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Executive Summary

Learning doesn't end after high school or college but rather it continues in both personal and professional settings for the rest of our lives. For example, as technology changes, the skills required for a particular job might change as well, which forces the worker to adapt. In addition, often an individual may just want to pursue new interests. In fact, according to the Bureau of Labor Statistics, on average, people change jobs about every five years (Mullins, 2009)! Regardless of the reason for change, to be successful in these new endeavors, lifelong learners must set goals and monitor their own learning. Therefore, teaching students how to self-regulate is important in education (Bransford, Brown & Cocking, 2000; Zimmerman, 2002). Unfortunately, due to the lack of emphasis on self-regulated learning in most teacher education programs and professional development opportunities, many teachers do not understand how to foster these skills. As a result, students often have not been taught how to adequately self-regulate. My research seeks to answer the question how can teachers best encourage and

support self-regulated learning in their students through the use of current technologies combined with sound pedagogy. This will help to shape learners who are motivated and able to readily assess the available information in any situation to make well informed decisions.

Web-based learning has risen sharply over the past decade (Kauffman, Zhao & Yang, 2011) and new educational technologies are emerging daily. These changes have lead educators to ask how they can best encourage and support self-regulated learning in their students through the use of these relatively new technology tools. There is growing evidence that Web 2.0 technologies such as blogs and wikis, along with other technologies such as Google Docs, and online formative quizzes that provide targeted feedback, can encourage and strengthen self-regulated learning by providing increased opportunities for planning and reflection (Kitsantas & Dabbagh, 2011; McLoughlin & Lee, 2010).

The research clearly shows the benefits of self-regulated learning (increased motivation, satisfaction, and academic performance) and it is beginning to show how various technologies can help students self-regulate. However, educators need practical advice and clearly defined technologies that they can easily use in their own classroom to enhance their students self-regulation. Often, it is hard to decide which technologies to use and what the possible advantages might be. More research is needed that focuses on how learning is impacted by commonly available educational technologies. If teachers have access to a technology resource bank that explains the available technologies and how they aid self-regulated learning, they will be much more willing and able to successfully implement this technology in their classrooms.

To investigate the effects of technology on self-regulated learning, I will use a quasi-experimental design where one classroom of chemistry students will use certain

technologies such as blogs, online quizzes and WIKI pages to aid their learning while another chemistry classroom will use alternate, non-technological methods (notebooks, paper and pen quizzes and traditional review sheets). Surveys and student interviews will then be conducted to gather data from both groups. The analysis of this data will allow for a comparison of the impact on self-regulated learning between the instruction with and without the technology.

Introduction and Background

Students will not spend their entire lives in a formal educational setting, yet they will always be expected to learn. According to Zimmerman (2002), "Self-regulation is important because a major function of education is the development of lifelong learning skills. After graduation from high school or college, young adults must learn many important skills informally" (p. 66). For example, bosses will often expect their employees to learn a new position. In addition self-employed persons must constantly refine their skills if they hope to stay in business. Therefore, it is crucial that students are taught how to engage in self-regulated learning in order to become lifelong learners who "take control of their own learning by defining learning goals and monitoring their progress in achieving them" (Bransford, Brown & Cocking, 2000, p. 18). If self-regulated learning relies on metacognition, careful planning, and the motivation to learn, how can teachers address these areas in an attempt to boost self-regulation? While various strategies and techniques can be used, new technologies are emerging daily that can help promote self-regulated learning. But what technologies are best? In other words, how can teachers best encourage and support self-regulated learning in their students through the use of current technologies combined with sound pedagogy in an effort to shape learners who are motivated and able to readily assess the available information in any situation to make well informed decisions? After all, we are in now living in a world where information is just a Google search away. However, looking up a fact and understanding a concept are completely different things. It doesn't do any good to look up a fact without having the ability to understand what it means, what else is impacted by it and how it helps to form the bigger picture.

Recently, while teaching high school students, I became frustrated by the lack of effort to learn among my students. Rather than taking control of and evaluating their learning, they are quick to close the book on past activities and assessments and move on to the current material regardless if the previous material has not yet been mastered. Formative assessments were just seen as a final quiz rather than a check point, my feedback on their Google Docs would go untouched, and homework assignments were viewed as a to-do list rather than as a way to learn. Therefore, I began to wonder how I could best encourage and foster self-regulated learning among my students. One of the first things I did was to give regular formative assessments which according to Bransford et al. (2000) "provide students with opportunities to revise and improve their thinking (Vye et al., 1998b), help students see their own progress over the course of weeks or months, and help teachers identify problems that need to be remedied" (p. 24-25). The testing software I used even breaks down the score by learning targets so that the students can see exactly where they need improvement. However, without specific guidance and structure from me, the students tend to ignore this data and therefore, it often has not led to improved student performance. Therefore, I need to know more about how to encourage and promote self-regulation in my classroom. In fact, since all students can prosper from "thinking about their thinking" and monitoring their progress, all primary, secondary and higher education teachers can help their students by better understanding how various technologies can encourage and strengthen self-regulated learning. Paris and Paris (2001) concluded that "students of all ages can benefit from analyses and discussions of strategies for learning" (p. 99) while in his study, Martinez (2006) concluded that metacognition "important and consequential for learners of all ages" (p. 699).

