International Journal of Teaching and Learning in Higher Education 2016, Volume 28, Number 1, 75-93
http://www.isetl.org/ijtlhe/ ISSN 1812-9129

Investigating Postsecondary Self-Regulated Learning Instructional Practices: The Development of the Self-Regulated Learning Observation Protocol

Leah D. Hoops and Shirley L. Yu
The Ohio State University

Qianqian Wang
Houston Independent School District

Virginia L. Hollyer
University of Houston

Promoting students' self-regulated learning (SRL) is one way to improve postsecondary student success. However, few studies have investigated the instructional practices of postsecondary instructors that may support students' SRL. This study sought to fill this gap. An undergraduate mathematics course was observed to determine instruction utilized in classrooms that could influence students' SRL. Results showed that instructor references were made to four areas of SRL: (a) cognition; (b) motivation and affect; (c) behavior; and, (d) context. The majority of references concerned cognition and fewer messages addressed motivation. Findings are discussed in terms of postsecondary instructional practices that may foster students' SRL. This project is significant because it developed an observation protocol to assess instructional practices that may support college students' SRL in specific college courses: the Self-Regulated Learning Observation Protocol (SRLOP).

As postsecondary outcomes have increasingly become a national area of concern, a focus on instructional practices in higher education has also surfaced (Altbach, 2011). Failure rates in undergraduate mathematics core courses, in particular, have remained high (Gupta, Harris, Carrier, & Caron, 2006). For example, only 40 to 60% of students successfully pass college precalculus nationwide (Olson, Cooper, & Lougheed, 2011). The high attrition rates in college Science, Technology, Engineering, and Mathematics (STEM) courses have prompted politicians and educators alike to focus on refining STEM pedagogy (McCray, DeHaan, & Schuck, 2003; Olson et al., 2011).

One approach to increasing postsecondary success rates is by teaching students how to become more effective self-regulated learners. Self-regulated learning (SRL) is the proactive process through which students become masters of their own learning and performance (Pintrich, 2004). Self-regulated learners take initiative in their education and persevere, constantly adapting to their learning environments and tasks at hand (Zimmerman, 2002). Becoming a more persistent self-regulated learner could especially benefit students in historically challenging undergraduate STEM courses, such as mathematics. SRL is viewed as controllable and unstable (Pintrich, 2000, 2004); therefore, college students' SRL practices can be influenced by classroom instructional practices.

Theoretical Framework

For this project, we adopted Pintrich's (2000; 2004) model of SRL which proposes a framework for classifying four areas of learning that students can regulate: (a) cognition; (b) motivation and affect; (c) behavior; and, (d) context. Although there are currently several other models of SRL that propose different constructs and mechanisms involved in the learning process (e.g., Boekaerts, 1996, 1999; Greene & Azevedo, 2007; Winne & Hadwin, 1998, 2008; Zimmerman, 2000), Pintrich's model was selected as a framework because it focuses on specific aspects of learning that students can be taught to control. In particular, Pintrich's SRL model includes context, a category exclusively dedicated to students' learning environment (i.e., one variable of particular interest in this study). Each of the four areas of SRL will be described in more detail below including strategies instructors can use to foster students' SRL for their courses.

Cognition

The first area of learning that students can regulate concerns techniques that students use to process information or perform a learning task, such as metacognitive strategies (Pintrich, 2000). There are many types of cognitive strategies that have been taught to college students through various methods such as rehearsal, elaboration, and organization (Hofer, Yu, & Pintrich, 1998). Elaborative and organizational strategies, such as concept mapping, have been shown to result in deeper understanding of learned material (Hofer et al., 1998). It is well-established that cognitive regulation is essential to deep and meaningful learning (Winne & Hadwin, 1998). There are many ways that instructors can promote students' cognitive regulation. For example, teachers could encourage students to use specific strategies to learn or perform a task, prompt students to monitor their level of understanding or gauge students' understanding themselves, or prepare students to learn new information.

Motivation and Affect

In addition, motivation and affective components play a key role in SRL (Pintrich, 1999, 2000; Zimmerman & Schunk, 2007). Students can regulate their motivation and affect just as they are able to regulate and monitor their cognition (Pintrich, 2004; Wolters, 1998, 2003). Motivation plays an especially important role in SRL because learners will not use self-regulatory strategies if they are unmotivated to do so (Zimmerman, 2000). Moreover, measures of achievement motivation have been shown to predict college students' academic performance above other aspects of students' SRL and ability levels (Robbins, Lauver, Le, Davis, Langley, & Carlstrom, 2004). Students' interests (see Hidi & Renninger, 2006) as well as expectancies and values (see Eccles, 2009) are critical components of their achievement motivation. To foster students' motivation in the classroom, college instructors could point out the usefulness of learning tasks so that students are motivated to engage with course material. Moreover, students who feel that their instructors are interesting are more likely to attend class (Gump, 2004); therefore, instructors could focus on sparking their students' situational interest by using humor.

Behavior

Behavioral aspects of SRL reflect the effort that students put into learning tasks, including help-seeking and time management (Pintrich, 2000). Students must engage in activities to purposely activate, foster, and sustain the learning process. Academic help-seeking, can be advantageous in improving students' understanding and achievement (Pintrich, 2000). Help-seeking behaviors include utilizing the various learning resources and supports on campus, such as learning centers and course review sessions. Time management behaviors, such as creating study schedules, help direct the learning process and are typically emphasized in SRL interventions (Hofer et al., 1998; Pintrich, 2000, 2004). Effective self-regulated learners actively engage in behaviors, such as help-seeking and time management, that help students reach their academic goals. Postsecondary instructors can encourage students to engage in these types of behaviors outside of the classroom or promote positive behavioral regulation during normal instruction. For example, an instructor could suggest that students visit the campus tutoring center to receive help on challenging assignments or scaffold students' use of time on in-class learning tasks.

Context

Finally, the contextual or environmental area of SRL involves external aspects specific to the learning task, such as classroom settings or rules of an assignment (Greene & Azevedo, 2007; Lodewyk, Winne, & Jamieson-Noel, 2009; Pintrich, 2000, 2004; Zimmerman, 1989). All learning occurs in a contextual setting; therefore, students must utilize specific strategies to monitor, alter, and control their learning environments. Although students may be unable to control their instructors' teaching styles or the content of their assignments, they can manage certain aspects of their learning environment (Pintrich, 2004). The area of context is not completely "self"-regulated because much of students' learning tasks and environments are external and beyond their control; however, context is considered an area of SRL because students do have some control over how their learning environments are structured. In addition, academic content, such as instructor feedback and assessment tasks, serves as an agent in students' SRL processes (Nicol & Macfarlane-Dick, 2006; Perry & Rahim, 2011). Instructional scaffolding of learning tasks can help students regulate their cognition, motivation and affect, and behavior.

Postsecondary Self-Regulated Learning

Because the majority of postsecondary learning takes place outside of the classroom (Hofer et al., 1998; Pintrich, 2004), college students must learn to effectively regulate their own learning processes in order to perform well in their courses. Although SRL skills are critical to postsecondary success (Hofer et al., 1998), many college students are not effective self-regulated learners (Bembenutty, 2008). Students often rely on the external support of their teachers through secondary schooling to direct their learning processes and find managing collegial coursework to be challenging (Boeakarts, 1999). Moreover, introductory undergraduate courses, such as mathematics, are often taught in large lecture halls (McCray et al., 2003; Olson et al., 2011) where instructors are unable to provide students with the individualized feedback and scaffolding that learners received through secondary education. In large lecture courses where instructors rarely are able to interact directly with their students, learners bear an even larger responsibility in monitoring and controlling how much they learn. As noted by Meyer and Turner (2002, p. 19), "co-regulation between a teacher and twenty-some students with varying needs and competencies is highly complex in whole-class instruction." If co-regulation is complex in a classroom of twenty-some students, imagine how complicated it can be in a large undergraduate lecture hall containing hundreds of students. Therefore, it is of particular importance that students be taught to effectively self-regulate their own learning in large courses in order to successfully master the complex material.

