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FOSTERING COLLEGE STUDENTS' SELF-REGULATED LEARNING WITH LEARNING TECHNOLOGIES

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***Abstract*:** Learning technologies have undoubtedly changed instructional delivery particularly in higher education contexts. The scope of this article is to discuss how learning technologies can support and promote college student self-regulation in distributed and online learning environments and reexamine the role of the instructor in scaffolding the development of independent, self-regulated learners. An overview of self-regulation and its processes from a social cognitive perspective is provided, followed by a description of learning technologies. Subsequently, guidelines on how instructors can foster student self-regulation along with specific examples to guide teaching practices are discussed.

***Key words*:** College students, Learning technologies, Self-regulated learning

Teaching with learning technologies in online or hybrid learning environments has grown at a phenomenal rate. According to recent findings, nearly six million college students (one-third) have enrolled in at least one online course (Allen & Seaman, 2011). Similarly, approximately 65% of higher education institutions report that developing their online learning programs is critical to their long-term growth. Learning technologies include a variety of Web tools, software applications, and mobile technologies that incorporate technological and instructive features and affordances of the Internet and the World Wide Web. The objective of these learning technologies is to facilitate the design, delivery, and management of online and distributed learning (Kitsantas & Dabbagh, 2010). Learning Management Systems (LMS) such as Blackboard, Moodle, Sakai, ANGEL, Desire2Learn, and eCollege,

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provide instructors with an array of Web 2.0 and social learning technologies and more authentic assessment features (e.g., electronic portfolios, and grading rubrics) to design online and distributed learning activities.

The benefits of using learning technologies in the classroom have been well documented in terms of their effects on learning outcomes (Smith, Salaway, & Borreson Caruso, 2009; Solomon & Schrum, 2007; Wang, Calandra, Hibbard, & McDowell Lefaiver, 2012), collaboration and social feedback (Kitsantas & Dabbagh, 2010, 2011), and students' learning approaches (Jairam & Kiewra, 2010; Lee, Lim, & Grabowski, 2010). More recently researchers have also examined how learning technologies can support or promote student self-regulated learning (Kitsantas & Dabbagh, 2010, 2011; Dabbagh & Kitsantas, 2012; Nicol, 2009). For example, research evidence shows that self-regulated learning processes such as goal-setting, self-monitoring, and self-evaluation can be supported by using experience and resource sharing tools (e.g., blogs and wikis) whereas communication tools can enhance help-seeking behaviors. In turn, technology-enriched learning designed to enhance student self-regulation and motivation facilitates academic performance and increases positive attitudes towards learning (Azevedo & Hadwin, 2005; Chang, 2007; Kramarski & Gutman, 2006; López-Morteo & López, 2007; Perry & Winne, 2006; Winne, 2006; Winne, Nesbit, Kumar, Hadwin, Lajoie, et al., 2006). The purpose of this paper is to describe the role of learning technologies in self-regulated learning and provide guidelines on how these technologies can be used in distributed and online learning environments to support student self-regulation particularly in higher education.

ENGAGING STUDENTS IN SELF-REGULATORY CYCLES OF LEARNING WITH LEARNING TECHNOLOGIES

Although there are several theoretical perspectives of self-regulated learning including, but not limited to phenomenological, cognitive constructivist, information processing, volitional etc., this paper focuses on self-regulation from a social cognitive perspective. According to this perspective, self-regulated learning refers to the degree to which students are proactive and responsible participants of their own learning process (Zimmerman, 2008). Specifically, self-regulated learners engage in a number of key self-regulatory processes including setting clear, specific, and challenging goals, using a variety of task strategies to accomplish these goals, and self-monitoring and evaluating their progress throughout practice episodes. They also report higher positive motivational beliefs and seek help as necessary (Zimmerman, 2000; Zimmerman & Kitsantas, 2005).

