Characteristics and Context of Primary Years Program (PYP) Students' Self-Efficacy and Self-Regulatory Development

A research report prepared for the International Baccalaureate by

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February 2015

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EXECUTIVE SUMMARY

This multi-phasic study incorporated both qualitative and quantitative methods to address a series of research questions. The focus of Phase I was the exploration of elementary level PYP classrooms through observational and interview methods with the purpose of documenting and understanding students' self-regulatory functioning. By conducting the qualitative portion of the study first, we became more familiar with the PYP classroom structure as well as obtained detailed data from PYP students and teachers. Findings from Phase I informed the development and adaptation of measurement scales used with a much larger survey research methodology in Phase II. The aim of Phase II was to (i) develop survey and observational measures to assess practices that lead to self-regulatory competency from both the student and teacher perspectives and (ii) examine the predictive power of these influences on students' self-efficacy for learning and development of self-regulation. The measures used were contextualized in mathematics. Finally the aim of Phase III was a qualitative case study approach to identify best practices of high self-regulatory classrooms.

Phase I. Data from phase one were extremely informative and permitted the development of the Teacher Self-Regulated Learning instructional practices instrument (T-SRL), an observational tool designed to capture classroom practices believed to enhance students' self-regulatory practices. Understanding teachers' strengths and identifying areas of weakness in the cyclic process of self-regulation could have a significant impact on student outcomes. This instrument provides a way to determine what areas of professional development might be helpful to teachers. This phase also provided interview data that revealed that teachers were aware of the IB curriculum elements and thoroughly implemented in the classrooms observed. The use of learner profiles was also discussed in terms of student self-regulation. Teachers mentioned that

learner profile was used in goal setting, feedback, and in the monitoring of progress. The IB practice of reflection was also discussed by a number of teachers. Some teachers used this emphasis by creating reflection journals which prompted students to reflect on their learning (e.g. "What did you learn? How did you learn this?"). One teacher also discussed the use of reflection packets which were sent home on the weekends with the hope that reflections would be shared with parents. Although the student sample size was small in this phase, the findings of the current investigation have important implications for teachers. For example, students who set process-oriented goals demonstrate not only greater motivation to persist in tasks, but also more strategic strategy use, and adaptive reflections of their performance. In contrast, students who set outcome-oriented goals exhibit less motivation, demonstrate fewer strategies, and make more maladaptive reflections of their performance (Cleary & Zimmerman, 2001; Kitsantas & Zimmerman, 2002). Overall, focusing on the processes not only helps students to enhance academic skills, but also increase their self-efficacy beliefs, task interest and performance (Kitsantas & Zimmerman, 1998; 2002).

Phase II. This phase of the project proved challenging in attempting to collect large scale data from teacher and their students across a broad variety of PYP classrooms. In many cases we were unable to get enough students to respond to surveys as the survey link was emailed to parents at home. In our attempts to be less disruptive to classroom time, we handicapped our study by not achieving the large diverse sample that we desired. However, we were able to gain data from a large enough sample of students to begin to discern the patterns of self-regulation among grade 3 through 5 students using the Elementary Plan, Practice & Reflect scale developed for this study. Very little research has been attempted in the field of self-regulation using student report and it is especially limited with elementary age students. Furthermore, we were able to replicate relationships in constructs that have been found with older children including the relationships between mastery experience and math self-efficacy. In this sample of PYP students, we also found moderate to strong relationships between social persuasion and math self-efficacy, likely due to the strong collaboration element found within the PYP curriculum.

Phase III. Finally in phase III of the study we have been able to find many common themes across the teacher interviews which align very closely with the social cognitive research perspective. This view is complementary to the IB curriculum advocating learner responsibility. Based on our findings, we provide guidelines for motivating students and creating a sense of responsibility as well as listing principles for designing effective learning environments. These recommendations include communicating to students that they possess the capacity to learn the material being taught and usefulness of the lessons. We also focus on developing responsible learning and emphasize the role of teachers in modeling and allowing for autonomy in the classroom in terms of choices and linking such choices to consequences. Furthermore, we advocate proper teacher modeling of internal attributions *(not blaming others for failures nor attributing success to luck*) and the practice of setting goals and evaluating goals in terms of progress and strategy adjustment. Lastly, we remind teachers of some key principles that may enhance learning in their classrooms. Each of these principles was evident in researcher observations of highly a self-regulatory classroom and also through researcher interviews with exemplary teachers. As a result of the final phase of this study, we recommend these principles also as be representative of the best practices in elementary mathematics education resulting in highly efficacious mathematics students who self-regulate their learning.

