Promoting Collaborative Social Learning Communities with Student Response Systems

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Abstract

Considering the versatility and pedagogical potential of student response systems (SRSs), this article outlines compelling reasons why student response system (SRS) use may provide one solution for transforming the passive and isolated online learning environment experienced by many students. SRS use combined with sound pedagogical practices can create an active learning environment comprised of a collaborative social learning community capable of effectively meeting varied learning needs. Newly developed SRSs have created the opportunity to explore online SRS use. Incorporation of SRS use within behaviorism, social constructivism, and many other pedagogical approaches makes it a tool worthy of consideration in solving pedagogical dilemmas and creating a positive learning experience. Despite a lack of research related to online SRS use, this article utilizes current SRS and online polling research and information to determine the primary benefits and challenges associated with online SRS use. This article provides information regarding the pedagogical possibilities of SRS use for teachers who incorporate SRSs in online learning environments.

Keywords: clickers, online polling, online learning environment, behaviorism, social constructivism, active learning, student engagement, peer instruction, classroom communication system, TurningPoint

Introduction

What are the current challenges for teaching with technology? According to a recent EDUCAUSE project (Little, et al., 2009), the biggest challenge is structuring a learning environment that promotes collaborative learning, critical thinking, interactive learning experiences, and creation of knowledge. Additional challenges include increasing student engagement, promoting information literacy, appropriately using technology, and promoting the use of technology within the current economic environment (Little, et al., 2009).

Reflecting on these challenges, an obvious solution is reliance on sound pedagogical practices (best practices) that incorporate versatile and affordable technologies. Drawing from social constructivism theory, use of pedagogies and technologies that promote the formation of collaborative social learning communities enable us to meet these educational challenges.

Online learning environments are often perceived as isolated and lonely experiences lacking social presence (Shen, Wang, & Pan, 2008; Wickersham & McGee, 2008) and promoting student passivity (Tremblay, 2006; Wang, Shen, Novak, & Pan, 2009). The Internet (made easily accessible through online learning) provides a rich environment for socially collaborative learning experiences. However, the technology skill set required for integration of some Internet innovations and necessary shifts in pedagogical practices can be intimidating for teachers and students (Bonk & Dennen, 2004; Little, et al., 2009; Tremblay, 2006).

In this article, the potential of the student response system (SRS), commonly referred to as clickers, to promote student engagement and a collaborative social learning community is explored. A SRS is basic technology that enables every student to respond in real-time to teacher-specified class activities using a keypad response device that transmits information to a receiver in the teacher's computer. The SRS

offers advantages based on its versatility and low technology skill demands when compared to other technologies. SRS technology is easily incorporated in education since its use is based on familiar pedagogical practices. With low technological and pedagogical demands, SRS use is palatable for consideration by teachers hesitant to adopt other more sophisticated technologies. SRS use does not require radical changes to course content or established pedagogical practices but can provide the impetus for desired changes.

In the literature, the potential for appropriate SRS use to transform a learning experience to meet many of the current educational challenges is well documented (Beatty, 2004; Bergtrom, 2006; Herreid, 2006; Nicol & Boyle, 2003; Paschal, 2002; Trees & Jackson, 2007; Zhu & Kaplan, 2006). Paired with effective pedagogical practices, the SRS has immense potential to promote meaningful student engagement in active learning experiences that improve learning outcomes, increase critical thinking skills, and support a collaborative social learning community at a relatively modest cost (Barber & Njus, 2007; Corbeil, 2005; Gauci, Dantas, Williams, & Kemm, 2009; Premkumar & Coupal, 2008; Trees & Jackson, 2007).