Self-regulatory processes and self-motivational beliefs interact in three cyclical phases, namely, the *forethought, performance*, and *self-reflection phases* (Zimmerman, 2000). During the forethought phase of self-regulation, highly self-regulated learners set specific process and outcome goals and plan how to accomplish these goals. Goals refer to intended outcomes of learning or performance, and there is evidence that goals that are process oriented particularly in the early stages of learning are more effective than outcome goals (Zimmerman & Kitsantas, 2005, 2007). Strategic planning refers to decisions about how one can accomplish a particular goal, such as selecting a strategy for working on a math problem. In terms of the learner's self-motivation in this phase, self-regulated learners report higher self-efficacy beliefs, outcome expectations, and task interest for assignments than more naïve self-regulated learners. Self-efficacy refers to the extent to which an individual believes he or she is competent in performing a task at a designated level, and outcome expectations refer to the consequences of individual's performance (Bandura, 1997). There is extensive evidence of the predictiveness of self-efficacy beliefs in academic learning and performance (Bandura, 1997; Zimmerman & Kitsantas, 2005). Task interest and outcome expectations are also beneficial in learning especially when learners must practice or learn a task on their own (Zimmerman, 2000).

During the *performance phase*, learners use self-control strategies. These strategies include self-instruction, imagery, attention focusing as well as task-specific strategies to accomplish their goals. Learners also engage in self-observation via self-monitoring techniques. Self-monitoring refers to deliberate tracking of some aspect of one's behavior and there is empirical evidence of its effectiveness in academic functioning (Kitsantas, 2002; Kitsantas & Zimmerman, 2006; Zimmerman & Kitsantas, 1997). Self-monitoring techniques may include record keeping, diary entries, keeping a journal, or using visual means such as a graph to keep data.

In the last phase, self-reflection, learners self-evaluate, report causal attributions, experience satisfaction, and adapt their performance in a systematic way to achieve their learning goals. Self-evaluation refers to comparing one's performance to a specific standard (Zimmerman, 2008). Self-regulated learners tend to self-evaluate frequently and objectively using self-monitored data. Attributions refer to causal beliefs about one's successes and failures, and there is extensive evidence of their importance to success in learning (Schunk, 1994; Kitsantas, Zimmerrman, & Cleary, 2000). Skilled self-regulated learners make more adaptive inferences which could include seeking further information or help that more naïve self-regulated learners.

The three phases of the self-regulation model, forethought, performance, and self-reflection are sustained cyclically by a self-regulatory feedback loop where information from each of the different phases inform the learner on how to adjust

his or her learning approach to more effectively accomplish academic goals. For example, self-reflective processes influence forethought processes for future courses of action, such as adjusting goals, engaging in strategic planning, selecting strategies, and motivational beliefs. Ultimately, engaging in these self-regulatory cycles of learning enhances student learning and performance (Zimmerman & Kitsantas, 2005). In fact, the impact of this three-phase self-regulatory model on achievement and motivation has been established in various academic areas and other domains such as health and sports (Zimmerman, 2000, 2008; Zimmerman & Kitsantas, 2005).

A growing body of research shows that learning technologies can engage learners in self-regulated cycles of learning (Kitsantas & Dabbagh, 2010). Specifically, research findings clearly demonstrate that learning technologies in higher education contexts have the potential to support different processes of self-regulation which may lead to improved learning (Dabbagh & Kitsantas, 2004). For example, Kitsantas and Dabbagh (2004), and Dabbagh and Kitsantas (2005) found that LMS administrative tools (e.g., course planning and scheduling tools such as the online calendar) supported student self-monitoring and help seeking; LMS collaborative and communication tools (e.g., e-mail, discussion forums, and document sharing tools) were more useful in supporting student goal setting, help seeking, and time management; LMS content creation and delivery tools (i.e., resource sharing and Web publishing tools) were particularly helpful for self-evaluation, task strategies, and goal setting whereas LMS learning tools (e.g., bookmarking tools, search tools, and help tools) were reported as more useful in supporting student use of task strategies. In light of these findings, it is critical that online course instructors proactively provide students with learning technologies that offer students opportunities to engage in self-regulated learning. Although the uses of these learning technologies (LMS tools and features) have many similarities, they contain some unique features. Below, I discuss how some of the existing learning technologies can support each of the three phases of self-regulation: the forethought, performance, and self-reflection phases. Specific examples of learning technologies and their instructional uses across the three phases of the self-regulation model are also presented in Table 1. These examples offered are indicative rather than exhaustive.