INTRODUCTION

The topic of academic self-regulation has been studied in a variety of contexts, such as learning-to-learn classes, writing, reading, math, and academic tutoring sessions (see chapters in edited books by Bembenutty, Clearly, & Kitsantas, 2013; Boekaerts, Pintrich, & Zeidner, 2000; Schunk & Zimmerman, 1998; Zimmerman & Schunk, 2011). Self-regulation refers to the degree to which students are metacognitivelly, motivationally, and behaviorally proactive and responsible participants in their own learning process (Zimmerman, 2000).Therefore, motivation and self-regulation are viewed as interdependent constructs. One way to assess student motivation is through self-efficacy. Self-efficacy is defined as the extent to which students believe they are capable in executing a learning task under specified conditions. Research in academic self-regulation has established that poor academic achievers exhibit impulsive behaviors, low academic goals, low self-efficacy beliefs in learning and self-regulated learning, and inaccurate assessment of their own performances. In contrast, high academic achievers are characterized by purposeful time management, establishment of realistic goals, healthy self-confidence, and accurate self-monitoring of progress (Kitsantas, 2002; Schunk & Zimmerman, 2008; Zimmerman & Ringle, 1981). Self-regulation theory contends that these effective learning behaviors can be taught irrespective of socioeconomic disadvantage, learner limitations, or other environmental factors. Indeed, the low academic achievement of capable advantaged students and the high achievement of disadvantaged students can be explained via self-regulation. Clearly, the teaching of academic self-regulation may serve as a powerful tool for our students to become responsible learners and therefore a basis for educational reform. By using instructional strategies based on principles of self-regulated learning, instructors can shift from an authoritarian role to that of a learning consultant who encourages students to independently self-reflect and adjust their efforts in a self-regulated way (Kitsantas, 2002; Kitsantas & Zimmerman, 1999, 2005, 2009).

Although there are many ways of conceptualizing self-regulated learning, the perspective that has received much attention is Zimmerman's (2000) three phase cyclic model of self-regulated learning from a social cognitive perspective. This cyclic model of self-regulated learning attempts to explain student achievement through self-regulatory processes embedded within three phases of learning. The first phase is called the forethought phase. In this phase, it is assumed that students have a preset notion of cognitions and motivations that precede the learning tasks. In this phase, highly self-regulated learners set hierarchical learning goals and strategically plan how to achieve these goals. This leads to the second phase of self-regulated learning called the performance phase. In this phase, the student is actually engaged in the learning task. In the last phase of the model, the self-reflection phase, the student uses self-monitored outcomes to reflect on his/her progress. Self-reactions in this phase (I failed because I am not good at this task or I failed because I did not use the correct strategy), will impact the first phase of self-regulated learning, hence the cyclic mature or feedback look of this model. If students are able to successfully regulate their learning, and are self-motivated, then indeed, students are well equipped to learn.

Fortunately, self-regulation can be taught and educators can design specific activities to train students to become self-regulated learners. From a social cognitive perspective (Kitsantas, 2002; Kitsantas & Dabbagh, 2010; Kitsantas, Reiser & Doster, 2004; Ramdass & Zimmerman, 2008; Schunk & Zimmerman, 1998; Zimmerman, 2000), learners' self-regulatory training is initially social in form but becomes increasingly self-directed. Four levels have been identified and have empirically been tested: observation, emulation, self-control, and self-regulation. When acquiring an academic skill at an *observational level*, learners watch a social model performing the desired task. In the *emulation level,* a learner duplicates the general form of a model's response on a similar task whereas in a *self-controlled level* of self-regulatory skill, a learner practices a strategy in structured settings outside the presence of models. During the fourth level, *self-regulation,* a learner practices in settings involving dynamic personal and contextual conditions. Empirical evidence shows that this multi-level model of the development of self-regulation enables learners to learn master tasks and experience greater motivation.