Literature Review

Postsecondary Self-Regulated Learning Instruction

Student success courses. Many formal instructional interventions, such as Student Success Courses, have been designed to help college students become better self-regulated learners (Wolters & Hoops, 2015. Student Success Courses (SSCs) teach students theory and strategies of SRL to help students achieve academic success. These courses have proven successful in increasing students' SRL behaviors (e.g., Forster, Swallow, Fodor, & Foulser, 1999; Hofer & Yu, 2003; Hoops, Yu, Burridge, & Wolters, 2015; Petrie & Helmcamp, 1998), grades (e.g., Bail, Zhang, & Tachiyama, 2008; Tuckman, 2003; Tuckman & Kennedy, 2011; Weinstein, 1994), retention (e.g., Forster et al., 1999; Lipsky & Ender, 1990; Tuckman & Kennedy, 2011), and graduation rates (e.g., Bail et al., 2008; Schnell, Louis, & Doetkott, 2003; Tuckman & Kennedy, 2011; Weinstein, Dierking, Husman, Roska, & Powdrill, 1998).

Integrated approach to strategy instruction. The SRL strategies taught in SSCs can also be integrated into traditional academic course curriculum (Hofer et al., 1998; Weinstein, Acee, & Jung, 2011); an integrated approach to SRL instruction can help students thrive in demanding college courses by providing learners with the tools to self-regulate their study habits for a particular course. Embedding strategy instruction into normal course curriculum increases the likelihood that students will apply the strategies they have learned to the material they are currently learning (Hofer et al., 1998). Additionally, the integrated approach to SRL instruction can be particularly helpful to less-proficient self-regulated learners (Barrie, 2007; Cornford, 2002; Weinstein, Tomberlin, Julie, & Kim, 2004). Therefore, investigating instructors' natural integrated approaches to SRL instruction could help researchers understand how and if current postsecondary classroom climates are conducive to fostering students' SRL behaviors.

Observing Self-Regulated Learning Instructional Practices

Although self-reports are the primary tools used to measure SRL (Perry & Rahim, 2011), it has long been argued that self-report data alone are insufficient for understanding the complexities of SRL in real contexts such as classrooms (Perry & Rahim, 2011; Perry & Winne, 2006; Winne, Jamieson-Noel, & Muis, 2002; Winne & Perry, 2000). According to Meyer and Turner (2002), researchers must study the contexts in which students' SRL develops in order to better understand self-regulatory processes in general. Because SRL supports and is supported by social forms of learning, such as within a classroom (Perry & Rahim, 2011), qualitative methods are well-suited to explore the relationship between teaching and learning during instruction (Meyer & Turner, 2002). Additionally, because SRL is a multi-dimensional construct (Perry & Rahim, 2011; Winne, 2011), qualitative methods, such as classroom observation, are suitable ways to explore SRL within educational environments. Studies examining teachers' instructional practices that support students' SRL have mostly been conducted exclusively in K-12 classroom settings.

Scaffolding elementary self-regulated learning in math class. Meyer and Turner (2002) have utilized qualitative methods to investigate instructors' scaffolding of elementary students' self-regulation development. The researchers utilized discourse analysis to record and code classroom observation data of teacher-student interactions during whole-class math lessons. Teachers' scaffolding comments were coded under three categories: (a) student understanding; (b) autonomy; and (c) positive classroom climate. Non-scaffolded responses were coded as either teacher-controlled or nonsupportive motivational or socioemotional. Finally, code proportions were calculated for each classroom by lesson and total instruction time observed. Discourse patterns were compared to understand how instructors could scaffold students' self-regulation during normal classroom instruction.

Promoting students' self-regulated learning through classroom structure. Perry and colleagues have also made advancements in investigating contextual aspects that support SRL development in the classroom through qualitative methods. Much of Perry's work has sought to understand how classroom features promote or constrain children's SRL development and engagement in a variety of classroom environments (Perry & Rahim, 2011). Through observation and interviewing, her work has focused on teachers' speech and behaviors that promote SRL and how students respond to such promptings. During classroom observations, an instrument was used to collect three types of information: (a) classroom; (b) teacher and students' speech; and, (c) high or low SRL environment (Perry, 1998; Perry, Hutchinson, & Thaurberger, 2007; Perry & VandeKamp, 2000; Perry, VandeKamp, Mercer, & Norby, 2002). Collecting the second type of information, teacher and students' speech, involved recording a running record of what occurred in the classroom. This often included teacher and student verbatim responses (Perry, 1998). During observation, observers recorded the times that student-teacher and student-student events took place. Based on running record observations, classrooms were designated as either high or low SRL-supportive (Perry, 1998).

Findings from this body of research have revealed that autonomy-supportive, structured classrooms that offer meaningful learning tasks for students to master over multiple sessions best promote children's' SRL engagement (Perry & Rahim, 2011). Specifically, elementary children were able to identify effective strategies students could use – or that they had used themselves – for self-regulating their writing (Perry & VandeKamp, 2000). Most students (78%) mentioned help-seeking strategies, such as seeking help from their teacher, parent, or peer if students were experiencing difficulties with a writing project. Additionally, 30% of students mentioned using strategies to persist in the face of difficulty, such as paying attention to the teacher or "try very, very hard" (Perry & VandeKamp, 2000, p. 839). Therefore, in elementary classrooms where instructors were observed explicitly promoting SRL practices, elementary children reported greater knowledge of and engagement in SRL.

Investigating classroom motivational climates. Additionally, a line of research investigating the impact of instructional practices on classroom motivational climates has been conducted utilizing the Observing Patterns of Adaptive Learning (OPAL; Patrick et al., 1997) protocol for classroom observations (e.g., Morrone, Harkness, D'Ambrosio, & Caulfield, 2004; Patrick, Anderman, Ryan, Edelin, & Midgley, 2001; Patrick & Ryan, 2008). The OPAL was designed "around narrative running records of teacher and student behavior observed during classroom instruction" (Patrick et al., 1997, p. 1). Researchers utilizing the OPAL recorded and coded observational data based on categories grounded in achievement goal theory (Patrick et al., 1997). Although this body of research was not focused on SRL instructional practices specifically, utilizing a running record observational approach guided by a specific theoretical framework is an appropriate method for evaluating SRL practices within a classroom context.

Purpose of Study

Although past research efforts have made great strides in investigating SRL-supportive instructional practices in K-12 classrooms, a critical need exists for studies that seek to understand contextual aspects of postsecondary classrooms that support students' SRL development. The purpose of this study was to investigate postsecondary instructional practices that may support students' SRL in an undergraduate mathematics course, specifically, precalculus. Understanding these instructional strategies can help educators identify pedagogies that contribute to student success in traditionally demanding college courses. This study contributes to research on SRL instruction in postsecondary education by examining an instructor's extant integrated teaching practices through observation. In this manner, we sought to discover which instructional practices, if any, were already in place that might influence students' SRL in courses with historically low success rates. To accomplish this task, the following research question was posed: What types of instructional practices are utilized in a college precalculus classroom that could influence students' self-regulated learning for the course?

Method

Participants

Participants were a university mathematics instructor, students enrolled in two sections of her undergraduate precalculus course (N = 645), and eight peer tutors at a large southeastern public research university. The observed instructor (who will be referred to as "Ms. Math" for the remainder of the article) was a female lecturer in the mathematics department who also taught courses for the natural sciences and mathematics teacher certification program at the university. Ms. Math had taught at the university for 10 years at the time of data collection; her instructional practices have been institutionally recognized by a university teaching excellence award. Although demographic data were not collected for the student participants, the university where the sample was taken is diverse with no ethnic majority. In 2012, university students reported their ethnicities as follows: African American (11%), Asian American (19%), Caucasian (32%), Hispanic (25%), International (9%), Multiracial (3%), and Other (1%). In addition, the reported mean age of undergraduate students was 22.5 years.