In the *forethought phase*, instructors can use administrative tools including course calendar, course planning and scheduling tools to help students create a weekly online goal setting template specific to the course objectives and requirements. Online calendars can help students monitor upcoming deadlines to help students set distal learning goals at the beginning of the course. This template can serve as a checklist where students can set short- and long-term goals to achieve the course goals. Instructors can also send personalized emails to each student

Table 1. Examples of learning technologies and instructional uses across forethought, performance, and self-reflection phases

Learning technologies	Definition	Instructional uses	Self-regulatory processes
Forethought phase			
Blogs/Journals	Online web-journal maintained by a user whose entries can be open for others to comment on	- Publishing questions online for others to answer - Providing and receiving feedback from peers - Combining notes with the course content to create a study guide	- Self-monitoring - Self-reflection - Self-efficacy
Podcasts	Downloadable digital audio or video media file	- Audio/video lectures - Recording study group sessions	- Modeling - Self-efficacy
Performance phase			
Social networks (e.g., MySpace, Facebook)	Online social structures	- Networking among students within and across institutions - Connecting with other experts in the field - File sharing and transfer	- Self-monitoring - Task strategies
Virtual worlds	Interactive, online, social environment	- Virtual modeling - Role playing/simulations - Online meetings/training - Providing instructor/peer feedback	- Self-efficacy - Peer modeling - Task strategies - Self-monitoring
Bookmarks	Online resources	- Collaborative learning - Bookmark sharing - Resource sharing	- Task strategies
Collect or compile features	Combining selected messages from the discussion board	- Collaborative and peer learning	- Task strategies
Administrative tools (e.g., calendar)	Online date keeper	- Keeping records of activities - Recording due dates - Recording daily and long-term tasks	- Time management - Goal setting - Self-monitoring
Online marking tools	Online test feedback	- Record keeping - Providing instructor/peer feedback	- Self-monitoring - Self-evaluation
Self-reflection phase			
Online Gradebook (LMS tools)	Online grades	- Record keeping - Providing instructor/peer feedback - Collaborative learning	- Self-evaluation - Self-satisfaction - Attributions
Wikis	Online, open access publishing tool	- Knowledge sharing - Debating - Bulletins	- Self-evaluation - Peer modeling - Seeking help

commending them on their progress and on meeting their goals as they monitor student progress. They should also provide information and model use of a variety of online learning tools available to enable students to achieve proximal and distal goals (e.g., the personal calendar, blogs, social bookmarking tools, etc.).

In terms of student motivational beliefs, instructors can boost student self-efficacy by providing them with links to video clips showing how other students have overcome obstacles and were able to achieve academic goals. It should be noted that research in blended learning environments showed (Lynch & Dembo, 2004) that out of five self-regulatory processes examined (intrinsic goal orientation, self-efficacy for learning and performance, time management, help-seeking and internet self-efficacy), only self-efficacy for learning and performance contributed significantly to student academic performance.

In the *performance phase*, instructors can encourage students to use Web publishing tools to underline, highlight, and cluster learning content which are important task specific strategies of this phase. Students can also use social bookmarking tools such as Delicious to assemble and organize a list of resources relevant to the topic of their homework assignments. In a study by Bernacki, Byrnes, and Cromley (2012) students who were instructed to read passages on a computer-based learning environment used a variety of learning technologies including highlighters, notepads, links, glossary, etc. to help them effectively learn the material in the passages. Ultimately, both highlighting (record keeping) and monitoring progress significantly and positively predicted an increase in the amount of knowledge acquired (Bernacki et al., 2012).