A review of the literature reveals that only a handful of studies have focused on how students self-regulate their learning in primary grades (Bembenutty, Clearly, & Kitsantas, 2013; Zimmerman & Schunk, 2011); and to our knowledge, no research has attempted to determine how teachers can design instruction to develop student self-regulation at this level. Given existing models of self-regulated learning (e.g., four-level model), which have been tested and found pertinent to the development of student self-regulation, research is needed to uncover what types of instructional contexts support and promote student self-regulatory skills and motivation in elementary school children. The purpose of this project is to address this issue with students enrolled in International Baccalaureate (IB) schools.

The IB Primary Years Program focuses on student learning through the use of interdisciplinary themes which provide the framework for teachers to engage students. The manner in which IB teachers are trained to develop inquiries and to challenge students are certainly influential to the development of student self-efficacy beliefs and students’ use of self-regulatory learning practices. The extent to which these practices encourage self-regulation and impact student efficacy beliefs is the primary focus of the proposed research. Second, we are interested in documenting the strengths of this instructional approach and curriculum in supporting self-regulatory development by comparing the PYP classrooms to more traditional settings. It is our expectation that the findings of the proposed project will provide recommendations for elementary school teachers on how to promote and support student self-regulated learning.

PHASE I OVERVIEW

The purpose of Phase I was to examine the context of the PYP classroom through observational and interview methods in terms of (i) the development of student self-efficacy and (ii) students' use of self-regulatory learning practices—within the context of math instruction. This examination of the PYP classroom focused on three main facets: the classroom in context, teachers in context, and students in context. All three facets were examined in terms of the development and facilitation of students' self-regulatory functioning—a desired outcome given its relationship to greater academic achievement and motivation.

Classroom in Context

The examination of the classroom in context was guided by the following question: *What instructional practices in elementary PYP classrooms are being used to facilitate student self-efficacy for learning and self-regulatory competence*? This question was pursued through the development of an observational protocol and through 32 classroom observations. Classroom observations were supplemented through scripting of the observed lessons, which included observers' reflections of the classroom context, as well as notes to support their selections of the various observation protocol items.

Teacher in Context

Teachers' role in facilitating self-regulated learning was considered through the following question: *How do teachers' beliefs about motivation and self-regulation influence their* *classroom practices*? This question was considered through teacher interviews with all participating teachers.

Student in Context

The following question guided the consideration of students in context: *How do elementary students, within the instructional context, self-regulate their learning and how does it impact their motivation*? This question was examined through the use micro-analytic interviews with all participating students. Students in context were also assessed through completion of a teacher rating scale for self-regulated learning and a scale related to culture openness.

METHODS

Sample

Three IB Primary Years Program (PYP) elementary schools from the Washington D.C. metropolitan area participated in Phase I. Fictitious names are used in this report to protect the identity of the participants. Riverside Elementary located in Virginia, Parkside Elementary located in Maryland, and Hillside Elementary located in Washington D.C. A total of eight classrooms participated from these schools.

Riverside Elementary

Riverside Elementary has offered the Primary Years Program since August 2012. Riverside has a total enrollment of 816 students. Students who attend this school are automatically enrolled in the PYP program. Demographically (see table 1), this school has a diverse student population. Academically, Riverside Elementary was designated as a School of Excellence.

Three classrooms participated in Phase I of the study; one each from 3rd, 4th, and 5th grade. In order to answer questions related to the classroom context, four classroom observations were conducted for each of three participating classrooms. Each of the four observations (per classroom) was conducted by a different research team member with each observation lasting for the length of an entire math lesson (usually an hour). Classroom observations were conducted between the months of October and November, 2013. Questions related to teacher in context were examined through teacher interviews. These interviews were conducted with all three teachers between the months of November and December, 2013.

Lastly, questions regarding students in context were examined through student microanalytic interviews. Each teacher was asked to identify three students who were believed to be above-average, average, and below-average academically (nine per classroom) as potential interview participants. Participation materials which asked for volunteers were then sent home with those students. Four students, two 3rd grade students and two 4th grade students participated in the interviews.

Table 1. PYP Student sample

Riverside Elementary School 2012-13		
Ethnicity		
Hispanic	30.3%	
Black /African-American	27.7%	
White	26.6%	
Asian	7.3%	
Other	8.1%	
Economically disadvantaged	37.9%	
SOL Pass Rates	English	Math
3rd grade	76%	74%
4th grade	75%	86%
5th grade	74%	80%

SOL = Virginia State Standards of Learning Assessment

Parkside Elementary

Parkside Elementary has been an IB PYP school since 2007. Parkside has a total enrollment of 852 students and belongs to the largest school system in Maryland. Demographically, (see table 2) this school hosts a diverse population. Academically, Parkside reports high rates of proficiency in math and English, with attendance rates above 95%, and 10.4% mobility rates.