The SRS has gained widespread adoption in higher education settings (Bergtrom, 2006; Bruff, 2007; Premkumar & Coupal, 2008) and is successfully utilized in teaching a variety of subjects (Abrahamson, 2002; Bergtrom, 2006 ; Gauci, et al., 2009; Penuel, Boscardin, Masyn, & Crawford, 2007; Roschelle, 2003). Current SRS literature describes outcomes largely based on traditional classroom SRS use (Barber & Njus, 2007; Beatty, 2004; Deal, 2007; Draper & Brown, 2004; Gauci, et al., 2009; Herreid, 2006; Hoekstra, 2008; Nicol & Boyle, 2003; Paschal, 2002; Penuel, et al., 2007; Premkumar & Coupal, 2008; Rice & Bunz, 2006; Skiba, 2006; Trees & Jackson, 2007). The innovations that permit SRS use in the online learning environment are very recent. Therefore, research on SRS use as part of online learning experiences is limited. This article explores the adoption of SRS technology (including consideration of online polling and mobile devices) in the synchronous or asynchronous online learning environment. Discussion of the applications and benefits of SRS use in the traditional classroom combined with literature describing the use of online polling and mobile devices, provides guidance for online use of SRSs. Obviously, one must maintain appropriate awareness and caution regarding generalization of this information to an online learning environment.

Student Response Systems

There are a variety of student response systems (SRSs) available for purchase and use in education. Each SRS presents users with unique advantages and disadvantages. For comparative assessments of SRSs, readers are referred to the work of Barber and Njus (2007) and manufacturers' websites for updated information.

Overview of a Traditional Student Response System

The Richard Stockton College of New Jersey (author's employer) selected TurningPoint as the preferred SRS. Based on author familiarity, TurningPoint SRS will be utilized to describe the technology. Hyperlinks in this paragraph will allow readers connected to the Internet to view components and additional information related to TurningPoint's SRS.

TurningPoint's SRS technology may be familiar to many educators as the company reports that more than 50% of all American higher education institutions use TurningPoint systems. (Turning Technologies, 2009). Typical use of TurningPoint occurs within PowerPoint presentations.

A traditional TurningPoint SRS is comprised of a small response device or handheld keypad commonly referred to as a clicker. Each student is assigned an individual response device. Using the response device, every student simultaneously responds to a question or statement presented within a PowerPoint slide. The teacher utilizes TurningPoint's software and the plug-in compatibility with PowerPoint to develop interactive slides requiring student response. Questions can be developed by the teacher prior to a class session or written "on the fly" in response to real time learning experiences.

A USB dongle similar to a flash drive serves as the wireless receiver that records and aggregates student responses. The dongle is inserted in an available USB port connected to the computer displaying the PowerPoint presentation.

After a TurningPoint slide is polled (students respond using response devices), a real-time graphic display of the results will appear within PowerPoint. The display is typically a bar graph or pie chart displayed on the computer screen or projected image of the computer screen. The projected graphic generated by student responses permits individual student responses to be anonymous to those viewing the display.

Student responses can always be collected anonymously or assigned to each individual student through the use of software. To obtain student specific information, addition of a participant list and report generation using TurningPoint software is required. Data collection within TurningPoint is robust and can be utilized for formative assessment, summative assessment, analysis of pedagogical effectiveness, research, identification of student learning trends, collection of demographic information, and other uses (Premkumar & Coupal, 2008).

New Generation Student Response Systems

Currently TurningPoint and other SRS manufacturers are offering products with more flexibility and mobility. A teacher can now utilize a SRS within applications as diverse as Excel spreadsheets, Word documents, PDF documents, whiteboard software, web pages, and other applications. Typically in these applications, a floating toolbar is created with graphic response displays appearing in a new window.

Another recent addition to the SRS is an optional handheld radio frequency receiver with an LCD screen that can be used for student polling when a computer or projector is not available.

For use in the online classroom environment, some SRSs enable students to use their own Internet-connected devices such as a personal computer, BlackBerry® smartphone, Apple® iPhone™ and iPod® touch as the response device. One of the primary advantages of SRS use with mobile devices is allowing students to participate from any location without sacrificing aggregated data collection and report generation. Currently, TurningPoint's SRS does not allow asynchronous collection of data due to issues with server timeout. Online polling (web polls) can offer some of the advantages of a SRS when asynchronous participation is desired. Online polling also provides a no cost SRS option.