Research also has something to say about how teachers can help boost self-regulated learning and metacognition. After stating that metacognition is consequential for all learners, Martinez (2006) asked the question "how can metacognitive skills be developed in the classroom?" He goes on to answer this question saying that students need the opportunity to practice and that teachers need to model metacognition (p. 699). Technology can help provide both this practice and modeling. In addition, specific feedback from teachers can alert students to potential weaknesses and errors in their thoughts and this feedback "can guide modification and refinement in thinking" (Bransford et al., 2000, p. 19). In other words, feedback, when provided correctly, encourages students to continue their learning process as they reflect on their original work (and it's weaknesses) while deciding how to best incorporate the thoughts and ideas of others. After all, it is only when someone is able to recognize their own limits, that they are then able to "take steps to remedy the situation" (Bransford et al., 2000, p. 47). Again, there are many ways in which technology can assist with this feedback such as through the use of comments in Google Docs and synchronous or asynchronous online chats.

I have only scratched the surface of what the research says about using technology to enhance self-regulated learning (including metacognition and progress monitoring) but already, the potential is clear. Not only can Web 2.0 technologies help to shift control from the teacher to the learner (McLoughlin & Lee, 2010), Kitsantas & Dabbagh (2011) concluded that "Web 2.0 technologies and social software tools provide innovation in college teaching and learning contexts, particularly with regard to supporting student self-regulation" (p. 105). Hopefully a deeper dive into the research will yield practical ways to use technology to foster self-regulated learning.

Literature Review

Introduction

The topic

While the academic benefits of self-regulated learning have long been recognized, the tools that can help students self-regulate have changed considerably as technology continues to advance at a breakneck speed. In particular, web-based learning has risen sharply over the past decade (Kauffman, Zhao & Yang, 2011). This change has lead educators to ask how they can best encourage and support self-regulated learning in their students through the use of current technologies combined with sound pedagogy in an effort to shape learners who are motivated and able to readily assess the available information in any situation.

General overview of the literature

Self-regulated learning is the "self-directive process by which learners transform their mental abilities into academic skills" (Zimmerman, 2002, p. 66). According to Zimmerman (2002), this cyclical process of self-regulation involves three phases. During the forethought phase, students set goals and plan out their learning. The performance phase then sees students follow the plan they set up during the forethought phase. In addition, this phase calls for students to observe and monitor the efficiency of their plan. Finally, the self-reflection phase refers to processes that occur after the learning. Self-reflection includes self-evaluation where the learner compares their performance against some predetermined standard. The cyclical nature of self-regulation can be seen as the self-reflection phase will affect future forethought phases.

There is growing evidence that Web 2.0 technologies, and technologies in general, can encourage self-regulated learning as they create these opportunities by shifting control from the

teacher to the learner (Kitsantas & Dabbagh, 2011). The International Society for Technology in Education (ISTE) recently released new student technology standards that focus on using technology to transform learning. ISTE (2016) begins the standards by stating that students should be empowered learners who "leverage technology to take an active role in choosing, achieving and demonstrating competency in their learning goals, informed by the learning sciences." These technology standards come a decade and a half after Paris and Paris (2001) found that self-regulated learning is "more likely when teachers create classroom environments in which students have opportunities to seek challenges, to reflect on their progress, and to take responsibility and pride in their accomplishments" (p. 99). Fortunately, Web 2.0 technologies such as blogs and wikis, along with other technologies such as Google Docs, learning management systems, and formative quizzes with algorithms, can provide the many opportunities of planning and reflection that Paris and Paris referred to. In addition, social software technologies often promote the development of 21st-century skills such as communicating, sharing, collaborating and networking (McLoughlin & Lee, 2010). However, even though students might be familiar with using these technology tools in their personal lives, they may not understand how to properly use them for learning (Kitsantas & Dabbagh, 2011). Therefore, much scaffolding is needed. In addition, due the rapid arrival of new technologies, much more research on the topic of technology and self-regulation is needed.