Three classrooms participated in this phase of the project; one classroom from 3rd, 4th, and 5th grade. Each classroom was observed four different times (during math instruction) by four different research team members. Observations were conducted between November and December, 2013. All three participating teachers took part in teacher interviews. No student interviews were conducted as the school district did not allow for student interviews to be conducted during the school day, making participation more cumbersome as parents became responsible to provide transportation to potential interviews before or after school.

Table 2. PYP Student Sample
Parkside Elementary School 2012-13

Ethnicity		
White	37.9%	
Asian	23.1%	
Black /African-American	16.7%	
Hispanic	14.4%	
Other	7.9%	
Economically disadvantaged	15.1%	
MD Proficiency Rates	Math	Reading
3rd grade	90.3%	>95%
4th grade	>95%	>95%
5th grade	>95%	88%

Hillside Elementary School

Hillside Elementary has been an IB PYP school since 2006. Hillside reported a total enrollment of 314 students for the 2012-13 school year. Demographically, Hillside is not as diverse as the two other participating schools (see table 3). Hillside reports 96% in seat attendance rates for 2012-13 school year. Academically, Hillside Elementary is considered a rising school, a term designated by DC Public Schools for schools that need support to continue to grow.

Two classrooms participated in Phase I: one 3rd grade classroom and one 5th grade classroom. No 4th grade classroom participated as the fourth grade teachers were new to the school and IB program. Both participating classrooms were observed during math instruction on four different occasions by four different research team members. Both teachers participated in teacher interviews conducted by research team members. A total of five students participated in microanalytic interviews, two from 3rd grade and three from 5th grade. Participants were recruited and selected following the same method described earlier.

Table 3. Student Sample

Hillside Elementary School 2012-13

Ethnicity		
Black/African-American	79%	
Hispanic	8%	
Multiple race	6%	
White	5%	
Asian	2%	
Economically disadvantaged	33%	
DC CAS Proficient/Adv. Rate	Math	Reading
All grades	71%	76%

DC CAS = D.C. Comprehensive Assessment System

Measures

Teachers' Self-Regulated Learning Instructional Practices (Kitsantas, Miller, & Chirinos, 2013). A 56 item observational instrument assessing teacher self-regulated learning practices (T-SRL) was created to examine classroom structures that support self-efficacy for learning and self-regulatory competence. In particular, this instrument was designed to examine teachers' ability to direct students to self-regulate in classroom settings. Part of the rationale for the development of this instrument lies in the understanding that self-regulation is a teachable skill which can be communicated through teacher's instructional practices, through classroom contexts, as well as through curriculum design.

The T-SRL is based on Zimmerman's (2000) three phase cyclical model of self-regulated learning which consists of forethought (precedes actions), performance control (during learning), and self-reflection phases (after performance). As such, the development of this instrument included items that reflected all three phases of SRL: forethought (N = 22 items), performance control (N = 15 items), and self-reflection (N = 9 items). Ten additional items were developed to examine classroom appearance (N = 4 items), classroom organization (N = 3 items), and IB themes in the classroom (N = 3 items). Items followed a 7 point Likert scale anchored with statements indicating presence or absence of targeted skills (e.g. "Teacher models step-by-step how to perform a task" contrasted by "teacher does not model step-by-step how to perform a task").

The initial instrument was reviewed by two expert SRL scholars and multiple items were revised based on their feedback. The revised version of the T-SRL was presented to research team members that would be administering the instrument in the 8 PYP classrooms. Team members were trained as to the purpose of the instrument, including a discussion of the items and their relationship to SRL processes. Formatting changes to the instrument were made based on team member feedback which included the addition of space for observer comments and observer feedback as to the ease of the evaluation.

Once observations were completed, further revisions were made to the T-SRL based on item level descriptive statistic and on observer comments. Multiple items with low variability and items that observers found difficult to observe and rate were discarded. A total of 40 items were retained including: classroom environment and structure (N = 9 items), forethought (N = 16 items), performance (N = 10 items), and self-reflection (N = 7 items).