Online Polling

Online polling systems are defined by Klaas & Baggaley (2003) as "...an asynchronous or real-time process of information gathering, obtained via responses to question(s) mediated by Web-based formats" (p. 1). Online polling has been found useful in building online communities (Corbeil, 2005; Klaas, 2003; Klaas & Baggaley, 2003). For the purpose of this article, use of online polling tools will be considered as a type of SRS since the technology performs similar functions. For example, a web poll permits a question to be asked, all students respond in a desired amount of time, and student responses are able to be viewed. Online polling may be a necessary option for utilization of a SRS in an asynchronous learning environment. One of the limiting factors in the use of online polling tools when compared to other SRSs is a decreased ability to store, manipulate, and analyze data collected. Some web polls provide data enhancements with the purchase of additional services or software. For online polling comparison information, refer to Baggaley, Kane, and Wade (2002) or information posted by Amit Agarwal (2008). For best practices using online polling, refer to Klaas (2003).

Mobile Devices

Many teachers create policies to limit student use of mobile devices in the traditional classroom based on the potential distraction or cheating opportunities (Shinn, 2009). However, it is reasonable to consider mobile devices as helpful technology tools that promote learning. As a familiar technology to many, web-enabled mobile devices can be expected to play a larger role in the education process (Roschelle, 2003; Shinn, 2009; Wang, et al., 2009). Use of a new generation SRS allows incorporation of mobile devices as a learning tool in traditional or online classes. The educational use of mobile devices (especially Internet-connected devices) should be explored to better understand the pedagogical uses and learning benefits (Roschelle, 2003; Wang, et al., 2009).

Shinn (2009) anticipates that with the evolution of mobile devices, "..they will become more versatile, more useful, and more essential...(requiring) students and faculty...to understand their immense...potential" (p. 38). With the ability to utilize mobile devices for SRSs, teachers are able to experiment and explore the learning potential of web-enabled mobile devices within a familiar

pedagogical practice (seeking student responses). Additional uses of mobile devices to develop an active, engaged social learning community might begin with SRS use and be further realized through the computing power, texting, image production, and audio capabilities of a mobile device (Shinn, 2009). The power of a mobile device harnessed for the purpose of creating a learning community is immense. Mobile device use is familiar to many students and provides an opportunity to extend learning outside of the classroom and learning management systems. This capacity allows students to be more proficient as active self-directed learners.

It is certainly worth noting that there are limitations to widespread inclusion of mobile devices as required learning tools. As with any technology, problems with the mobile device itself and compatibility issues with educational applications might be expected. At the current time, not all students and teachers have mobile devices. Students and teachers with web-enabled mobile devices may discover that the costs associated with frequent use in education creates a financial burden. This financial limitation is alleviated by using SRSs that provide students with the option of using any Internet-connected device including personal computers, mobile devices, and/or response devices specific to the SRS. In some education settings, students are provided with response devices so cost and access issues are negligible.

Learning Experiences Supported by SRS Use Based on Familiar Pedagogical Practice

Student response systems (SRSs) were developed based on the ubiquitous educational practice of students raising hands to answer a question or indicate agreement or disagreement with a statement posed by the teacher. Draper and Brown (2004) observe that when requesting raised hands (voluntary student participation), the participation rate is typically 7.8% or lower. Using a SRS with expectations that the entire class participates, the potential student participation rate increases to 100% (Paschal, 2002). Clearly, this represents improved interactivity and student engagement with SRS use (Gauci, et al., 2009; Paschal, 2002; Premkumar & Coupal, 2008). In this manner, a primary benefit to SRS use is the technology's ability to permit all students to respond to thought provoking questions and statements posed within a variety of course media.

In a traditional or online class using a SRS, expectations of full participation with aggregation of student responses ensures that each student understands the value of her individual contribution to class discussions. Full participation also promotes and supports the validity of the class forming a social learning community. Realization of these benefits within an online class represents a significant advantage over other participation techniques.