Rationale

In a world where information on nearly every topic is readily available, self-regulated learning is an important skill for all students. Therefore, it is crucial that students are taught how to engage in self-regulated learning in order to become lifelong learners who "take control of

their own learning by defining learning goals and monitoring their progress in achieving them" (Bransford, Brown & Cocking, 2000, p. 18). However, many teachers do not understand how to foster these skills and therefore, students often have not been taught how to adequately self-regulate. To start, teachers need to be aware of the existing pedagogical and technological knowledge in relation to self-regulated learning. This review takes a narrower look at self-regulation as it focuses on what is already known about how various technologies can aid in producing self-regulated learners.

Body

Kinds of work reviewed

Self-regulated learners set goals, display effective study habits, plan and monitor their time, and reflect on their success (Clark, 2012). According to Zimmerman (2002), this enhances student "self-satisfaction and motivation to continue to improve their methods of learning" (p. 66) and because of this increased motivation, self-regulated students are more likely to view their futures optimistically and to succeed academically. This is due in part because rather than basing their confidence on how much they have studied, self-regulated learners stop studying when they think their goals will be accomplished (Isaacson & Fujita, 2006). However, to foster self-regulatory behavior, students must be active participants in open-ended assignments that allow them to independently regulate their efforts (Barak, 2010; Clark, 2012).

When used thoughtfully and intentionally, Web 2.0 technologies (technologies that allow people to interact, collaborate, create and share with others) can foster an active and social learning style where students are co-producers in their learning (McLoughlin & Lee, 2010). For example, social media can be used to create personal learning environments that can foster

self-regulated learning through collaboration and personal information management (Dabbagh & Kitsantas, 2012). In addition, tools such as Skype, wikis, blogs, and social networking sites (such as Facebook) can all aid in self-regulating processes such as self-evaluation and help seeking. While students might be proficient with using Web 2.0 tools in their personal life, they often lack the knowledge and skills to use this same tool in an academic setting (McLoughlin & Lee, 2010). This was shown in a study by ECAR (Smith, 2009) that revealed that about two thirds of the college students surveyed indicated that their instructors did not provide adequate training on the technology needed for their coursework (Kitsantas & Dabbagh, 2011). Therefore, it is important that students have the necessary tools and training to synthesize information from multiple sources (Kauffman, Zhao, & Yang, 2011). These issues indicate that not only do instructors need to be informed about the benefits of Web 2.0 technologies but they also need to learn about how to effectively use them in their teaching.

Description of selected important works

Despite the push for active and student-centered learning, formative assessments and feedback continue to be dominated by the teacher (Nicol & Macfarlane‐Dick, 2006). This view of formative assessments does not help to develop the self-regulation skills needed to prepare students for the real world as the students are not required to set goals, evaluate their performance or reflect on their learning. Nicol and Macfarlane-Dick (2006) proposed seven principles for good feedback practice. They stated that good feedback should clarify performance goals, develop reflection, deliver high quality information to students about their learning, encourage teacher and peer dialogue, encourage positive motivational beliefs, provide opportunities to close the gap between current and desired performances and provide information

to the teacher to help shape their teaching. While many of these practices can be executed without technology, the correct technology can aid and enhance their efficiency and effectiveness.

E-portfolios (collections of evidence representing what a person or organization has learned over time and designed for an audience) can be used for reflection, planning, synthesizing, sharing, discussion and more. Alexiou and Paraskeva (2010) conducted a three phase study on e-portfolios. Their experimental procedure consisted of three phases that were based on Zimmerman's (2002) cyclical model of self-regulation: forethought, performance control and self-reflection. First, the students started with goal setting and planning. Next, they entered the performance phase where they gathered information that was used to evaluate the effectiveness of their planning. Finally, the students reflected on their self-monitored information and evaluated their performance. Through qualitative and quantitative data, the authors concluded that by providing scaffolding, e-portfolios had a positive effect on student learning by enhancing the self-regulated learning skills of goal setting and reflection.

Kauffman, Zhao, and Yang (2011) showed how technology can aide in note taking by allowing students to successfully synthesize information from multiple sources. In their study, they designed an experiment to investigate how different note taking methods (conventional, outline and matrix) affects self-monitoring. The results of their experiment indicated that structured, online note taking tools resulted in more complete notes and better student achievement. In addition, they also found that self-monitoring prompts lead to an increase in note taking and academic performance regardless of which note taking method was used.