Teacher Interview Protocol. The purpose of the interviews was to examine teachers' beliefs about motivation and self-regulation, and how these beliefs influenced their classroom practices (within the context of math instruction). Interviews followed a semi-structured format with six (N = 6) open-ended questions focusing on self-regulation, student competence, teaching practices and the IB curriculum, teacher instructional style, types of feedback provided, and greatest challenge students experience during math instruction. Sample questions include: "What are your beliefs about student self-regulation?" and "What is your perspective regarding student competence beliefs?"

Completed interviews were systematically analyzed through a coding system constructed to reflect the purposes of this facet of the project (see Appendix B). For question one, teacher responses were analyzed according to the three phases of SRL, with responses coded as either present or absent (per phase). Responses for question one were also analyzed as to whether teachers made a connection between aspects of SRL and the IB program. For question two, competence responses were analyzed according to Bandura's (1997) four sources of self-efficacy (mastery, vicarious, social, physiological/affect). The four sources were coded as either present or absent in the teachers' responses. These answers were also examined as to whether teachers made a connection between competence and the IB program. For question three, teachers' beliefs (about self-regulation and student competence) were examined in terms of how they fit with their teaching practices and how their teaching practices align with components of the IB program. Responses were coded as either present or absent in terms of the 10 attributes of the "IB learner profile" (The IB learner profile, 2015).

Question four examined responses of perceived instructional styles in terms of mastery oriented, performance oriented, guided/social feedback, and self-reflection. Responses were also coded in terms of whether connections were made between instructional styles and the IB program. Question 5 analyzed responses to types of feedback provided (by teachers) in terms of process/mastery feedback and outcome/performance feedback. Responses were then coded as to whether connections were made between feedback provided and the IB program. Lastly, question six (greatest challenge student face during math) was analyzed in terms of open coding given the many possibilities that exist regarding challenges.

Student SRL Microanalysis Interviews (Kitsantas & Miller, 2013). Students in context were examined through microanalytic interviews. Microanalytic interviews are event measures that assess students' engagement in self-regulated learning while working on a relevant task (e.g. a math problem from that day's math lesson). Interviews were structured around two main parts, the first containing 12 items while the latter containing 11 items. During the first part of the interview, students were asked forethought phase related questions (competence beliefs, goal setting, use of agenda, persistence, strategic planning, help seeking) within the context math. The second part of the interview presented students a math problem from that day's math lesson. Students were then asked about their confidence in correctly solving that problem, their plan to approach the problem, their interest in the problem, and their belief regarding whether it was more important to solve the problem correctly or to learn from the problem. Next, students were asked to solve the problem. Once the problem was completed, students were asked whether they used the plan they described earlier, their monitoring practices, their satisfaction with their performance, and their reasons as to why they succeed or failed in solving that problem.

Completed interviews were analyzed through a coding scheme that analyzed each of the 23 microanalytic questions in terms of the self-regulatory process the items aimed to assess (see Appendix C). For example, questions two and four examined the process of strategic planning. These questions were then coded according to whether planning was present in the students' responses and whether the responses described a specific planning technique or a general planning technique.

Student Cultural Openness (adapted from Kelley & Meyers, 1995). A six item scale was constructed to assess students' cultural openness (see Appendix E). Items were adapted from the Cross-Cultural Adaptability Inventory (Kelley & Meyers, 1995). Items examined students' perceptions of relating to people different than themselves, understanding people who are different than themselves, and learning from people different than themselves. For example, item four asked students "When I meet people who are different from me, I am interested in learning more about them". Items followed a 6-point Likert scale format, with a score of 1 indicating *definitely true* and a score of 6 indicating *definitely Not true*.

Teacher Rating Scale of Student Self-Regulated Learning (Kitsantas & Miller, 2013). Teachers completed a 28 item rating scale for each student who participated in the microanalytic interviews. The rating scales measured teacher's perception of participating students' goal setting, strategic planning, monitoring, self-reflection, and motivation to learn in mathematics. Sample items included: “Student selects the appropriate strategies before beginning a math assignment”, “Student uses graded work to help set goals for future assignments”. Teachers were asked to consider each item in terms of how often the student exhibited the learning behaviors, using a 5-point Likert scale ranging from *almost never* (to *almost always*. Teachers also had the option to select *don’t know*.

Artifacts. Classroom materials (e.g. worksheets, assignments) from each observed math lesson were collected. Artifacts were examined within the context of self-regulated learning.