Wikis can also be used as a vehicle for integrating class notes in a course which is an important task strategy for self-regulation. A *Wiki* is a website that can be accessed and edited online by learners with an internet connection, a web browser, and permission to edit (Rosen & Nelson, 2008). Faculty can use wikis to engage students in collaborative projects that support the creation, editing, and management of content. They can also enable peer and expert feedback (Harris & Rea, 2009).

Similarly, another learning technology that supports the use of strategies, particularly organizational strategies is online bookmarking (Solomon & Schrum, 2007). For example, Delicious allows users to store their bookmarks on the Web rather than on the desktop browser. This is important because learners can access their bookmarks anywhere. Additionally, users can organize, categorize, and classify information in new ways using tags. These tags can enable them to share their bookmarks and search other people's bookmarks.

Time management strategies are also critical in the performance phase as students engage in practice episodes. Puzziferro (2008) found with undergraduate students who were enrolled in an online course that those who achieved high

academically reported higher levels of time management and effort regulation than students who did not achieve high academically. Learning technologies can help students develop time management skills. Instructors can use the course syllabus feature of an LMS to post the weekly, monthly, and semester timeline and the personal electronic calendar to help students plan and manage their semester assignments. In fact, proficient instructors in using learning technologies also suggest (Dabbagh & Kitsantas, 2009) that online calendar and syllabus tools were most effective in communicating to students the course schedule, timelines, and assignment due dates.

Instructors can also encourage students to engage in self-observation through the use of self-assessment tools to monitor their understanding of the learning content. First, personalized calendars and or a personal tasks journal can help students keep track of their progress on a daily, weekly, and monthly basis. Second, assessment tools such as portfolios and online gradebooks are valuable in assisting students to monitor their learning (Dabbagh & Kitsantas, 2005; Kitsantas & Dabbagh, 2004). Finally, other researchers (Jarvela, Naykki, Laru, & Luokkanen, 2007) found that social software tools such as blogs, wikis, and photo sharing applications can help students monitor their learning by receiving feedback from other students through blogs and wiki features as well as elaborate on their own understanding of the material through online discussions.

During the *self-reflection phase*, instructors can use blogs to enhance student understanding of content by capturing their reflections chronologically on readings and course topics, enabling self-monitoring and self-evaluation. This method allows the student as well as the instructor to visually see their progression and patterns of development (Rosen & Nelson, 2008). Blogs permit students to write reflectively, complete assignments, collaborate with classmates, and share knowledge, enabling a true learning community. In addition, blogs can be used as e-portfolios. Specifically, instructors can instruct students to think about their learning processes, what they have learned, how they have learned, and how to increase their learning. This process not only encourages students to think about themselves as learners, but may also encourage students to adopt more effective learning strategies. Furthermore, student blogs may also provide valuable information for how an instructor can help students academically either through assisting him or her with setting goals or by encouraging the adoption of more effective strategies.

Moreover, research suggests that expert college instructors using learning technologies to promote student self-regulation skills in online and distributed courses report that content creation and delivery tools (e.g., resource sharing and tagging tools, audio and video editors to generate podcasts, vcasts, and webcasts, wikis, etc.), as well

as administrative tools (e.g., course calendar and Google Calendar™, authentication and authorization tools, etc.), can help support student self-monitoring and self-evaluation efforts (Dabbagh & Kitsantas, 2009). Virtual worlds such as Second Life, where students can create their own avatars and interact with others in a virtual environment can also promote student self-reflection. For example, Jarmon, Traphagen, Mayrath, and Trivedi (2009) found that through collaborative projects in Second Life students were able to engage in self-reflection using daily journal entries and observations as well as adapt different strategies to effectively complete projects. Similarly, Dreher, Reiners, Dreher, and Dreher (2009) suggest that, depending on the project design, virtual world projects allow students to receive instant self-evaluative feedback on their progress, ideas, and decisions. In closing, it seems that students who publish comments or entries into Web 2.0 tools in the form of blogs or using other similar learning technologies engage in self-regulated cycles of learning because they need to set goals and plan out what they will publish or engage in to complete related course assignments.