Collection, aggregation, and display of student responses are important advantages of SRS use in online learning environments. In a synchronous learning environment, within seconds of students responding to a SRS question, the teacher and students are provided with a visual display (graph) representing aggregated student response. Through the response display, students receive instant and useful feedback as a tangible product (graph) that allows comparison and promotes awareness of peer responses (Baggaley, et al., 2002; Deal, 2007; Paschal, 2002; Roschelle, 2003). Building learning experiences based on a student response graph facilitates meaningful knowledge construction. In an asynchronous online learning environment, students are provided with a specified period of time to respond to SRS questions. When the time allotted expires, the data display is made available for viewing (students do not view the ongoing changes in student responses during the process unless such viewing is desired by the teacher). Once the data display is made available, the display itself (graph) facilitates discussion or is further considered as a learning object to promote a learning opportunity responsive to the results. This variation in the use of student response data is considered as part of effective pedagogical practice. Regardless of the learning environment, the response display is useful in promoting discussion and generating higher level critical thinking.

A SRS can perform routine pedagogical tasks (such as taking attendance), however, such use offers little advantage in the online learning environment since learning management systems can perform the same routine tasks. The true power of the SRS is its ability to support learning that promotes student interaction and collaboration. It is important to recognize that the tool (SRS) supports the facilitation of a collaborative social learning community; it is the pedagogical incorporation of a SRS into a well designed learning experience that ultimately determines the successful results of student engagement and collaborative learning (Beatty, 2004; Deal 2007; Shinn, 2009). Teachers who utilize effective questioning strategies, promote active discussions, and provide feedback within the learning experience are more

likely to experience success and satisfaction with SRS use (Crouch & Mazur, 2001; Penuel, et al., 2007). Teachers completely unfamiliar with SRS use might consider review of the article by Premkumar and Coupal (2008) as it provides practical tips for successful use of a SRS (based on traditional classroom use).

In the online environment, the versatility of SRS use within various applications, web pages, and learning management systems makes consideration of SRS use an exciting prospect. The type of SRS uses described in the literature and observed in classroom environments should be considered and adapted for implementation in online learning environments.

Potential Challenges

The challenges that may arise when using a SRS are similar to the challenges in adopting any technology tool (Beatty, 2004; Kay, 2009). Some of the more common challenges include poor use of a SRS because of ineffective pedagogical planning or implementation, technology failures, compatibility issues (more common when students and teachers are using a variety of web-enabled devices), lack of support, inadequate training opportunities, limited access to experienced mentors for teachers learning to use a SRS, data loss caused by human or computer error, resistance to change (violation of status quo), financial constraints, and accessibility issues.

Many of these challenges can be overcome with creative and low-cost solutions. Some challenges are prevented with effective practices including orientation of students to the SRS and technology support for faculty. For online teaching, the use of no cost online polling can offset financial limitations. Another financial solution is the purchase of appropriate SRSs by the school (perhaps through a grant). This enables students and faculty to use a SRS at no cost.

Use of the SRS: Behaviorism Approach

Many online courses contain adapted classroom materials (lectures or "push out" presentations) based on a behaviorism approach (Shen, et al., 2008). Inherent to the behaviorism approach is the expectation of a passive student role within a teacher-centered learning experience (Hoekstra, 2008; Shen, et al., 2008). Therefore, the exclusive use of a behaviorism approach to pedagogy is not expected to lead to the development of an active online social learning community. In behaviorism-based learning environments, SRS use is consistent with the pedagogy and involves the completion of familiar tasks such as monitoring student behavior by obtaining correct responses to multiple-choice questions (quizzing), taking attendance, collecting student information, polling student opinions, and assessing student background knowledge or preparation for class (Beatty, 2004; Deal, 2007; Judson & Sawada, 2002).

SRS use framed within a behaviorism approach will not promote the advanced interactivity and collaborative social learning community that is supported by SRS use conceptualized within other pedagogical approaches. Many of the tasks associated with SRS use guided by the behaviorism approach can be accomplished within learning management systems. However, recognizing that some courses are designed and implemented based on behaviorism-based pedagogical approach, it is worthwhile to note that the use of a SRS is shown to improve student engagement (Bergtrom, 2006; Deal, 2007; Edens, 2006; Gauci, et al., 2009; Hoekstra, 2008; Paschal, 2002; Premkumar & Coupal, 2008).