Observational Protocol and Data Collection

The Self-Regulated Learning Observation Protocol (SRLOP) was developed by the research team to investigate instructional practices in college classrooms that can support students' SRL for a particular course. Specifically, the SRLOP was designed to utilize in the undergraduate mathematics course studied. Although designing an observation protocol was not an original study objective, the instrument was created in order to answer our specific research question. Therefore, the framework that emerged is both a product and measure of this research project. The SRLOP is based on Pintrich's (2000, 2004) model of SRL and includes multiple categories of instructional practices that can influence students' SRL. The SRLOP coding structure categorizes observed teacher and students' behaviors and statements according to the four areas of learning that students can control (i.e., the four aspects of SRL):

(a) cognition; (b) motivation and affect; (c) behavior; and, (d) context. A description of the final SRLOP coding categories within these four areas will be presented with the results as they emerged and were refined throughout this research project.

The OPAL development process outlined by Patrick and colleagues (1997) strongly guided this project's observation process and the creation of the SRLOP. The protocol is both a product of a priori theory (i.e., Pintrich, 2000, 2004) and a grounded theory approach. During the first class of the fall 2011 semester, the first author observed one class of one section of Ms. Math's precalculus course with instructor consent. Enrollment in this course was 500 students, and it was taught in a large lecture hall; therefore, the researcher was able to observe unobtrusively by sitting in the back of the room. During the first class, the researcher recorded narrative running records of what occurred in the classroom, paying particular attention to comments the instructor made regarding students' SRL practices in the four areas of learning which were relevant to research interests. This observer made note of time throughout observation, documenting events in sequential order. This type of observational strategy is aligned with the method used by Perry and colleagues (Perry, 1998; Perry & VandeKamp, 2000; Perry et al., 2007; Perry et al., 2002); we chose this approach to get a sense of what naturally occurred in the classroom and how, or if, Ms. Math promoted students' SRL during class time.

The first author observed an additional class session during the second week of the semester to set the standard for data collection and to gain a fuller sense of Ms. Math's instructional behaviors. After the second observation was complete, a second observer (third author) with university teaching experience was trained on the observational protocol by the first author. All subsequent observations were conducted by the second observer for the duration of the semester. Because the observed course met twice a week, the second observer typically attended and collected data during both of the weekly class sessions. Over the duration of the fall semester, a total of 22 periods (33 hours) of classroom activity were observed and recorded.

During the third week of the semester, the presence of in-class peer tutors became a part of normal course procedures. Peer tutors were student staff at the university mathematics department's tutoring center. The tutoring intervention was implemented as part of an institutional and departmental effort to improve student success rates in STEM courses. Moreover, Ms. Math actively worked to incorporate student success initiatives, such as the peer tutoring program, into her classrooms. Tutors typically arrived to class 10 minutes into each class and positioned themselves around the lecture hall. Ms. Math gave in-class pop quizzes ("poppers") during most class sessions which students were asked to turn in at the end of class for a grade; if students needed help solving popper questions, they would raise their hands to solicit a tutor's help. Students could also raise their hands to receive help from tutors during Ms. Math's lectures. This in-class intervention was meant to provide more individualized help to students than is typically possible in large lecture courses.

At the beginning of the spring 2012 semester, the research team met to discuss the fall 2011 data and the themes that emerged from it. A final coding scheme was then developed based on the fall data and Pintrich's (2000, 2004) SRL framework that would be used to code the existing data and to guide future observations. In this manner, the categories within each of the four areas of SRL emerged from the data using the constant-comparison method utilized by grounded theory researchers; that is, we searched for "themes and patterns to build theory" (Glesne, 2011, p. 187) using constant case comparison.

The decision was then made to observe an additional unit of Ms. Math's precalculus course to (a) test and finalize the protocol, and (b) collect a reliable dataset to answer this project's original research question. The precalculus section observed during spring 2012 was much smaller than the previous section (i.e., less than 200 students). Because the in-class tutoring intervention was introduced partway through the semester as it was during the fall, a unit near the end of the semester was selected for data collection to gain insight into what happens during regular instruction time (i.e., at a time in the semester when both students, tutors, and instructor had settled into their "normal course routine"). Over the course of five weeks, the first and third authors alternated turns observing two consecutive class periods using the new protocol. This rotation schedule was designed so that each observer was able to observe sequential lessons in order to gain a better understanding of how the instructor stopped and started each lesson. A total of 11 hours of observation data (nine periods) were collected during the spring 2012 semester. After spring 2012 data collection was complete, the first and second author met to revisit the protocol and confirm the SRLOP categories before proceeding with data analysis.

Analysis of the Data

Once initial SRLOP categories were finalized, the first and second author independently analyzed the same class period of spring data (over 10% of the total observed spring unit) using NVivo 9 qualitative analysis software. The coders (i.e., first and second authors) were guided by a list of coding categories and descriptions designed collaboratively by the research team. Interrater reliability (% agreement) of coding decisions was then calculated for the double-coded data. Percentage agreement was chosen over kappa because the researchers developed the coding categories together. Therefore, it was deemed unnecessary to take chance of agreement into consideration since researchers should achieve agreement intentionally. After reaching consensus on all codes, the first author continued to analyze the remaining eight class periods of data independently.

Initial calculation of interrater reliability yielded high agreement (≥ 90%) agreement on the majority of coding categories (i.e., the most micro-level data under which data were able to be coded). To reach consensus, the coders discussed categories with lower agreement, revisiting the analyzed data together until 100% agreement was achieved. During the final coding process, additional coding classifications emerged further refining the SRLOP framework. Many of these new classifications resolved ambiguities in the original categories that led to low interrater reliability, helping to confirm the final observational framework and codes. Finally, the first and fourth authors met to complete a member check of final coding decisions. The fourth author ("Ms. Math") was selected for member check to promote higher internal reliability of the coded data (Glesne, 2011).

Results

A total of 405 statements or "chunks" of spring 2012 observation data were coded under the SRLOP framework. Of the four main SRL categories, the observed instructional practices of the mathematics professor during the final observed unit focused mostly on Cognition (42%), Behavior (29%), and Context (23%), with only 6% of all observed instruction concerning student Motivation and Affect. The final SRLOP included 12 major categories of SRL postsecondary instructional practices within the four areas of SRL (Cognition, $n = 4$; Motivation and Affect, $n = 2$; Behavior, $n = 2$; Context, $n = 4$).

Table 1 displays the percentages of all SRL references made during the spring observation period arranged by SRLOP category. Appendix A includes a complete list of the final SRLOP categories including descriptions and examples of instructional references. SRLOP categories and subcategories are arranged first by area of SRL, then in alphabetical order. Appendix A serves as the final SRLOP framework and can be utilized by future researchers to observe postsecondary classrooms. All references in Appendix A are from the fall 2011 observation data that helped shape the protocol's framework. Instructional strategy results will be presented first by SRLOP categorization. Each category will be described and two examples will be given. Examples provided are from the spring 2012 observation period and have been edited to improve readability and preserve confidentiality of study participants.

Observed Cognition

The 169 cognitive references made by the instructor during the observed spring 2012 unit divided into four main categories as follows: Metacognition (40%), Test-Taking Strategies (29%), Information Processing Strategies (23%), and Advance Organizers (8%).

Metacognition ($n = 68$). References to students' metacognition included the instructor prompting students to engage in metacognitive processes, such as thinking about how to solve a problem or engage in a learning task. Metacognitive statements help students think about their cognitive processes and/or trigger them to do so. Of the 68 references made regarding Metacognition, 72% involved the instructor checking for students' understanding of lecture material and 28% involved her prompting students to think about how to solve a problem or engage with course content.

Example 1:
"Anyone have questions about how I manipulate the negative sign?"
Example 2:
"There are two answers to the question. However, let me ask you a question. What if the measure of the angle is 15, not 30?"