Although it is important for instructors to know how to prompt students to use different processes of self-regulation with learning technologies within each phase of self-regulation, it is equally important to know how to design the learning environment to support student self-regulation as well as how to assist students to develop self-regulation skills. In the subsequent two sections, I discuss these issues in detail based on available empirical research evidence.

Designing learning environments to facilitate student self-regulation

The design of the learning environment matters! Researchers (Barnard-Brak, Paton, & Lan, 2010; Winters, Greene, & Costich, 2008) argue that without thoughtful design of online courses to actually include components aimed at improving student self-regulation, development of the skills is unlikely. To this regard, Winters et al. (2008) conducted a literature review guided by three questions in Computer Based Learning Environments (CBLE): 1) what sorts of tasks and student characteristics are related to self-regulated learning; 2) what conditions and tools increase students' development and use of self-regulated learning; and 3) what are the different conceptual, theoretical, and methodological issues with conducting research in CBLEs and self-regulated learning? A total of 33 empirical articles were located. In terms of learner characteristics, the review revealed that students who had high prior knowledge, achieved high academically, were motivated (e.g., as captured by self-efficacy, goal orientation, and learner control) had engaged in more adaptive self-regulated learning in CBLEs than students who had low prior knowledge, motivation

and academic achievement. In terms of the conditions that allow for self-regulated learning in CBLEs, the review revealed that although there are several available CBLE tools that aid student self-regulation, students typically do not actively use those tools. Further, students in CBLEs who were provided scaffolding support for content were more likely to engage in planning, monitoring, and strategy processes than students who were not provided scaffolding support. This finding suggests that students must be instructed to use different tools in CBLEs in order to actually use those tools to self-regulate their learning. If not, students will most likely resort to traditional studying such as reading the assigned textbook. Finally, in terms of theoretical and methodological issues, the authors suggested that many articles did not base their studies on a strong theoretical framework. Specifically, it was reported that researchers tended to investigate pieces of self-regulation as opposed to self-regulation as a whole. For example, researchers in some cases focused on behavioral self-regulation processes, and ignored the motivational aspects of self-regulation. In addition, although many researchers claimed that their study was to investigate "self-regulation", many researchers just provided a general definition of self-regulation with no clear operational definition. Most studies relied on self-report survey data-which do not accurately portray self-regulation. Overall, this review of studies showed that learning environment design is critical for supporting student self-regulation and that there is a need for systematic empirical research to guide instructors on how to design those types of learning environments (Winters et al., 2008).

A limited number of empirical studies that have focused on testing the effectiveness of the design of online or distributed environments to prompt student self-regulation showed that instructors need to prompt students to engage in self-regulated learning (Jairam & Kiewra, 2010; Schwienhorst, 2002). Jairam and Kiewra (2010) developed a computer-based study method called Select, Organize, Associate, and Regulate (SOAR). The cognitive processes in each of the different components of SOAR are related to student self-regulation (e.g., Select = paying attention to and highlighting important points; Organize = organizing different ideas in a coherent manner; Associate = finding relationships between the different points; and Regulate = metacognitively engaging with the material by summarizing and monitoring understanding). Using an experimental design with 114 undergraduate students, the results revealed that students who were assigned to the condition that prompted them to engage in all of the components of the SOAR while studying displayed the highest levels of achievement out of all the group conditions. Students in the control condition showed very limited engagement in self-regulated learning while studying, which demonstrates that students must be exposed to certain tools or prompts in order to effectively engage in self-regulation while learning online.