Kaleta & Joosten (2007) report that 94% of faculty agreed or strongly agreed that use of a SRS increased student engagement in class. In a study by Gauci, et al. (2009), 83% of students reported increased engagement with the use of a SRS. Additional changes in student behavior include improved student learning (Bergtrom, 2006; Deal, 2007; Edens, 2006; Gauci, et al., 2009; Herreid, 2006; Kay, 2009, Premkumar & Coupal, 2008), reinforcement through feedback (Edens, 2006; Rice & Bunz, 2006), better preparation for class (Edens, 2006; Paschal, 2002; Trees & Jackson, 2007), increased motivation (Beatty, 2004; Gauci, et al., 2009), and improved attention (Beatty, 2004; Edens, 2006; Herreid, 2006; Hoekstra, 2008). Students also report perceptions of fun, entertainment and enjoyment with SRS use (Beatty, 2004: Deal, 2007; Herreid, 2006; Hoekstra, 2008). Although these results are based on traditional classroom experiences, it may be reasonable to expect similar results in a synchronous online learning environment that is based on a behaviorism approach.

Benefits for the teacher with behaviorism-based SRS use include positive changes in student behavior, effective collection of student responses, rapid grading of formative and summative assessments, and improved pedagogy in pacing lectures and structuring learning activities based on real-time feedback (Bruff, 2007; Deal, 2007; Paschal, 2002; Skiba,2006). The ability to customize instruction based on the collection, aggregation, and display of student responses in real-time (instant feedback) promotes better utilization of learning time (time on task) and a learning experience tailored to student needs (Baggaley, et al., 2002; Draper & Brown, 2004; Herreid, 2006; Penuel, et al., 2007).

In the synchronous online learning environment, the ability to structure learning experiences can be achieved using an if-then contingency design (Baggaley, et al., 2002) meaning *if* a specific event occurs *then* the learning experience is structured to be responsive to that event. For example, students are presented with a series of SRS questions related to the identification of five central concepts of ethical behavior discussed in the assigned course readings. After each question is polled using the SRS, the response displays (graphs) indicate that an overwhelming majority of students understand the central concepts from the readings. The students and teacher use this information to determine that student learning related to ethical behavior concepts discussed in the readings has been achieved. The teacher can utilize action buttons (hyperlinks) within a presentation to progress to the next desired learning activity (a new concept) and will not use the portion of the course that was designed to review the concepts of ethical behavior discussed in the assigned readings. Likewise, a teacher could note poor understanding of a concept and determine that additional review and discussion is required.

The use of a SRS guided solely by a behaviorism approach in the asynchronous online learning environment would not provide meaningful pedagogical or learning benefits. A social constructivism or other pedagogical approach is necessary to obtain the highest levels of benefit from SRS use in the asynchronous environment.

Use of SRS: Social Constructivism Approach

Well designed social constructivist pedagogical practices supported by SRS use can promote and sustain an active and collaborative social learning community. A social constructivist approach recognizes the responsibility of the student to actively create conceptual understanding and application (scaffolding) with recognition of the social aspects of learning that occurs through discussion and interaction with others (zone of proximal development) (McKeachie & Svinicki, 2006; Nicol & Boyle, 2003; Rice & Bunz, 2006). The teaching role changes from presenter of information and collector of data to that of facilitator and learning coach (Bonk & Dennen, 2002; McKeachie & Svinicki, 2006; Merrill, 2004).

SRS use within a constructivist and social learning context includes activities such as Mazur's (1997) peer instruction (Crouch & Mazur, 2001; Deal, 2007; Hoekstra, 2008; Nicol & Boyle, 2003), think-pair-share (Beatty, 2004; McKeachie & Svinicki, 2006), class wide discussion (Dufresne, Gerace, Leonard, Mestre, & Wenk, 1996; Nicol & Boyle, 2003; Penuel, et al., 2007), creation of clicker sets (Bergtrom, 2006), comparison questions (Beatty, 2004), case studies (Herreid, 2006), team competitions/games (McKeachie & Svinicki, 2006) and problem-based learning (PBL) activities (Hoekstra, 2008). More information on each of these learning activities can be found in the literature cited.