Test-Taking Strategies ($n = 49$). This category contained instances when Ms. Math mentioned specific strategies or resources that students could use while taking an assessment. It should be noted that all exams for this course were administered online via the department's computer lab testing center. Test-taking strategies included ways in which students should have used resources, such as sanctioned formula sheets, as well as cautions against poor test-taking strategies (i.e., specific things students should avoid doing while taking an assessment). The majority of the 49 references to Test-Taking Strategies concerned a formula link that students would need to utilize during the upcoming exam. Although the formulas were available to students via the link, Ms. Math made sure that students understood exactly how they should use the link during test-taking.

Example 1:
Ms. Math emphasizes the importance of the formula sheet and gives students instructions for using it during the next exam.
Example 2:
"Here is the formula sheet. Get to know it well...Here is the formula sheet that will be on the link."

Table 1
Instructional References to Self-Regulated Learning Arranged by SRLOP Categories

	References	
	N	%
SELF-REGULATED LEARNING TOTAL	405	100
Cognition	169	42
Metacognition	68	40
Test-Taking Strategies	49	29
Information Processing Strategies	39	23
Advance Organizers	13	8
Motivation and Affect	26	6
Value	18	69
Interest	8	31
Behavior	118	29
Help-Seeking	102	86
Time Management	16	14
Context	92	23
Student Responsibility	71	77
Task Difficulty	10	11
Instructor Feedback	7	8
Rules and Management	4	4

Note. Table 1 only reflects data collected during the spring 2012 semester. All percentages displayed represent each category's percentage of the largest category to which they belong. For example, the Cognition category represents 42% the total SRL references ($N = 405$); Metacognition represents 40% of the Cognition category ($n = 169$). Therefore, the total number of references displayed in the *N* column exceeds 405, the total number of SRL references.

Information Processing Strategies (*n* = 39). This category included instances Ms. Math mentioned a specific strategy that students could use to process information and/or taught students a strategy to help them learn the course material. These types of statements provide students with tools to process, understand, or display information. The 39 Information Processing Strategies alerted students to problem-solving "tricks" such as using substitution as a tool.

Example 1:
Ms. Math starts to work out the next example and explains to students a strategy they can use to solve the equation.
Example 2:
Ms. Math tells students the name of the strategy she is using to solve this equation (using the conjugate forms).

Advance Organizers (*n* = 13). The least-utilized cognitive reference made by the instructor, Advance Organizers, alerted students to what content would be covered in class that day. This area includes any time the instructor set the tone of the day's lecture by letting students know what content would be covered or prepared them to recognize and process the new material. These statements were usually made at the beginning of class.

Example 1:
"Let us get started now. Here we go. We are going to study algebra with identity."
Example 2:
"Today we are going to start test 4 materials."

Observed Motivation and Affect

The instructor utilized fewer instructional practices concerning aspects of students' achievement motivation ($n = 26$) relative to the other three areas of SRL. Motivational references fell into two basic categories as follows: Value (69%) and Interest (31%).

Value (*n* = 18). This motivational category included instances when the instructor highlighted the importance or usefulness of a task. These statements helped students know what their focus should be and how to better regulate their study time based on the significance of mastering certain tasks (i.e., spend more time studying concepts and tasks that will be well-represented on an exam or relevant to a future career). Ms. Math's statement regarding value were usually explicit (i.e., specific) and not simply ones in which students had to infer the importance of the task. These statements often included the word "important", transparently alerting students to the material critical to comprehend.

Example 1:
Ms. Math works out a problem and says, "This is important from an identity standpoint."
Example 2:
"Here is another one. This one is for engineering, math, and science majors."

Interest (n = 8). In the Interest category, the instructor triggered students' situational interest by making humorous remarks. This includes instances where the instructor gained students' attention by saying something funny, sharing a personal story, or making other types of remarks meant to spark or maintain situational interest.

Example 1:
"How many times is that now that I have mentioned the link? If any of you forget this, I will personally execute you!" The students laugh.
Example 2:
Ms. Math tells students that now is the time to ask questions because she won't be with them on the exam. She says that come exam time, she will be having cappuccino and knitting, and it would be really amazing if she could do that while giving them a review.

Observed Behavior

The 118 behavioral references divided into the two main behavior categories as follows: Help-Seeking (86%) and Time Management (14%).

Help-seeking (*n* = 102). This behavioral category included instances where students sought help during class by asking questions and statements Ms. Math made to address the giving or receiving of help. The majority of Help-Seeking references (98%) encouraged students to find assistance or involved students engaging in help-seeking activities during class, and only 2% referred students to resources where they could get help outside of the classroom. Also, most in-class help-seeking involved peer assistance rather than students seeking help from Ms. Math.

Example 1:
Ms. Math enters the classroom and begins to set up. She talks to a few students as she sets up who have questions.
Example 2:
Students communicate with each other to work out the problem.

Time management (*n* = 16). The second behavioral category included instances where the instructor made statements or suggestions regarding students' use of time to prepare for the course outside the classroom. Of the 16 Time Management promptings, 56% reminded students of course deadlines and 44% offered guidance for managing time spent on learning tasks. Ms. Math reminded students of course deadlines as well as institutional deadlines that impacted the course, such as add/drop dates. Time Management statements only comprised 4% of the total SRL references made by the instructor.

Example 1:
Ms. Math announces that homework is due Saturday, and homework is due today from Tuesday's lecture.
Example 2:
"Some of you may be saying, 'Oh my God, she's going so fast!' Yes, I am! I'm trying to speed you up so you don't take 30 minutes on the problems and then don't have time for the free response questions when you take the exam."

Observed Context

Finally, the 92 contextual references made during the observed spring 2012 unit fell into four categories as follows: Student Responsibility (77%), Task Difficulty (11%), Instructor Feedback (8%), and Rules and Management (4%).

Student responsibility (*n* = 71). This category included Ms. Math's statements regarding students' responsibility on evaluative tasks, such as exams, homework assignments, quizzes, and class discussion. Ms. Math frequently referenced students' responsibility in her class, and these comments comprised 18% of the total SRL references made during the academic unit. The 71 Student Responsibility statements pointed out material students were specifically responsible for mastering, such as material to be covered on assignments and exams and actions students must take (e.g., memorize a formula or create a formula sheet).

Example 1:
"Be prepared for this question because it is a quiz question."
Example 2:
"You must have this memorized by heart."

Task difficulty (*n* = 10). This contextual category included instances where the instructor highlighted the difficulty level of a learning task. These statements helped students properly evaluate the difficulty level of a task and suggest the level of effort required to complete the task, providing guidance for study time and effort regulation. Task Difficulty statements were surprisingly scarce considering the perceived difficulty level of the subject.

Example 1:
"Whenever you see double angles, get happy because they're not real hard."
Example 2:
"This is a really complicated one."

Instructor feedback (*n* = 7). This category included the instructor's comments that provided feedback regarding students' performance and behavior. For example, Ms. Math would reinforce the asking of questions or discusses performance on past assignments. Instructor Feedback is categorized under context because it is an aspect of the learning environment that can impact students' regulation of cognition, motivation/affect, and behavior. Instructor Feedback was utilized rarely compared to other contextual promptings, but the seven comments made by the instructor praised students for participating in class.

Example 1:
"Those are good questions. They are great!"
Example 2:
Ms. Math makes a small mistake, and students correct it. She thanks students, makes the correction, and then moves on.

Rules and management (*n* = 4). The last SRLOP category included Ms. Math's mentioning explicit and implicit behavioral guidelines, norms, and expectations for the classroom, as well as the procedures by which the classroom functioned. Rules and Management references included covering the class rules on the syllabus along with statements reflecting course policies, such as the usage of cell phones in class. Rules and Management were mainly referenced when the instructor asked students not to talk or reminded them to make their reservations to take the upcoming exam at the computer lab testing center.

Example 1:
One student asks a question, and the Ms. Math cannot hear her. "Guys, I cannot even hear her. Could you please talk less?"
Example 2:
"Does everybody have the reservation for test 4? Make sure you have the reservation for test 4."