Conclusion

How this work is informed by the work of others

The research clearly shows the benefits of self-regulated learning (increased motivation, satisfaction, and academic performance) and it is beginning to show how various technologies can help students self-regulate. However, over half the authors concluded by calling for more research and further investigation on how technology can aid self-regulated learning. Educators need practical advice and clearly defined technologies that they can easily use in their own classroom to enhance their students self-regulation. Therefore, I would like to pursue how specific technologies can be used to meet Nicol and Macfarlane-Dick's (2006) seven principles for good feedback practice. While there is no one-size-fits-all piece of technology, looking into the use of Web 2.0 technologies is a good place to start. Finally, this review has helped to guide my own research plan. My original plan was centered around gathering data with self-reported Likert scale questionnaires. However, the research noted that behavioral data might provide less bias and error than self-report data (Bernacki, Byrnes, & Cromley, 2012). Therefore, while I still plan to gather data from surveys, I also plan to carefully observe how the students are interacting with technology and how it appears to affect their self-regulation.

Research Plan

Methods

My research seeks to answer the question how can teachers best encourage and support self-regulated learning in their students through the use of current technologies combined with sound pedagogy in an effort to shape learners who are motivated and able to readily assess the available information in any situation to make well informed decisions? To answer this question, a quasi-experimental design will be used where one classroom of chemistry students will use certain technologies to aid their learning while another chemistry classroom will use alternate, non-technological methods. Surveys and student interviews will then be conducted to gather data from both groups. The analysis of this data will allow for a comparison of the impact on self-regulated learning between the instruction with and without the technology.

Sample

While this research question can apply to learners of all ages, I am specifically interested in studying self-regulated learning in the high school where I teach. More specifically, my sample will include sophomores and juniors who are taking general chemistry. While there are currently six sections of this chemistry class, I only teach one section as does another teacher. A third teacher teachers four sections. I chose chemistry students because I have easy access to them and can compare my 8th hour class of 25 students with that of my co-worker's 25 students in 2nd hour. Since both of us only teach one chemistry class, other classes and teachers will not be affected by this study. Also, including the other teacher's four chemistry sections would generate too much data at this point. Finally, sophomores and juniors are an ideal age as they

already know the ropes of high school but they have not yet developed the lazy-inducing condition of senioritis.

Study Design

Having access to 2nd hour and 8th chemistry will allow me to set up a quasi-experimental design where I can compare the impact of using certain technologies with sound pedagogy in my classroom with the lack of these technologies in the other chemistry teacher's classroom. While this quasi-experimental design has the potential to introduce extra (uncontrolled) variables as all teachers are different, I have taught with the other chemistry teacher for nine years and I am very familiar with how she teaches. In addition, over the past three years we have developed a chemistry professional learning team (PLT) and through this, we have invested a significant amount of time in standardizing all the chemistry classes. We now carry out identical plans on a daily basis which also includes the use of common formative and summative assessments. This collaboration among the chemistry teachers and uniformity among the chemistry classes will allow a fair test of the effects of technology on self-regulated learning.

Data Sources

Surveys and interviews will be used to acquire data. Each student will fill out a brief survey (similar to the Academic Self-Regulated Learning Scale or The Motivated Strategies for Learning Questionnaire) asking them to reflect on their learning by indicating their level of planning, monitoring, and evaluating. Possible survey questions include: "How much of an opportunity did you have to think about and get your questions answered?", "As you prepared for this assessment, how aware were you regarding which topics you needed to spend more time on?" and "If you needed more practice on a topic, how likely were you to know where to look?"

I plan to use a Likert scale to gather this data because it will enable me to quantify the results and thus assess the statistical significance of the data. In addition, a survey is also a practical way to gather data from 50 busy high school students. At the end of the survey, students will be asked to state their confidence level as well as predict their score both before and after taking an assessment (but before receiving their score). Following an assessment, a sub-group of students will be interviewed using a semi-structured protocol which will allow me to hear what they have to say regarding how the technology/pedagogy or the other non-technological alternative helped them to self-regulate. For example, I will ask the students in each group about how and why a specific tool helped them plan and prepare for the assessment. In addition, I will ask them about their confidence prior to the test and what either caused or prevented a high level of confidence. An Excel spreadsheet will be used to draw a random sample of students from each group of 25. By reducing the total number of students to ten, I can spend more time during the interview process and extract richer data.

Procedure

First, I need to talk with my colleague about controlling this research. My chemistry class will incorporate additional technology while the other chemistry class will continue as normal. We will attempt to keep all other aspects of the class controlled. Next, both of us will teach the current unit. My students will document their learning on a blog that is shared with their classmates. Among other things, they will record their thoughts, pose questions, and respond to discussion prompts. Due to the sharing nature of blogging, they will be expected to view and respond to some of their classmates posts. The other class will document their learning in a notebook. They too will record their thoughts, pose questions and respond to discussion prompts.