Procedure

Each of the 8 classrooms was observed on four different occasions by four different observers for a total of 32 observations. Each observation occurred during math instruction and the observers were present for the entire mathematics lesson which ranged from 45 minutes to 90 minutes. Observers included the principal investigator, co-principal investigator, a retired faculty member, and six doctoral students. All observers participated in training regarding the IB curriculum as well as a discussion of the instrument and piloting protocol. Observers were asked to rate the quality of the teacher’s ability to provide the SRL element. Observers were also instructed to record comments while completing the observational protocol, including comments regarding the ease of the evaluation.

In addition to completing the T-SRL instrument for each observed lesson, observers also scripted the entire lesson, including their reflections as to students’ response to the observed lesson, observed student engagement, and observed student motivation. These additional points of data (scripting, comments, and reflections) served to supplement the observations made through the T-SRL. Classroom observations were completed in the fall and early winter of the 2013 academic year.

Participating teachers were individually interviewed by members of the research team. All teachers provident consent prior to the interviews. Interviews were conducted in the schools and were conducted at the teachers' convenience. Interviews were guided by the semi-structured teacher interview protocol. Interviews lasted approximately one hour and were completed in the fall and early winter of the 2013 academic year.

Student in context was examined through microanalytic interviews, student cultural openness scale, and through the teacher rating scale of student self-regulated learning. The selection of participants followed a two-step process. First, teachers were asked to nominate six students from their classroom that fit the following criteria: two high-achieving students, two average-achieving students, and two below-average achieving students. Teachers sent home invitations to participate in the research project along with parental consent forms to selected students. A total of nine students returned parental consent forms and participated in the interviews. All interviews were conducted at the schools by research team members. Prior to the interviews, teachers provided the math problem (from that day's lesson) that was used in the microanalytic interviews. Students completed the cultural openness scale after they finished the microanalysis interview. Lastly, teachers completed the rating scale of self-regulated learning for each participating student.

RESULTS

Classroom Context

Classroom context was assessed through the use of a 56-item T-SRL observational protocol. This observational instrument had two main components: classroom environment and structure items and self-regulated learning items. Classroom environment and structure was conceptualized in terms of classroom appearance, classroom organization, and IB themes in the classroom. Self-regulated learning items were considered in terms of the theory's three phases: forethought phase, performance phase and self-reflection phase. The observer rated each items on a 1 (not occurring) to 7 (frequently occurring) Likert scale. Ratings on each item across the 4 observations were averaged for each classroom. These ratings were examined descriptively for each grade level. Although the sample size is small, statistical comparisons were examined and reported when significant.

Classroom Environment and Structure

Classroom Appearance. In terms of classroom appearance (N = 4 items) there were no significant differences observed between the grades. Third grade classrooms tended to score higher in the visibility of motivational materials (*M* = 6.33), visibility of goals or objectives (*M* = 6.33), and visibility of student expectations (*M* = 6.50) as compared to fourth (*M* = 5.25, 5.50, 6.13) and fifth grade (*M* = 5.08, 6.00, 5.50). A composite score of all four items indicated that third grade classrooms scored higher (*M* = 6.40) on this subset of classroom environment than fourth grade (*M* = 5.81) and fifth grade (*M* = 5.77) classrooms.

Classroom Organization. Classroom organization items (*N* = 2) assessed classroom features that facilitate organization such as the use of agendas and the visibility of classroom schedules. These items did not show significant differences between the three grades. Of interest, all three grades showed low use agendas with mean scores ranging from 1.44 to 2.25 on a scale from 1 to 7. Composite wise, third grade classrooms (*M* = 4.29) scored the highest, followed by fourth grade classrooms (*M* = 4.19) and fifth grade classrooms (*M* = 3.42).

IB Themes. IB themes items (*N*= 3) examined classroom environments by looking for features such as the global nature of the IB program and visibility of IB program goals/IB curriculum materials. There were no significant differences among the grades among these items.

Classrooms tended to score high in their visibility of IB curriculum materials and IB program goals, with third grade classroom scoring the highest in these two items (*M* = 6.50, *M* = 6.25). Surprisingly, all three grades scored relatively low on their depictions of the global nature of the IB program, with means ranging from 3.33 to 4.50.