Discussion

The purpose of this study was to investigate postsecondary instructional practices that support students' SRL in an undergraduate mathematics course, specifically, precalculus. Through observations of an undergraduate mathematics course taught in a large lecture format, we created an observational protocol and then utilized it to code the instructional practices of the observed instructor. This observational protocol differs from extant instruments in that it classifies observed instructional practices by four areas of SRL. We also did not seek to count SRL-instructional practices by category as they were observed. Additionally, the SRLOP is not meant to classify observed classrooms as either high or low SRL supportive, but was designed as a tool to better understand current instructional practices that may support college students' SRL. We are not making claims that Ms. Math's observed practices did, in fact, promote her students to engage in SRL practices for her course; we simply assert that the practices we observed *could* trigger – or guide – students to regulate their own learning.

Regarding observed SRL-instructional practices, we found that through various practices and statements, the precalculus instructor, Ms. Math, focused equally on the areas of behavior and context and spent the majority of her instruction time prompting cognitive aspects of student learning. However, very few references were made to motivational and affective features of education relative to other areas of learning that students can control. We will discuss the implications of these findings, organized by Pintrich's (2000, 2004) areas of SRL.

Cognition Language

Findings revealed that metacognitive promptings represented 17% of the total SRL references made by Ms. Math during the observed academic unit. Metacognition is a very important aspect of students' SRL (Winne & Hadwin, 1998; Zimmerman, 1989). These types of learning strategies are useful and help students learn new information effectively (McCray et al., 2003). One plausible explanation for the instructor's heavy emphasis on cognition could be the high salience of cognitive strategies in achieving success in a mathematics course. This finding alone could begin to tell us more about mathematics instruction. Although it cannot be determined how Ms. Math's promptings impacted her students' SRL, our observers were able to recognize Ms. Math's emphasis on this aspect of cognition in the observed class sessions.

Motivation and Affect Language

Although cognitive strategies are undoubtedly essential to students' SRL in mathematics courses, motivation also plays a critical role in SRL (Pintrich, 2000; Zimmerman & Schunk, 2007), including impacting the types of strategies students choose to use (Pintrich, 1999) and how much effort they expend (Schunk & Pajares, 2009; Schunk, Pintrich, & Meece, 2008). Cognitive and affective aspects of the classroom environment have been found to be interrelated; students utilize more productive learning strategies when instructors employ motivational instructional practices (Turner et al., 2002). Therefore, the finding that little instructional time was spent fostering students' motivation to learn in the precalculus course suggests an opportunity to enhance Ms. Math's pedagogy. At the end of our study, Ms. Math was trained to integrate more motivational strategies into her normal course instruction. The ended result is that her future students' SRL could improve, ultimately resulting in better success rates in Ms. Math's more challenging courses.

We would also like to point out that although Ms. Math made fewer motivational references compared to other areas of SRL, it is noteworthy that she did utilize some motivational strategies as part of her normal instructional practices. To give some background, our research project developed out of a shared interest and collaborative effort to improve student success in STEM by the mathematics instructor (fourth author) and the second author. The instructor's concern for student achievement could explain the class time she spent fostering student motivation. Ms. Math's use of task and utility value references, specifically, is encouraging. Learners are more likely to put forth higher amounts of effort on learning tasks they find personally relevant and valuable (Cole, Bergin, & Whittaker, 2008). We believe that encouraging more STEM instructors to focus on promoting student motivation could possibly improve students' SRL and academic achievement in historically challenging courses.

Behavior Language

According to Pintrich (2004), effective self-regulated learners actively monitor whether or not they need help and then elicit help from reliable sources whenever necessary. One quarter of Ms. Math's SRL instructional practices involved help-seeking; this finding should be interpreted in light of the unique situation of the in-class tutoring intervention. Although help-seeking was a large part of the specific course and unit examined, we realize that this is typically not the case in large undergraduate courses. However, the collaborative learning environment that the weekly pop-quizzes ("poppers") and support of in-class tutors and classmates created might serve as an example of best-practices.

Past research has shown that problem-based environments, where tasks are structured to promote student engagement with course material during class sessions, are conducive to student learning and success in undergraduate mathematics courses (Olsen et al., 2011). Because active problem-solving during class can promote student learning and collaboration, perhaps in-class interventions such as the one we observed would aid in promoting students' adaptive help-seeking behaviors (Ryan, Patrick, & Shim, 2005; Ryan & Pintrich, 1997; Ryan, Pintrich, & Midgley, 2001) in other challenging undergraduate courses.

Additionally, we found that only four percent of total SRL instructional references in a complete academic unit were made regarding time management. Perhaps, the lower number of references could be attributed to the point in the semester when observations were taken. Postsecondary instructors typically discuss course deadlines at the beginning of the semester when the syllabus is covered. Therefore, the observed lack of focus on students' time management could represent postsecondary instructors' tendency to focus heavily on time management at the start of the semester only, leaving students with guidance to manage their time for the duration of the semester. Because effective time management skills contribute to students' success in college (Britton & Tesser, 1991; Pintrich, 2004), it could be useful for instructors to provide students with more temporal guidance throughout the semester, particularly in challenging courses such as precalculus.

Context Language

Almost 25% of Ms. Math's referenced instructional practices concerned contextual aspects of SRL. Ms. Math might have focused heavily on contextual aspects of learning tasks due to the challenging nature of tasks (e.g., assignments, exams, and studying) involved in her course. Particularly noteworthy is our finding that 18% of the instructor's total SRL references made during the observed spring unit concerned students' responsibility in the course. SRL is the proactive process through which students become *masters* of their own learning and performance (Pintrich, 2004), meaning self-regulated learners take responsibility for their learning. We consider Ms. Math's emphasis of her students' academic responsibility a strength of her pedagogy and SRL instruction.

Future Research

The Self-Regulated Learning Observational Protocol was designed to specifically to investigate the instructional practices in college classrooms that support students' SRL. Although the SRLOP was originally designed for use in an undergraduate mathematics classroom, it could be used to observe any postsecondary classroom and could also be modified for use in secondary education settings where students are given autonomy to control aspects of their own learning. Because our population of interest is college students, we propose potential uses of the SRLOP in postsecondary settings.

The SRLOP could be utilized to compare the SRL instructional practices of college classrooms that vary by size, subject, level, or institution. The information gathered from these types of studies could be used to identify instructional best-practices across disciplines and courses. Identifying how instructors can encourage students' SRL for their courses during regular instruction can benefit both students and instructors (Perry & VandeKamp, 2000). Moreover, the SRLOP can be used in combination with self-report instruments to see if students perceive and respond to instructional promptings to self-regulate their learning. Future studies should investigate whether or not – or to what extent – instructor-initiated strategies impact students' actual SRL engagement.

To best utilize the SRLOP, we discovered that data were most useful when observers recorded all activities that happened within a single class period. Observers using the SRLOP in the future are encouraged to create a continuous record, emphasizing the instructor and his or her statements and behaviors that could impact students' SRL. In particular, observers should describe the categories of events outlined in Appendix A. Findings indicate that recording both verbatim dialogue and commentary is useful, and all final SRLOP categories are suitable for both types of data. A sample of a running record is provided in Appendix B to guide data collection.

To analyze observational data taken utilizing the SRLOP, we recommend using a qualitative analysis software package, such as NVivo, to categorize the data based on the SRLOP categories. Any amount of data can be "coded" under a category (i.e., a few words, sentences, or an entire paragraph), as was done in this study, depending on the context and research purposes. Our results showed that statements or "chunks" of the running record may be suitably coded under multiple categories; therefore, the SRLOP allows for compound-coding of data.

Suggestions for Postsecondary Instruction

As the needs of American society have changed, so has the role of teachers and faculty (Altbach, 2011; Spring, 2011). For example, STEM instructors have had to make adjustments to the way they teach as the demand for competent STEM graduates has increased (De Vise, 2012; Olsen et al., 2011). Based on the responsibility that the professoriate has to students and society, we recommend that faculty members from all disciplines receive training in effective teaching practices that promote student learning and achievement. Teaching practices based on principles of educational psychology have been shown to be effective in improving college student learning (Bembenutty, 2008) and should be incorporated into all postsecondary courses. It is especially important that students not only be taught *what* to learn, but also *how* to learn. The body of research that can be produced using the newly-created SRLOP has the potential to enhance faculty training and development, ultimately contributing to college students' success.