In addition, my class will use a learning management program called Edify to break down the formative assessment data into individual learning targets while the other class will receive the same formative assessments through traditional pencil and paper methods. By automatically receiving the learning target data, the students in my class will be able to better evaluate their learning and set appropriate goals. Finally, towards the end of the unit, my class will use a WIKI as their review sheet allowing them to gather and share resources and information. As they search for and select resources, they will need to evaluate the effectiveness of the various resources. This WIKI will also allow my students to reflect on their knowledge as they attempt to help other classmates. The other class will have a traditional paper review sheet.

At the end of the unit, when it becomes time to take the summative assessment, I will ask all the students to complete their survey and predict their assessment score. After taking the assessment (but before receiving their grade) they will again predict their score. Finally, after the summative assessment has been graded and returned, I will conduct interviews with five students from each class. This semi-structured interview will try to discover why students responded to the survey the way that they did and it will ask the students about the role of blogging, Edify, and WIKI's (or notebooks, quizzes and review sheets) in their learning.

Data Analysis

The results from the survey will be analyzed by first calculating the average response on each Likert scale question as well the student confidence level before and after taking an assessment. A side-by-side bar graph of these average responses (that includes the SEM) will provide a visual summary of the data. The averages of each question between groups will also be compared by using a t-test to determine whether or not the differences between groups are

significant. These results will hopefully show whether or not technology makes a difference in self-regulated learning. If students who used the technology during the chemistry unit record higher levels of planning, monitoring, and evaluating, then a claim could be made that technology can support student self-regulated learning. In addition, as I read through and transcribe the interviews, I will code the data and rearrange it as categories and themes emerge. This data will provide deeper insight on how the students viewed learning with and without the technology and will help to decide whether or not the technology made a practical significance.

Works Cited

Alexiou, A., & Paraskeva, F. (2010). Enhancing self-regulated learning skills through the implementation of an e-portfolio tool. *Procedia-Social and Behavioral Sciences*, *2*(2), 3048-3054.

Barak, M. (2010). Motivating self-regulated learning in technology education. *International Journal of Technology and Design Education*, *20*(4), 381-401.

Bransford, J. L., Brown, A. L., & Cocking, R. R. (2000). How people learn: Brain, mind, experience, and school (Expanded Edition). Washington, DC: National Academy Press.

Bernacki, M. L., Byrnes, J. P., & Cromley, J. G. (2012). The effects of achievement goals and self-regulated learning behaviors on reading comprehension in technology-enhanced learning environments. *Contemporary Educational Psychology*, *37*(2), 148-161.

Clark, I. (2012). Formative assessment: Assessment is for self-regulated learning. *Educational Psychology Review*, *24*(2), 205-249.

Dabbagh, N., & Kitsantas, A. (2012). Personal learning environments, social media, and self-regulated learning: A natural formula for connecting formal and informal learning. *The Internet and higher education*, *15*(1), 3-8.

International Society for Technology in Education. (2016). *ISTE standards for students.*

Isaacson, R. M., & Fujita, F. (2006). Metacognitive knowledge monitoring and self-regulated learning: Academic success and reflections on learning. *Journal of Scholarship of Teaching and Learning*, *6*(1), 39-55.

Kauffman, D. F., Zhao, R., & Yang, Y. S. (2011). Effects of online note taking formats and self-monitoring prompts on learning from online text: Using technology to enhance self-regulated learning. *Contemporary Educational Psychology*, *36*(4), 313-322.

Kitsantas, A., & Dabbagh, N. (2011). The role of Web 2.0 technologies in self‐regulated learning. *New Directions for Teaching and Learning*, *2011*(126), 99-106.

Martinez, M. E. (2006). What is metacognition? *Phi Delta Kappan*, *87*(9), 696-699.

McLoughlin, C., & Lee, M. J. (2010). Personalised and self regulated learning in the Web 2.0 era: International exemplars of innovative pedagogy using social software. *Australasian Journal of Educational Technology*, *26*(1), 28-43.

Mullis, J. (2009). Career planning the second time around. *Occupational Outlook Quarterly, 53*(2), 12-15.

Nicol, D. J., & Macfarlane‐Dick, D. (2006). Formative assessment and self‐regulated learning: A model and seven principles of good feedback practice. *Studies in higher education*, *31*(2), 199-218.

Paris, S. G., & Paris, A. H. (2001). Classroom applications of research on self-regulated learning. *Educational psychologist*, *36*(2), 89-101.

Smith, S. D., Salaway, G., and Caruso, J. B. (2009). *The ECAR study of undergraduate students and information technology*. EDUCAUSE Center for Applied Research. Available from: www.educause.edu/ecar

Zimmerman, B. J. (2002). Becoming a self-regulated learner: An overview. *Theory into practice*, *41*(2), 64-70.