Research evidence also shows similar findings in virtual world learning environments. Schwienhorst (2002) suggests that when virtual environments are designed appropriately, they can enhance student motivational and self-regulatory processes, particularly in second language learning. For example, instructors can: design virtual worlds to allow students to assume different roles to expose students to different perspectives, provide common social spaces to offer opportunities to collaborate and practice speaking in a second language with peers, provide a variety of organizational spaces (e.g., administrative areas, achievement records, lecture halls etc.) as opposed to a series of buttons or menus to enhance student organization, and enable students to organize their own spaces according to their own preferences. Schweinhorst (2002) suggests that due to the highly customizable nature of virtual worlds, it can potentially lead to stronger levels of cognitive engagement than traditional face-to-face learning. Virtual worlds allow students to keep records of their previous work, which not only allows students to reflect on their previous achievements, but also provide them with more study materials and resources. Further, functions like chat can allow students to implicitly practice their literacy skills (Merchant, 2010).

Other researchers have provided some suggestions on how to design effective virtual world learning environments where students will be more likely to engage in learning (Wang et al., 2012). Drawing from their findings, Wang et al. (2012) provided two sets of suggestions for designing a virtual world learning environment. The first set of recommendations was with regard to student interaction and use of different tools and functions of the virtual world. That is, students should be familiar with technology tools that allow them to interact with other avatars and comfortable with navigating the virtual environment. The second set of recommendations was with regards to the different pedagogical aspects that virtual environments should incorporate. These include setting an appropriate time limit for task completion, monitoring student performance, encouraging student self-reflection, and providing feedback. In summary, empirical research findings seem to suggest that students are more likely to engage in self-regulation when learning technologies are embedded with tools designed specifically to support student self-regulation. In light of these findings, below I present a model that illustrates how self-regulation can be supported through learning technologies.

ACQUIRING SELF-REGULATORY COMPETENCE WITH LEARNING TECHNOLOGIES

Acquisition of new skills in any domain is best learned through modeling, where learners have the opportunity to observe a demonstration of the desired behavior by an expert instructor (Bandura, 1997). Zimmerman (2000) describes four levels in which self-regulation can be developed: observation, emulation, self-control, and self-regulation. These four levels are designed to support the metacognitive, motivational and behavioral aspects of learning. Based on social cognitive theory, this training model highlights the initial reliance on social support and the gradual shift towards more self-sustained self-regulated learning. In the first phase, observation, students are exposed to the task through an expert model. Specifically, a model demonstrates the task to be mastered step-by-step while students observe this process. This phase of learning enables students to develop a basic understanding of the skills needed to complete the task as well as build up basic strategies and plans for learning. In the second phase, emulation, students are instructed to emulate the task that was demonstrated by the model. In this phase, students are provided with support, encouragement, and feedback from peers and instructors.

In the third phase, self-control, students move beyond just emulation and begin to practice the skills independently. Here, students focus on mastering the different steps of the learning task and carefully monitor their progress towards mastery. At this level, students are focusing more on process oriented goals than outcome goals. Finally, in the fourth phase, self-regulation, students shift from setting process-oriented goals to more outcome-oriented goals. Because students have mastered the processes associated with the given task, they can now begin on focusing their attention to outcomes. Instructor feedback is sought only when needed (e.g., unforced errors are made). This model of developing self-regulatory skills has been empirically supported (see, Kitsantas et al., 2000; Zimmerman & Kitsantas, 1997). Given the effectiveness of this model in helping learners develop skills, the question is how learning technologies can be used to help instructors develop student self-regulation when acquiring new skills?