Conclusion

Because college students are expected to take full responsibility for their learning (Boekearts, 1999), it is of particular importance to understand classroom attributes that help them to do so. This study is significant because it began to explore extant postsecondary instructional practices that could potentially contribute to students' SRL. These findings can help us begin to better understand why students typically struggle in challenging undergraduate courses, such as precalculus. By expanding the work of Perry and colleagues (Perry, 1998; Perry et al., 2007; Perry et al., 2002; Perry & VandeKamp, 2000) into postsecondary classrooms, we have started to fill a gap in the literature. However, we have only begun to scratch the surface in understanding SRL processes in college classrooms; more studies of how SRL can be taught are needed (Perry et al., 2007), particularly in higher education.

References

Altbach, P. G. (2011). The professoriate in the twenty-first century. In P. G. Altbach, P. J. Gumport, & R. O. Berdahl (Eds.), *American higher education in the 21st century: Social, political and economic challenges* (pp. 227–253). Baltimore, MD: John Hopkins University Press.

Bail, F. T., Zhang, S., & Tachiyama, G. T. (2008). Effects of a self-regulated learning course on the academic performance and graduation rate of college students in an academic support program. *Journal of College Reading and Learning, 39*, 54–73.

Barrie, S. C. (2007). A conceptual framework for the teaching and learning of generic graduate attributes. *Studies in Higher Education, 32*, 439–458.

Bembenutty, H. (2008). The teacher of teachers talks about learning to learn: An interview with Wilbert (Bill) J. McKeachie. *Teaching of Psychology, 35*, 363–372.

Boekaerts, M. (1996). Self-regulated learning at the junction of cognition and motivation. *European Psychologist, 1*, 100–112.

Boekaerts, M. (1999). Self-regulated learning: Where we are today. *International Journal of Educational Research, 31*, 445–457.

Britton, B. K., & Tesser, A. (1991). Effects of time-management practices on college grades. *Journal of Educational Psychology, 83*, 405–410.

Cole, J. S., Bergin, D. A., & Whittaker, T. A. (2008). Predicting student achievement for low stakes tests with effort and task value. *Contemporary Educational Psychology, 33*, 609–624.

Cornford, I. R. (2002). Learning-to-learn strategies as a basis for effective lifelong learning. *International Journal of Lifelong Education*, *21*, 357–368.

De Vise, D. (2012, February 16). Colleges looking beyond the lecture. *The Washington Post*. Retrieved from https://www.washingtonpost.com/local/education/colleges-looking-beyond-the-lecture/2012/02/03/gIQA7iUaGR _story.html

Eccles, J. (2009). Who am I and what am I going to do with my life? Personal and collective identities as motivators of action. *Educational Psychology, 44*, 78–89.

Forster, B., Swallow, C., Fodor, J. H., & Foulser, J. E. (1999). Effects of a college study skills course on at-risk first-year students. *NASPA Journal, 36*, 120–132.

Glesne, C. (2011). *Becoming qualitative researchers: An introduction*. New York, NY: Pearson.

Greene, J. A., & Azevedo, R. (2007). A theoretical review of Winne and Hadwin's model of self-regulated learning: New perspectives and directions. *Review of Educational Research, 77,* 334–372.

Gump, S. E. (2004). Keep students coming by keeping them interested: Motivators for class attendance. *College Student Journal, 38*, 157-160.

Gupta, S., Harris, D. E., Carrier, N. M., & Caron, P. (2006). Predictors of student success in entry-level undergraduate mathematics courses. *College Student Journal, 40*, 97–108.

Hidi, S., & Renninger, K. A., (2006). The four-phase model of interest development. *Educational Psychologist, 41*, 111–127.

Hofer, B. K., & Yu, S. L. (2003). Teaching self-regulated learning through a "learning to learn" course. *Teaching of Psychology, 30*, 30–33.

Hofer, B. K., Yu, S. L., & Pintrich, P. R. (1998). Teaching college students to be self-regulated learners. In D. Schunk & B. Zimmerman (Eds.), *Self-regulated learning: From teaching to self-reflective practice* (pp. 57–85). New York, NY: Guilford Press.

Hoops, L. D., Yu, S. L., Burridge, A. B., & Wolters, C. A. (2015). The impact of a student success course on undergraduate outcomes. *Journal of College Reading and Learning, 45*(2), 123-146.

Lipsky, S. A., & Ender, S. C. (1990). Impact of a study skills courses on probationary students' academic performance. *Journal of the Freshman Year Experience, 2*, 7-15.

Lodewyk, K., Winne, P., & Jamieson-Noel, D. (2009). Implications of task structure on self-regulated learning and achievement. *Educational Psychology, 29,* 1–25.

McCray, R., DeHaan, R. L., & Schuck, J. A. (Eds.). (2003). *Improving undergraduate instruction in science, technology, engineering, and mathematics: Report of a workshop*. Washington, DC: National Academies Press.

Meyer, D. K., & Turner, J. C. (2002). Using instructional discourse analysis to study the scaffolding of student self-regulation. *Educational Psychologist, 37*, 17–25.

Morrone, A. S., Harkness, S. S., D'Ambrosio, B., & Caulfield, R. (2004). Patterns of instructional discourse that promote the perception of mastery goals in a social constructive mathematics course. *Educational Studies in Mathematics, 56*, 19-38.

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*, 199–218.

Olson, J. C., Cooper, S., & Lougheed, T. (2011). Influences of teaching approaches and class size on undergraduate mathematical learning. *PRIMUS, 21*, 732–751.

Patrick, H., Anderman, L. H., Ryan, A. M., Edelin, K. C., & Midgley, C. (2001). Teachers' communication of goal orientations in four fifth-grade classrooms. *The Elementary School Journal, 102*, 35-58.

Patrick, H., & Ryan, A. M. (2008). What do students think about when evaluating their classroom's mastery goal structure? An examination of young adolescents' explanations. *The Journal of Experimental Education, 77*, 99-124.

Patrick, H., Ryan, A. M., Anderman, L. H., Middleton, M., Linnenbrink, L., Hruda, L. Z., Edelin, K. C., Kaplin, A., & Midgley, C. (1997). *Observing patterns of adaptive learning: A Protocol for classroom observations*. Retrieved from http://www.umich.edu/~pals/finalopal.pdf

Perry, N. E. (1998). Young children's self-regulated learning and the contexts that support it. *Journal of Educational Psychology, 90*, 715–729.

Perry, N. E., Hutchinson, L., & Thaurberger, C. (2007). Talking about teaching self-regulated learning: Scaffolding student teachers' development and use of practices that promote self-regulated learning, *International Journal of Educational Research, 47*, 97–108.

Perry, N.E., & Rahim, A. (2011). Studying self-regulated learning in classrooms. In B. Zimmerman & D. Schunk (Eds.), *Handbook of self-regulation of learning and performance* (pp. 122-136). New York, NY: Routledge.

Perry, N. E., & VandeKamp, K.O. (2000). Creating classroom contexts that support young children's development of self-regulated learning. *International Journal of Educational Research, 33*, 821–843.

Perry, N. E., VandeKamp, K. O., Mercer, L. K., & Norby, C. J. (2002). Investigating teacher-student interactions that foster self-regulated learning. *Educational Psychologist, 37*, 5–15.

Perry, N. E., & Winne, P. H. (2006). Learning from learning kits: gStudy traces of students' self-regulated engagements with computerized content, *Educational Psychology Review, 18*, 211–228.

Petrie, T. A., & Helmcamp, A. (1998). Evaluation of an academic study skills course. *Journal of College Student Development, 39*, 112–116.

Pintrich, P. R. (1999). The role of motivation in promoting and sustaining self-regulated learning. *International Journal of Educational Research, 31*, 459–470.

Pintrich, P. R. (2000). The role of goal orientation in self-regulated learning. In M. Boekaerts, & P. R. Pintrich (Eds.), *Handbook of self-regulation*. (pp. 451–502). San Diego, CA: Academic Press.