Annotated Bibliography

Alexiou, A., & Paraskeva, F. (2010). Enhancing self-regulated learning skills through the implementation of an e-portfolio tool. *Procedia-Social and Behavioral Sciences*, *2*(2), 3048-3054.

E-portfolios (collections of evidence representing what a person or organization has learned over time and designed for an audience) are an emerging Web 2.0 technology that can be used for reflection, planning, synthesizing, sharing, discussion and more. Educators believe that e-portfolios can allow students to become active, independent and self-regulated learners. Due to the push for the personalization of learning, it is important that learners are able to customize their e-portfolios thus creating a sense of ownership. Fortunately, thanks to rapidly evolving technology, there are many options for e-portfolios. This research uses a correlational method where 41 students from a computer science class were voluntarily assigned to the e-portfolio tool. A questionnaire was given before the project. The experimental procedure consisted of three phases based on Zimmerman's (2000) cyclical model of self-regulation: forethought, performance control and self-reflection. After the cycle, students had to complete three rubrics of self-assessment. Based on quantitative and qualitative data, the authors conclude that e-portfolios have some positive effects on student learning by providing a scaffold while also enhancing students self-regulated learning skills. However, due to the small sample size, more research should be conducted.

Barak, M. (2010). Motivating self-regulated learning in technology education. *International Journal of Technology and Design Education*, *20*(4), 381-401.

This article is a secondary data analysis that proposes a model for self-regulated learning in technology education by focusing on three dimensions - cognition, metacognition, and motivation as well as discussing how technology can aid in problem solving and creativity. To foster students' self-regulatory behavior, they must be engaged in open-ended assignments. However, students need support. Teaching the students strategies for creativity in problem solving can help improve their ability to monitor their own thinking, reflect on their learning and increase their self-efficacy beliefs. Technology education can provide a great platform for fostering self-regulatory behavior as students often have a personal connection to technology issues. The author concludes that more research is needed about metacognition in technology class as well as how teachers' pedagogical content knowledge can foster cognition, metacognition and motivation in technology education.

Bernacki, M. L., Byrnes, J. P., & Cromley, J. G. (2012). The effects of achievement goals and self-regulated learning behaviors on reading comprehension in technology-enhanced learning environments. *Contemporary Educational Psychology*, *37*(2), 148-161.

"More recent studies of self-regulated learning tend to employ event-based measurement strategies in the form of trace methodologies (Winne, 2006) and think-aloud protocols (e.g. Greene & Azevedo, 2009). These methods capture SRL strategies as they are being employed, which both Zimmerman (2008) and Winne (2010) suggest provide heightened authenticity in their identification of strategy use" (p. 151). "Behavioral data is more robust against the bias and error associated with self-report data. If we can develop behavioral traces that reflect SRL strategies, our models of the learning process will support better investigations into the links between motivational constructs, learning behaviors and learning outcomes. It will be important to examine these relationships in additional learning environments, both in traditional classrooms where trace data can be collected and in multiple technology-enhanced learning environments where different task conditions (e.g. tool provision, task structure, domain, measures of learning) are present. Further investigation will allow us to determine the degree to which relations between achievement goals, learning behaviors and learning outcomes are robust across contexts or are dependent on features of a learning task" (p. 160).

Clark, I. (2012). Formative assessment: Assessment is for self-regulated learning. *Educational Psychology Review*, *24*(2), 205-249.

This article is a secondary data analysis that looked at 199 sources related to assessment, motivation, and learning. The purpose of the research is to discuss how formative assessments can reinforce self-regulated learning and how it is in line with Bandura's (1986) Social Cognitive Theory. The article concludes that formative assessments can make thinking processes transparent.
"Self-regulated students hold a strong sense of self-efficacy which supports the acquisition of effective study habits: they plan and monitor time; structure a productive work environment; and use social resources effectively" (p. 241). "When students are engaged as active participants in their own learning progression they believe that they are capable learners who use goal setting strategies and independently regulate their efforts as they apprehend desired outcomes" (p. 242).

Dabbagh, N., & Kitsantas, A. (2012). Personal learning environments, social media, and self-regulated learning: A natural formula for connecting formal and informal learning. *The Internet and higher education*, *15*(1), 3-8.