The use of SRS activities based on a social constructivism approach can convey the same positive benefits obtained in a behaviorism-based approach but has more strength and pedagogical power based on the ability of these activities to promote interactivity, active engagement, social collaboration, cognitive investment, shared knowledge, and student cooperation within a learner-centered environment (Hoekstra, 2008; Rice & Bunz, 2006; Wickersham & McGee 2008). In the asynchronous learning environment, a teacher can combine the use of selective release features in the learning management system to promote desired learning experiences. It is reported that SRS use within a social constructivism approach supports the development of higher level critical thinking skills, promotes opportunities to solve real-world problems, develops metacognitive skills, socially engages students in active learning experiences, increases student satisfaction and competence, and results in better student learning outcomes (Beatty, 2004; Crouch & Mazur, 2001; Deal, 2007; Hoekstra, 2008; Rice & Bunz, 2006 ; Roschelle, 2003; Shinn, 2009; Wickersham & McGee 2008).

Benefits to the teacher with social constructivist-based SRS use include enhanced student-student and student-teacher collaboration, an interactive and cooperative learning experience, use of a tool that

permits easy measurement of student knowledge and skills, the ability to provide instant and meaningful feedback, access to data collected for analysis and research, creation of a flexible and adaptable learning environment, and increased student responsibility for learning (Rice & Bunz, 2006; Wickersham & McGee 2008).

Literature describing social constructivism approaches to SRS use is based primarily on experiences in the traditional classroom. To appreciate application to the online environment, a description of peer instruction in the online learning environment is provided.

Peer instruction, pioneered by Mazur (1997), is an interactive experience where course information is presented and followed by questioning to test understanding, application, or analysis of the information. Using a SRS, students respond individually to question(s) posed and are provided with visual feedback (aggregation of individual student responses in a bar graph). Students then form small groups and discuss their responses and reasoning in selecting those responses (students instructing other students). After sufficient small group discussion, the questioning is repeated to measure changes in student understanding. This learning activity enhances conceptual knowledge, critical thinking, and the effectiveness of class discussion (Crouch & Mazur, 2001; Dufresne, et al., 1996; Mazur, 1997; Nicol & Boyle, 2003; Penuel, et al., 2007; Rice & Bunz, 2006) within a social learning community.

When utilizing peer instruction online, the teacher (or a student) poses a question or statement (or shows an image or video clip) for student response. Exactly what the teacher poses to the students will be based on desired learning outcomes. All students respond to the question or statement individually using the appropriate SRS. In the synchronous online environment, question polling to response aggregation is quick (30 -120 seconds); in an asynchronous environment perhaps 24-72 hours are provided for student responses. The aggregated student response is visually displayed to teacher and students.

In this description of online peer instruction, let's assume that the question polled has two correct responses and three incorrect responses. Of the two correct responses, one is more correct than the other. Based on the student response graph, we note that 20% of the students answered with the most correct response; 35% answered with the less correct answer; 45% of the students selected one of the three incorrect responses. Without providing the correct answer or any explanations, the teacher instructs the students to discuss the question and answers with a small group of peers based on each student's understanding of the concept (peer instruction).

The small group discussion is accomplished online with breakout rooms or other available discussion tools including text-based or audio discussion tools, chat rooms, or virtual worlds (Second Life). The discussion can be synchronous or asynchronous. In the asynchronous learning experience, time limits need to be established to permit the completion of learning related to the concept being discussed. Throughout the discussion, students are engaged in analysis and critical thinking as they describe the reasoning behind the selection of particular answers. Students can look at the graph and note the answer selected by the majority of the class to determine if that is indeed the most correct answer. The advantages of student to student teaching practices are numerous (Hoekstra, 2008; McKeachie & Svinicki, 2006; Nicol & Boyle, 2003). Having students engage in meaningful and focused discussion results in more student-student and student-teacher interaction (social learning). This kind of ongoing social interaction promotes and sustains a collaborative social learning community engaged in knowledge construction.