Forethought Phase Self-Regulatory Processes

The forethought phase of the T-SRL contains 16 items (*N* = 16) organized under the following processes: goal setting, strategic planning, self-efficacy, outcome expectations, task interest/value, and goal orientation. These items helped assessed classroom practices believed to enhance the practice of task analysis as well as student motivational beliefs.

Goal Setting. Goal setting was examined through three items (*N*= 3). These items focused on practices such as identifying and setting learning process goals, and the step-by-step modeling of tasks. Third grade classrooms scored the highest on these three items (*M* = 3.58, 4.33, 5.83), though no significant differences were found across the grades. A general trend of 3rd grade classrooms scoring higher (on these items) than 4th grade classrooms and 4th grade classroom scoring higher than 5th grade classrooms emerged. This trend was supported by the mean composite scores 3rd grade (*M* = 4.58), 4th grade (*M* = 3.58), and 5th grade (*M* = 3.44).

Strategic Planning. Strategic planning items (*N* = 2) examined practices that encouraged students to prepare to face a task by having students approach the task in terms of initial strategies and by breaking down tasks into its parts. Scores on item one, which focused on the practice of teachers discussing strategies as a way to initially approach tasks, found significant differences between 3rd (*M* = 6.33) and 4th (*M* = 4.50) grade classrooms, $F(2, 28) = 3.82$, $p = .03$, $\eta^2=.22$. Eta squared effect sizes can be interpreted as follows: small (.01), medium (.04) and large (.14) (Warner, 2013). For item two, no significant differences were observed among the grades, though 3rd grade classrooms continued to score highest, which was also reflected by the composite scores 3rd (*M* = 6.29), 4th (4.94), and 5th (5.17).

Self-Efficacy. Self-efficacy items (*N*= 4) examined practices believed to develop student competency beliefs. The first three items focused on practices such as providing students with opportunities to experience success, student modeling of successful task completion in the presence of other students, and verbal competence persuasions from teachers. These items were constructed to reflect three (out of the four) sources of self-efficacy. The fourth item examined the development of student competency beliefs in terms of teachers making connections between students' capability and their use of strategies as well as their effort. For item one, significant differences were found between 3rd grade classrooms (*M* = 6.42, *SD* = 1.00) and 4th grade classrooms (*M* = 5.00, *SD* = 1.31), and between 3rd and 5th grade classrooms (*M* = 5.33, *SD* = 1.56), $F(2, 29) = 3.40$, $p = .05$, $\eta^2=.19$. For item three, significant differences were found between 3rd (*M* = 6.33, *SD* = .99) and 4th grade classrooms (*M* = 3.29, *SD* = 2.21), and between 3rd and 5th grade classrooms (*M* = 4.25, *SD* = 2.05), $F(2, 28) = 7.76$, $p = .002$, $\eta^2=.36$. On item four, significant differences were observed between 3rd (*M* = 5.92, *SD* = 1.83) and 4th grade classrooms (*M* = 2.29, *SD* = 1.60), and between 3rd and 5th grade classrooms (*M* = 3.92, *SD* = 2.15), $F(2, 28) = 8.34$, $p = .001$, $\eta^2=.37$. Lastly, composite averages also showed significant differences between 3rd (*M* = 6.04, *SD* = 1.02) and 4th grade classrooms (*M* = 4.18, *SD* = 1.38), and between 3rd and 5th grade classrooms (*M* = 4.85, *SD* = 1.48), $F(2, 29) = 5.38$, $p = .01$, $\eta^2=.27$.

Outcome Expectations. Outcome expectation items (*N* = 2) examined whether teachers made connections between the observed task and a desired end goal, as well as whether teachers discussed end results in terms of strategy use, planning, and goal setting. Individually, no significant differences were observed for the two items. In both cases, 3rd grade classrooms (*M* =

5.25, 5.08) scored higher on these items compared to 4th grade (*M* = 3.00, 3.00) and 5th grade (*M* = 3.83, 3.50) classrooms. Composite wise, significant differences were observed between 3rd (*M* = 5.16, *SD* = 1.64) and 4th grade (*M* = 3.19, *SD* = 2.05) classrooms, $F(2, 29) = 3.23$, $p = .05$, $\eta^2 = .18$.