This article is a secondary data analysis that looks at the research that supports the claim that a personal learning environment can support self-regulated learning. In addition, the authors

provide a pedagogical framework for using social media to create personalized learning environments that support self-regulated learning. In today's world, learners are becoming more active participants in their learning as learning becomes more personalized. Learning in the context of social media can be highly motivational yet most higher education institutions still rely on traditional learning management systems that do not allow for any personalization of the activities or networking. Personal learning environments however, can foster self-regulated learning by using social media to manage personal information, collaborate, and aggregate the information obtained (a three-tiered framework). Since this has not been tested empirically, research studies need to be designed to track which self-regulated learning strategies most influence students' personal learning environments.

International Society for Technology in Education. (2016). *ISTE standards for students.*

Empowered Learner: 1a. Students intentionally set learning goals, apply strategies to meet them and use technology tools to reflect on their learning.

Isaacson, R. M., & Fujita, F. (2006). Metacognitive knowledge monitoring and self-regulated learning: Academic success and reflections on learning. *Journal of Scholarship of Teaching and Learning*, *6*(1), 39-55.

This article describes a correlational research method that looks at the relationship between metacognition, self-regulated learning and academic success. 84 students in an educational psychology course took weekly objective tests paired with a questionnaire for each test. Part of the questionnaire was given prior to the test and focused on how much they studied, their goal and their confidence of success. After taking the test, they finished the questionnaire by predicting their score and their confidence level. While the test contained 40 questions, students only had to choose 30 of them. However, the questions had different difficulty levels so the the overall points earned depended on both the questions chosen and the accuracy of the answers. The results indicate the students who employ metacognitive knowledge monitoring are better able to predict their performance, do not tie their confidence to the number of hours studied and are able to choose more difficult questions. These students stop studying when they believe they will achieve their goal. Further study is encouraged to explore the relationship between metacognitive awareness and learning when higher level thinking is required.

Kauffman, D. F., Zhao, R., & Yang, Y. S. (2011). Effects of online note taking formats and self-monitoring prompts on learning from online text: Using technology to enhance self-regulated learning. *Contemporary Educational Psychology*, *36*(4), 313-322.

Web based learning has risen sharply over the past decade. However, many instructors believe that online instruction fails to produce the same level of learning outcomes as face-to-face due to the large amount of information that students must process in the absence of instructional support. Therefore, it is important that students have the necessary tools and training to synthesize information from multiple sources. The research used a quasi-experimental method to investigate how different note taking methods (conventional, outline and matrix) affects self-monitoring. Two experiments were conducted. Experiment 1 took 30 students from five sections of a psychology course and randomly assigned them to the three different note-taking groups. The pre-experimental survey indicated that the three groups were similar in many respects (age, knowledge of the topic, class standing, etc). The groups were given a 1998 word text and instructed to gather a list of important information. On day one, the students logged onto the computer, read the text and took notes using their assigned tool. Four days later, they came back and had 15 minutes to study their notes prior to the post test.
Experiment 2 expanded the procedure by including the use of self-monitoring prompts. This is important because very little research has explored how teachers can encourage metacognition during note taking. Experiment 2 began with 119 students divided into the three note taking groups. A second factor was the absence or presence of self-monitoring prompts (half the students received prompts that encouraged them to monitor their progress). The results of experiment 1 indicated that structured note taking tools resulted in more complete notes and better student achievement. Experiment 2 confirmed these results and also found that self-monitoring prompts lead to an increase in notes and performance regardless of which note taking method was used.

Kitsantas, A., & Dabbagh, N. (2011). The role of Web 2.0 technologies in self-regulated learning. *New Directions for Teaching and Learning*, *2011*(126), 99-106.

This article is a secondary data analysis about how Web 2.0 technologies (technologies that allow people to interact, collaborate, create and share with others) can aid self-regulated learning but only if both the student and instructor have adequate training. Some research has suggested that Web 2.0 technologies have the potential to promote self-regulated learning. Tools such as Skype, wikis, blogs, and social networking sites (such as Facebook) can all aid in self-regulating processes such as self-evaluation and help seeking. However, there is very little research on this topic. In addition, students often find it a challenge to separate the use of Web 2.0 technologies in their personal, social and academic contexts. A study by ECAR also revealed that about two thirds of the college students surveyed indicated that their instructors did not provide adequate training on the technology needed for their coursework. These issues indicate that not only do instructors need to be informed about the benefits of Web 2.0 technologies but they also need to learn about how to effectively use them in their teaching.

McLoughlin, C., & Lee, M. J. (2010). Personalised and self regulated learning in the Web 2.0 era: International exemplars of innovative pedagogy using social software. *Australasian Journal of Educational Technology*, *26*(1), 28-43.