Pintrich, P. (2004). A conceptual framework for assessing motivation and self–regulated learning in college students. *Educational Psychology Review, 16*, 385–407.

Robbins, S. B., Lauver, K., Le, H., Davis, D., Langley, R., & Carlstrom, A. (2004). Do psychosocial and study skill factors predict college outcomes? A meta-analysis. *Psychological Bulletin, 130*, 261–288.

Ryan, A. M., Patrick, H., & Shim, S. (2005). Differential profiles of students identified by their teacher as having avoidant, appropriate, or dependent help-seeking tendencies in the classroom. *Journal of Educational Psychology, 97*, 275-285.

Ryan, A. M., & Pintrich, P. R. (1997). "Should I ask for help?" The role of motivation and attitudes in adolescents' help seeking in math class. *Journal of Educational Psychology, 89*, 329-341.

Ryan, A. M., Pintrich, P. R., & Midgley, C. (2001). Avoiding seeking help in the classroom: Who and why? *Educational Psychology Review, 13*, 93-114.

Schnell, C. A., Louis, K. S., & Doetkott, C. (2003). The first-year seminar as a means of improving college graduation rates. *Journal of the First-Year Experience and Students in Transition, 15*, 53–75.

Schunk, D.H., & Pajares, F. (2009) Self-efficacy theory. In K. Wentzel.& A. Wigfield, (Eds.), *Handbook of motivation at school.* (pp. 35–54). New York, NY: Routledge.

Schunk, D., Pintrich, P., & Meece, J. (2008). *Motivation in education: Theory, research, and applications (3rd ed.)*. Englewood Cliffs, NJ: Prentice Hall.

Spring, J. (2011). *American education (15th ed.).* New York, NY: McGraw-Hill.

Tuckman, B. W. (2003). The effect of learning and motivation strategies training on college students' achievement. *Journal of College Student Development, 44*, 430–437.

Tuckman, B.W., & Kennedy, G. J. (2011). Teaching learning strategies to increase success of first-term college students. *The Journal of Experimental Education, 79*, 478–504.

Weinstein, C. E. (1994). Strategic learning/strategic teaching: Flip sides of a coin. In P. R. Pintrich, D. R. Brown, & C. E. Weinstein (Eds.), *Student motivation, cognition, and learning: Essays in honor of Wilbert J. McKeachie* (pp. 257–273). Hillsdale, NJ: Lawrence Erlbaum.

Weinstein, C.E., Acee, T. W., & Jung, J-H. (2011). Self-regulation and learning strategies. *New Directions for Teaching and Learning, 126,* 45–53.

Weinstein, C. E., Dierking, D., Husman, J., Roska, L., & Powdrill, L., (1998). The impact of a course in strategic learning on the long-term retention of college students. In J. L. Higbee & P. L. Dwinell (Eds.), *Developmental education: Preparing successful college students* (pp. 85–96). Columbia, SC: National Resource Center for the First-Year Experience & Students in Transition.

Weinstein, C. E., Tomberlin, T. L., Julie, A. L., & Kim, J. (2004). Helping students to become strategic learners: The roles of assessment, teachers, instruction, and students. In J. Ee, A. Chang, & O. Tan (Eds.), *Thinking about thinking: What educators need to know* (pp. 282–310). Singapore: McGraw-Hill.

Winne, P. H. (2011). A cognitive and metacognitive analysis of self-regulated learning. In B. Zimmerman & D. Schunk (Eds.), *Handbook of self-regulation of learning and performance* (pp. 15–32). New York, NY: Routledge.

Winne, P. H., & Hadwin, A. F. (1998). Studying as self-regulated learning. In D. J. Hacker, J. Dunlosky, & A. C. Graesser (Eds.), *Metacognition in educational theory and practice* (pp. 279–306). Hillsdale, NJ: Erlbaum.

Winne, P. H., & Hadwin, A. F. (2008). The weave of motivation and self-regulated learning. In D. Schunk & B. Zimmerman (Eds.), *Motivation and self-regulated learning: Theory, research, and applications* (pp. 297–314). New York, NY: Taylor & Francis.

Winne, P. H., Jamieson-Noel, D. L., & Muis, K. (2002). Methodological issues and advances in researching tactics, strategies, and self-regulated learning. In P.R. Pintrich & M.L. Maehr (Eds.), *Advances in motivation and achievement: New directions in measures and methods* (Vol. 12, pp. 121–155). Greenwich, CT: JAI Press.

Winne, P., & Perry, N. (2000). Measuring self-regulated learning. In M. Boekaerts, P. Pintrich, and M. Zeidner (Eds.), *Handbook of self-regulation*. (pp. 531–566). San Diego, CA: Academic Press.

Wolters, C. A. (1998). Self-regulated learning and college students' regulation of motivation. *Journal of Educational Psychology, 90*, 224–225.

Wolters, C. A. (2003). Regulation of motivation: Evaluating an underemphasized aspect of self-regulated learning. *Educational Psychologist, 38,* 189–205.

Wolters, C. A., & Hoops, L. D. (2015). Self-regulated learning interventions for motivationally disengaged college students. In T. L. Cleary (Ed.), *Self-regulated learning interventions with at-risk youth: Enhancing adaptability, performance, and well-being* (pp. 67-88). Washington, DC: American Psychological Association.

Zimmerman, B. (1989). A social cognitive view of self-regulated learning and academic learning. *Journal of Educational Psychology, 81,* 329–339.

Zimmerman, B. J. (2000). Attaining self-regulation: A social cognitive perspective. In M. Boekaerts, P.R. Pintrich, & M. Zeidner (Eds.), *Handbook of self–regulation: Theory, research, and applications* (pp. 13–29). San Diego, CA: Academic Press.

Zimmerman, B.J. (2002). Becoming a self-regulated learner: An overview. *Theory Into Practice, 41*, 64–70.

Zimmerman, B. J., & Schunk, D. H. (2007). Motivation: An essential dimension of self-regulated learning. In D. H. Schunk & B. J. Zimmerman (Eds.), *Motivation and self-regulated learning: Theory, research, and applications* (pp. 1–30). Mahwah, NJ: Lawrence Erlbaum.

LEAH HOOPS is a Doctoral Candidate in Higher Education and Student Affairs at The Ohio State University where she also works as a Graduate Instructional Consultant at University Center for the Advancement of Teaching (UCAT).

SHIRLEY YU is Associate Professor of Educational Psychology in the Department of Educational Studies. She is interested in the self-regulated learning and achievement of women and ethnic minority students in science, technology, engineering and mathematics (STEM).

QIANQIAN WANG is a Confucius Institute Manager of Houston Independent School District. Her research interests include self-regulated learning strategies, foreign language learners' motivation, and Chinese language studies.

VIRGINIA (LEIGH) HOLLYER is the Assistant Department Chair for the Core Curriculum at the University of Houston. She is interested in helping students in large sections become engaged in learning.