Figure 1 provides examples of different learning technologies that can be used to help students develop self-regulatory skills throughout the four-phased model. According to this figure, in observation phase, instructors can demonstrate the steps involved in learning a new skill using learning technologies. The goal of this phase is for the instructor to model the steps in properly acquiring a new skill. Here, the instructor should clearly describe the different steps, discuss common mistakes, and/or any strategies to completing the different steps. This can be done using video uploads to YouTube, which allows students to watch the demonstration at their own pace as well as

replay segments. In addition, podcasts which are audio files that may be lectures or any other presentation can be downloaded into devices such as iPods, MP3 players, laptops or mobile phones makes it very convenient for learners to access information without Internet connectivity. Although audio files are not a new concept, the ease of creating, uploading, and downloading these files have made podcasts popular in education (Sprague & Pixley, 2008). Podcasts can help students listen to the material at their own convenience at whatever place they choose to. Podcasts are also available anytime and provide students with opportunities to supplement their studies. Podcasts can have a variety of uses including listening to expert lectures, supplemental materials from textbooks, or learning a new language. Specifically, Solomon and Schrum (2007) suggest that the use of podcasts enhances the acquisition of a second language by allowing the student to use a variety of strategies including asking him or herself questions while listening to the podcast, repeating phrases, and vocabulary. Alternatively, instructors can use collaborative and communication tools, specifically the screen-sharing whiteboard tool or a virtual session tool such as Adobe Connect or Blackboard Collaborate to model student how to solve a problem in math or do an assignment. This approach also provided the students with the opportunity to ask questions as they are observing the modeling process.

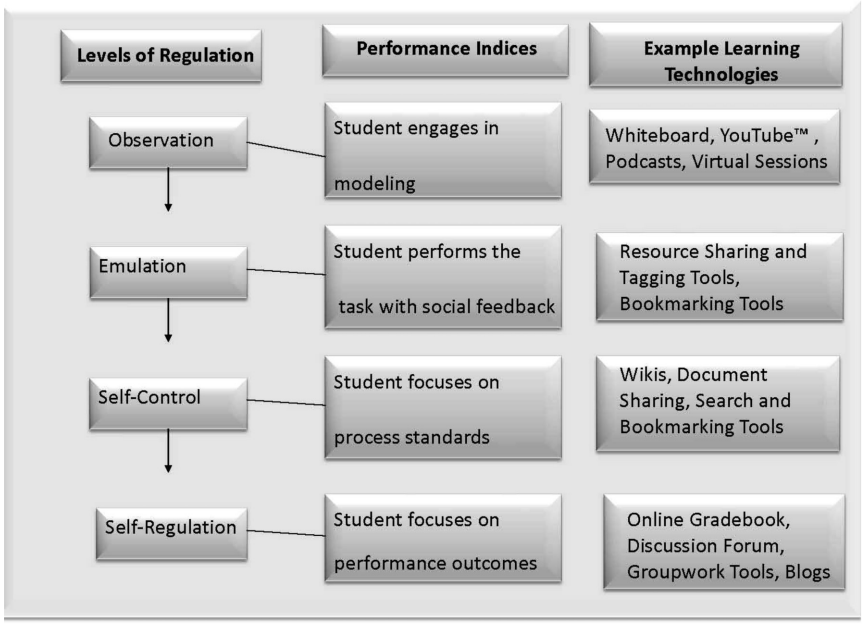

Figure 1. Development of Self-Regulation with Learning Technologies

For the *emulation level* of the four-phase training model, instructors can place students in small groups and schedule virtual sessions with each group so that students can emulate a learning task while the instructor can observe and provide feedback on their performance. The goal of the emulation phase is to allow students to practice the modeled procedures with careful supervision from the instructor. The instructor should anticipate that students may experience difficulty with accurately modeling the procedures and should provide extensive feedback and guidance to students. Therefore, at this phase of training, the instructor should closely monitor student performance and engagement. Through the use of virtual worlds such as Second Life, students have the opportunity to model their skills for others as well as collaborate with others in an online virtual environment through avatars. Wang and Braman (2009) suggest that virtual worlds also provide an outlet for students to discuss topics with people around the world and, depending on the assignment, these worlds can provide 3D modeling and role playing opportunities. Additionally, Jarmon et al. (2009) suggest that learning in Second Life increases students' motivation and interest as well as their desires to use Second Life on their own time.