When used appropriately, Web 2.0 technologies can shift control from the teacher to the learner. In addition, these social software technologies often promote the development of 21st-century skills such as communication skill, sharing, collaboration and networking. Through the use of secondary data analysis, this article argues that for self-regulated learning to occur, students not only need to be able to choose and personalize the necessary technology tools but they also need adequate scaffolding to support them. While students might be proficient with using Web 2.0 tools in their personal life, they often lack the knowledge and skills to use this same tool in an academic setting. Therefore, increased scaffolding is needed as well as sound pedagogical strategies. Web 2.0 technologies foster an active and social learning style where students are co-producers in their learning. This differs greatly from the controlled and passive culture of traditional education therefore more research is needed in this area.

Nicol, D. J., & Macfarlane‐Dick, D. (2006). Formative assessment and self‐regulated learning: A model and seven principles of good feedback practice. *Studies in higher education*, *31*(2), 199-218.

This article is a secondary data analysis that looks at the research of formative assessments and feedback within a model of self-regulated learning. Despite the push for active and student-centered learning, formative assessments and feedback continue to be dominated by the teacher. While students have been given more responsibility for their learning, they have not been given increased responsibility when it comes to assessments which does not favor student self-regulation or motivation. In addition, as class sizes become larger and larger, this teacher dominated method of formative assessment is becoming more difficult to manage. Therefore, the current methods of feedback need to be re-examined. The article builds upon prior research to provide a model of self-regulation and internal feedback and includes seven principles of good feedback. Each of the seven principles is followed by the rationale, associated research, and strategies that teachers can use to facilitate self-regulation. While these principles are a starting point, more research is needed to refine them, identify gaps and gather more evidence about the potential of formative assessments and feedback to support self-regulated learning.

Paris, S. G., & Paris, A. H. (2001). Classroom applications of research on self-regulated learning. *Educational psychologist*, *36*(2), 89-101.

“SRL is also more likely when teachers create classroom environments in which students have opportunities to seek challenges, to reflect on their progress, and to take responsibility and pride

in their accomplishments" (p. 99). "Students of all ages can benefit from analyses and discussions of strategies for learning" (p. 99). "Teachers need to be able to describe appropriate strategies—what they are, how they operate, and when they should be applied—and be able to lead discussions so that students can explore their understanding about how they learn" (p. 99). "Second, teachers can design open-ended instructional activities and scaffold assistance for student inquiry. Less emphasis should be placed on workbook exercises and routine tasks and more emphases should be placed on working together to guide students to more effective approaches to learning. Third, teachers can minimize objective tests (e.g., multiple-choice tests, true–false tests), competitive test scores, and public comparisons of performance which detract from students' sense of efficacy and mastery. Projects, portfolios, and performance assessments can motivate students, provide opportunities for SRL, and enhance creative expression" (p.99).

Zimmerman, B. J. (2002). Becoming a self-regulated learner: An overview. *Theory into practice*, *41*(2), 64-70.

Self-regulated learning "is the self-directive process by which learners transform their mental abilities into academic skills. Learning is viewed as an activity that students do for themselves in a *proactive* way rather than as a covert event that happens to them in reaction to teaching. Self-regulation refers to self-generated thoughts, feelings, and behaviors that are oriented to attaining goals (Zimmerman, 2000)" (p. 65). "This enhances their self-satisfaction and motivation to continue to improve their methods of learning. Because of their superior motivation and adaptive learning methods, self-regulated students are not only more likely to succeed academically but to view their futures optimistically" (p. 66). "Self-regulation is important because a major function of education is the development of lifelong learning skills. After graduation from high school or college, young adults must learn many important skills informally" (p. 66). "learning psychologists view the structure of self- regulatory processes in terms of three cyclical phases. The forethought phase refers to processes and beliefs that occur *before* efforts to learn; the performance phase refers to processes that occur *dur- ing* behavioral implementation, and self-reflection refers to processes that occur *after* each learning effort" (p. 67). "Research on the quality and quantity of students' use of self-regulatory processes has revealed high correlations with academic achievement track placement as well as with performance on standardized test scores (Zimmerman & Martinez-Pons, 1986)" (p. 69). "Although research findings strongly support the importance of students' use of self-regulatory processes, few teachers effectively prepare students to learn on their own (Zimmerman, Bonner, & Kovach, 1996). Students are seldom given choices regarding academic tasks to pursue, methods for carrying out complex assignments, or study partners. Few teachers encourage students to establish specific goals for their academic work or teach explicit study strategies. Also, students are rarely asked to self-evaluate their work or estimate their competence on new tasks. Teachers seldom assess students' beliefs about learning, such as self-efficacy perceptions

or causal attributions, in order to identify cognitive or motivational difficulties before they become problematic" (p. 69). "In an era when these essential qualities for lifelong learning are distressingly absent in many students, teaching self-regulated learning processes is especially relevant" (p. 70).