After the discussion period ends, the same question is polled again and students submit their answers (individually or as a group). In this fictitious example, it is noted that the student responses change and correct answers are selected by 95% of the students as a result of peer instruction. The teacher (or a student) can provide a concept summary as needed to further alleviate any potential misunderstandings (Beatty, 2004; Kay, 2009; Paschal, 2002; Wickersham & McGee 2008) and assist students in differentiating between two correct answers. Based on the SRS feedback (graph), the teacher is able to understand and address the variation in conceptual knowledge without having to address each student individually (Roschelle, 2003).

In a study conducted by Nicol & Boyle (2003), students involved in peer instruction reported improved conceptual knowledge, appreciation for adaptation of teaching to be responsive to student needs, and

opportunities to explore concepts and solve problems with the assistance of peers. During interviews conducted as part of the Nicol & Boyle (2003) study, students reported that "peer discussion provided opportunities to think about the problem in more detail, to explore alternative viewpoints and problem-solving approaches, and to ask for and hear different explanations" (p. 465). Student participants described peer explanations of concepts as being more understandable than teacher explanations (teacher's understanding is at a higher level not easily conveyed to student level).

At the teacher's prerogative, factors in peer instruction can be manipulated (i.e. groups can remain stable or rotate in each class) to best accomplish pedagogical and learning objectives while promoting social engagement.

With this one brief description and exploration of other creative uses of a SRS, one can appreciate the potential for the online classroom to become an active and engaging learning experience. The online learning experience can be designed to promote and support a learner-centered collaborative social learning community (Hoekstra, 2008; Rice & Bunz, 2006; Roschelle, 2003). Students collaborate and assist in the generation of knowledge and contribute to the overall learning experience.

Conclusion

The SRS represents a versatile and simply elegant technology solution to the biggest current educational challenge described by Little, et al. (2009), as structuring a learning environment that promotes collaborative learning, critical thinking, interactive learning experiences, and creation of knowledge. SRSs also address other challenges described by Little, et al. (2009) through its proven ability to increase student engagement and promote appropriate technology integration with reasonable financial costs. SRS use and related technological components (with the inclusion of online polling) have advanced sufficiently to permit integration of the SRS in the online environment.

As one considers the potential for SRS use in the online learning environment it is critical to remember that the SRS is merely a tool in the learning process. The effective use of a SRS is entirely dependent upon consistency with pedagogical and social processes (Beatty, 2004; Barber & Njus, 2007; Deal, 2007; Ellis, Ginns, & Piggott, 2009; Merrill, 2004; Penuel, et al., 2007; Premkumar & Coupal, 2008; Roschelle, 2003). The SRS is a versatile tool that can be implemented successfully within a variety of pedagogical approaches and not limited to the behaviorism and social constructivism approaches discussed in this article.

Appropriate SRS use paired with effective pedagogical practices has immense potential in the online environment to promote meaningful student engagement, active learning experiences, improve learning outcomes, increase critical thinking, develop problem-solving skills, and support a collaborative social learning community (Corbeil,2005; Gauci, et al., 2009; Premkumar & Coupal, 2008). An amazing benefit of the SRS is its ability to provide students and teachers with visible representations of student thinking and problem-solving (metacognition) and all of the benefits that entails (Beatty, 2004; Judson & Sawada, 2002; Penuel, et al., 2007).

As SRS use migrates to online learning environments, it is reasonable to assume that challenges will occur. However, the potential of SRSs to support the promotion and sustainment of an actively engaged collaborative social learning community in a new context (online) is so promising that overcoming any obstacles or challenges to implementation is worth the effort. SRSs represent technology that can be implemented to increase pedagogical effectiveness in any discipline. SRS use confers numerous benefits described throughout this article. It is obvious that more research is needed especially to determine best practices for SRS use (Fies & Marshall, 2006). As SRS use is adopted in the online environment, meaningful evaluation and measurement of its impact on student learning and pedagogical effectiveness must be systematically researched. Research could specify quality benchmarks promoting best practices for online SRS use. With established pedagogical frameworks for online SRS use, continued research (using reliable and valid tools) could measure student learning outcome achievement, student and teacher perceptions of the online learning experience, student retention in online courses, effective pedagogical innovations and a variety of variables discussed in this article.

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