In the *self-control phase*, the third phase of the training model, an instructor can set up a class wiki and provide several examples of the assignment to expose students to different strategies while they are practicing on their own. Specifically, at this phase of instruction, the instructor should allow students to practice the procedures independently with limited supervision. However, the instructor should continue to stress process-oriented goals and emphasize that at this level, students should attempt to develop mastery. In addition, criteria checklists should be available (e.g., through course documents features) to encourage students to set process-oriented goals related to the learning task and to help students monitor their progress. Instructors who use LMS features to support the self-control phase can use content creation and delivery tools (blogs, content modules etc.,) to set up assignments areas for each student to practice independently.

In the *self-regulation level* of the four phase training model, students engage in learning independently. Students have now automatized the steps and can turn their attention to outcomes. Therefore, at this phase, the instructor should shift from emphasizing process-related goals to outcome-related goals. However, if they encounter any difficulties with related concepts, learning technologies can provide the opportunity for students to modify existing strategies to improve their learning and performance. The instructor should direct students on where to find reliable resources for self-study and self-improvement. Students can also use assessment tools (e.g., grading rubrics) to judge performance outcomes. Furthermore, instructors should be available to respond to students using collaborative and communication tools if help is

needed. Finally, social software and social networking among groups or individuals may allow students to engage in conversational interactions that provide opportunities for feedback and self-reflection in case performance outcomes do not meet standards.

Overall, research shows that learning technologies can help students develop self-regulatory skills that in turn will sustain their learning efforts to accomplish their goals. However, it should be noted that the instructor also plays a critical role in self-regulation development. The degree to which students actively engage in self-regulation partially depends on the actions of the teacher and the classroom environment (Urdan & Turner, 2005). Focusing prematurely on outcomes and /or not offering students the opportunity to use different learning technologies to accomplish a goal could have detrimental consequences on students' motivational beliefs. Therefore, it is important for instructors to not only design environments that allow students to develop self-regulation, but also design lessons where students are provided with choice which in turn will encourage and motivate students to be proactive learners. For example, a research methods professor who instructs students to choose from a list of approved topics regarding writing a literature review for their final projects and offers a variety of learning technologies to assist them in organizing their research supports student autonomy (Deci & Ryan, 1985) and influences the amount of motivation, interest, and effort a student devotes to the task (Zimmerman, 2008).

CONCLUSION

Current research offers a number of guidelines for educators on how to use learning technologies to support student self-regulation. In summary, using LMS tools and other learning technologies, instructors can teach students how to set process-oriented goals to complete long-term projects. Using tools such as the calendar feature, instructors can trigger student strategic planning on how to accomplish these goals by providing specific deadlines and due dates to students. Virtual worlds where instructors plan all activities ahead prior to implementation and train students to navigate the virtual world and its basic functions can be used to model strategies (e.g., organizational, rehearsal, visualization, etc.) to help students work on course projects. Students can also be prompted to keep track and reflect on their progress via task aligned checklists, journals, and rubrics.

Furthermore, social networking tools, which are currently very popular among college and adolescent students can support student motivation. Instructors can guide students to create informal networks that are tailored to their interests and learning needs using social networking tools. These networks eventually become informal

learning environments and support systems for building resources and collaboration. Students can join several existing groups on Facebook and other social networking sites that are specifically geared to their course topics, majors, or professions. Faculty can also encourage students to become members of such groups to expand their knowledge of the field, interact with peers and experts, and become members of a community of practice that has lifelong learning implications. Instructors or students can create their own social network using platforms which allow maximum control over design features, type of membership, and educational purpose or goals.

In closing, there is no doubt that learning technologies offer innovative methods to teach students self-regulation skills. The learning technology field continues to grow, and given that the design of the learning environment matters, it is critical that instructors teaching online or distributed courses receive professional development on how to harness the benefits that these technologies can offer to facilitate student self-regulation. More systematic, rigorous research is also needed to shed light on how use of learning technologies can promote self-regulated learning in these types of learning environments.

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