be self-regulated, self-directed, motivated and engaged in learning process to achieve optimal learning outcomes. Evidence suggests that self-regulation is needed in both face-to-face and online learning environments. However, research on, and application of, self-regulatory strategies in online learning environments remains relatively limited relative to what is known about face-to-face learning environments. Thus, it is important to explore and identify effective interactive functions in online learning environments in order to enhance learners' self-regulated learning. Emerging technologies will undoubtedly continue to change learning environments. To harness the power of educational technologies for self-regulated learning, it is essential to use evidence-based and effective elements or functions in the design of online learning environments to optimize learning and achievement.

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