Appendix A
Final Self-Regulated Learning Observation Protocol (SRLOP) Categories, Descriptions, and Examples of Category References

Category	Description	Example
I. COGNITION	The Cognition area refers to ways the instructor encourages students to use specific strategies to learn or perform a task, prompts students to monitor their level of understanding or gauges students' understanding themselves, and prepares students to learn new information.	
A. Metacognition	This category includes instances where the instructor prompts students to engage in metacognitive processes, such as thinking about how to solve a problem or engage in a learning task. These statements help students think about their cognitive processes and/or trigger them to do so.	The professor checks with students. "Everybody is OK with that?", "Are we all OK with that?"
B. Test-Taking Strategies	This category contains instances when the instructor mentions specific strategies or resources that students can use while taking an assessment. This includes ways in which students should use resources, such as "cheat sheets" or formula links, and poor test-taking strategies (i.e., specific things students should avoid doing while taking an assessment).	The professor emphasizes the importance of the formula sheet and gives students instructions for using it during the next exam.
C. Information Processing Strategies	This category includes instances where the instructor mentions a specific strategy that students can use to process information and/or teaches students a strategy to help them learn the course material. These statements provide students with tools to process, understand, or display information.	"What if you do not remember?" The professor draws students' attention and then explains how to memorize a mathematic rule.
D. Advance Organizers	This category includes any time the instructor sets the tone of the day's lecture by letting students know what content will be covered, preparing them to recognize and process the new material. These statements are usually made at the beginning of class.	"What we're doing today is sine and cosine of A + B."
II. MOTIVATION AND AFFECT	The Motivation and Affect area refers to ways the instructor points out aspects of a learning task that pertain to students' achievement motivation or sparks student interest inside the classroom.	
A. Value	This category includes instances when the instructor highlights the importance or relevance of a task. These statements help students know what their focus should be and how to better regulate their study time based on the importance of mastering certain tasks (i.e., spend more time studying concepts and tasks that will be well-	Professor tells students "This one is terribly important."

	represented on an exam or pertinent to a students' future career). A statement regarding task value is usually explicit (i.e., specific) and not simply one in which students must infer the importance of a task.	
B. Interest	This category includes instances where the instructor sparks students' interest by saying something funny, sharing a personal story, or other types of statements which may trigger or maintain situational interest.	"Anyone remember Karate Kid? 'Wax on, wax off.' Well, these problems are like that."
III. BEHAVIOR	The Behavior area refers to the two main types of SRL behaviors, (A) Help-Seeking and (B) Time Management that take place inside the classroom or instances where the instructor encourages students to engage in these types of behaviors outside of the classroom.	
A. Help-Seeking	This category includes instances where students seek help during class by asking questions and statements made where the instructor addresses the giving or receiving of help, typically during class (*Internal*), or also by suggesting outside resources students may use to supplement their learning (*External*).	Students are fairly loud, talking and trying to solve the problems together. (*Internal*) "Please go to the math tutoring center if you need assistance…They are open 60 hours a week." (*External*)
B. Time Management	This category includes instances where the instructor makes statements or suggestions regarding students' use of time to prepare for the course outside the classroom. These references can be in regard to explicit assignment deadlines or simply offer guidance of how to manage time during study sessions or while completing learning tasks.	Professor encourages students to start homework today so they don't have 140 problems to do right before the due date.
IV. CONTEXT	The Context area refers to the task-specific or classroom-specific aspects of the learning environment. These aspects help students regulate their cognition, motivation/affect, and behavior.	
A. Student Responsibility	This category includes any statements the instructor makes regarding students' responsibility on evaluation tasks, such as exams, homework assignments, quizzes, and class discussion. These references can explicitly direct students' attention to assessed material or instruct them to take action such as memorizing specific course material (e.g., formulas).	"Listen up! This question is a test 4 multiple choice item." "These identities will not be in the test. You should know it by heart."
B. Task Difficulty	This category includes instances where the instructor highlights the difficulty level of a learning task and is included in attribution theory. These statements help students properly evaluate the difficulty level of a task and insinuate the level of effort required to complete the task, helping students regulate their study time and effort.	Professor continues to work out the problem. "If you get the idea that this is a tough Algebraic exercise, you're exactly correct."

C. Instructor Feedback	This category includes the instructor's comments that provide feedback regarding students' performance and behavior. For example, when he/she reinforces the asking of questions or discusses performance on past assignments. Instructor Feedback is categorized under context because it is an aspect of the learning environment that can impact students' regulation of cognition, motivation/affect, and behavior.	Students propose a solution to the problem. Professor: "…it works great. What a great suggestion! Thank you for the suggestion. I love it."
D. Rules and Management	This category includes mentioning the explicit and implicit behavioral guidelines, norms, and expectations for the classroom as well as the procedures by which the classroom functions. This includes covering the class rules on the syllabus along with statements reflecting course policies, such as using cell phones in class.	Professor makes the point clear that there is no extra credit. "I know policies are different at other schools, so I am addressing it right now."

Note. The major 4 areas of self-regulated learning (Cognition, Motivation and Affect, Behavior, and Context) serve as the framework for the SRLOP and are not meant to be coded. That is why no examples are listed for them. Categories that do have examples listed for them in the final column serve as the most micro-level under which data can be coded.

Appendix B
Sample of a Running Record

KEY: P = Professor; S(s) = Student(s); HW = Homework

10:00 – Class begins. Syllabus pulled up and P begins class. “Welcome to Pre-Cal class”

P introduces self and covers the rules for her course.

- Don’t try to visit me before or after class in this room: “meet me outside after class…I would love to meet with you!”
- There is no email tutoring**;** go to the tutoring center for tutoring (P gave Ss directions to the campus tutoring center)
- “Please go to the tutoring center if you need assistance…they are open 60 hours a week”

10:05 – P discusses the Policy Quiz (some students still entering class). For 1st quiz, students must get 100% correct. Quiz covers course policies.

“I’m going to address question 4 of the quiz head on…if you don’t like your grade at the end of the semester, too bad!”

P makes the point clear that there is no extra credit. “I know policies are different at other schools, so I am addressing it right now.” She makes sure students know they are responsible for their grade – no extra credit will be given.

Continues discussing policy quiz – there are 20-25 course policy questions and all answers are available on the course website.

After mentioning the course website, P writes down her web address on the board and explains the web address. “ I ran an animal rescue mission for years…dept chair thought it was funny to include that in my webpage…so that explains my website.”

P explains that on homepage are the Math 13xx policies and discussed where to find answers for quiz. She says, “10% of the class already got 100% on this quiz already!”

10:07 – P begins lecturing: “Let’s start right in on test 2 material!” (Ss around me groan and reluctantly take out pens/pencils and paper).

P pulls up the packet notes (found on her website which students are instructed to print and bring to class each time) up on overhead and jumps right into lecture.

P: “This class is all about functions!”

P begins writing on the handout document on the screen and explaining where students can find resources for class. “On the website you can find basic graphs…the 15 most famous graphs.”

10:10 – P points students to the course website again “…there is a nice review that you can do…”

P points students to the HW and tells them the first HW due date for the semester. As she works out problems she says “this problem is on the HW…”

P explains that HW due date was extended because of the add/drops that will happen at the beginning of the course (she makes sure students not only know *when* the HW is due, but *why* it is due that particular day).

P talks about domains and continues to highlight text on the screen. She talks very fast, but writes down all that she says on the screen and explains everything that she does.

P says “I think of numbers as people, just like I think of animals as people…”

No real response from Ss as they take notes fast and furiously.

10:11 – S asks a question and P explains: “Good question…sometimes I lose my mind while I’m up here, so just let me know. That’s why this is all available on the internet. Feel free to ask questions anytime.”

P wants students to point out her mistakes/inconsistencies – she makes it clear that she values their questions/opinions.

10:12 – P moved on to 3rd page of the workbook. Directs students to “look in Ch. 2 lecture notes for a reminder of Vertical asymptotes” because “we’re going to do lots with that this semester…”

P continues to write notes on board; Ss take furious notes. No Ss talk or use phones during lecture – too busy taking notes.

10:15 – P makes mistake while working out problem and pauses…

P says: “I’m brain deaf on the first day, this is bad!” No Ss laugh

P moves on with lecture: “OK, regarding evaluation. You all should be working on the practice test pretty soon here….yes, there will be lots of questions in this class with minus signs. So get over your ‘minus-sign-itis’ by the time you take Calculus.”

P works out another problem and points students to what they will need to know for the first test/Pre-Cal class. Makes the comment “this is something I want you to focus on…”

As P works out problems, she continually points on what students need to know for the test, HW, quizzes, etc. She even points out where most students usually miss points: “…there are several places that are point losers…people forget about squaring…”

She continues to work out problem while pointing out comment mistakes: “don’t make that mistake in a hurry!”

P explains all her actions and tells Ss “I don’t want you to lose points due to test pressure.”

Note. This example only contains a portion of a class period (*n* = 15 minutes) so that the reader gains a better understanding of the running record technique.