Task Interest/Value. Three items (*N* = 3) were used to examine the subprocess of task interest and value. These items focused on teachers' attempts to incorporate students' interests into the lesson, asking students' about their prior experience with the current topic, and the communication of the task value to the students. No significant differences were observed on item one. Third grade classrooms scored the highest on this item (*M* = 3.64), though this average was the second lowest mean out of the 16 forethought phase items. For item two, no significant differences were observed, with all three grades scoring relatively close to each other. Item three showed significant differences between 3rd (*M* = 4.17, *SD* = 2.25) and 4th grade (*M* = 1.57, *SD* = 1.13), and between 3rd and 5th grade (*M* = 1.92, *SD* = 1.92) classrooms, $F(2, 29) = 6.12$, $p = .01$, $\eta^2 = .30$. Lastly, composite scores showed significant differences between 3rd (*M* = 4.53, *SD* = 1.42) and 5th grade (*M* = 2.94, *SD* = 1.23) classrooms, $F(2, 29) = 3.57$, $p = .04$, $\eta^2 = .20$.

Goal Orientation. Two items (*N* = 2) examined the subprocess of goal orientation. These items examined classroom environments in terms of mastery orientation (emphasis given to the process of learning) and performance orientation (environment avoids a sense of competition among students). For item one, significant differences were observed between 3rd (*M* = 6.42, *SD* = .90) and 4th grade (*M* = 4.25, *SD* = 1.58) classrooms, and between 3rd and 5th grade (*M* = 4.50, *SD* = 1.68) classroom, $F(2, 29) = 7.78$, $p = .002$, $\eta^2 = .35$. No significant differences were observed on item two, though there was a general decline in scores across the grades with 3rd (*M* = 6.17) serving as the high point, followed by 4th (*M* = 5.62) and 5th grade (*M* = 5.33). For the composite, significant differences were observed between 3rd (*M* = 6.29, *SD* = .94) and 4th grade (*M* = 4.94, *SD* = 1.45), and between 3rd and 5th grade (*M* = 4.92, *SD* = 1.38) classrooms, $F(2, 29) = 4.48$, $p = .02$, η^2=.24.

Performance Phase Self-Regulatory Processes

The performance phase of the T-SRL contains nine items (*N* = 9) organized under the following processes: task strategy, self-instruction, attention focusing, and metacognitive monitoring. These items helped assessed classroom practices believed to facilitate student task engagement and to help students attend to aspects of their performance and outcomes.

Task strategies. Three items (*N* = 3) examined classroom practices of incorporating strategies (e.g. highlighting, note taking) as part of the lesson, reminding students to use strategies, and teacher praise and or recognition for student strategy use. For item one, significant differences were observed between 3rd (*M* = 5.58, *SD* = 2.28) and 5th grade classrooms (*M* = 2.92, *SD* = 2.35), $F(2, 29) = 3.88$, $p = .03$ η^2=.21. Significant differences were observed on item two between 3rd grade (*M* = 5.83, *SD* = 2.29) and 5th grade (*M* = 3.08, *SD* = 2.35) classrooms, $F(2, 28) = 4.32$, $p = .02$ η^2=.24. On item three, significant differences were observed between 3rd grade (*M* = 5.42, *SD* = 2.28) and 5th grade (*M* = 3.08, *SD* = 2.11) classrooms, $F(2, 29) = 3.59$, $p = .04$, η^2=.20. Lastly, significant differences were observed on composite averages between 3rd grade (*M* = 5.61, *SD* = 2.22) and 5th grade (*M* = 3.03, *SD* = 2.17) classrooms, $F(2, 29) = 4.22$, $p = .03$, η^2=.23.

Self-Instruction. The subprocess of self-instruction was examined through two items (*N* = 2). These items considered practices such as the modeling of self-instruction (e.g. self-talk) as a strategy and the encouragement (and or) praising of self-instruction as a learning strategy. For items one and two, no significant differences were observed between the grades. Third grade classrooms scored the highest on these two items (*M* = 4.09, 4.08) while 4th (*M* = 1.88, 2.13) and 5th grade (*M* = 2.50, 2.58) scored relatively low on these item. Composite wise, a significant difference was observed between 3rd grade (*M* = 4.08, *SD* = 1.93) and 4th grade (*M* = 2.00, *SD* = 1.49) classrooms, $F(2, 29) = 3.41$, $p = .05$, η^2=.19.

Attention focusing. Two items (*N* = 2) were used to assess the process of attention focusing. These items examined classroom practices such as teacher efforts to refocus distracted students and teacher praise or recognition for students who were focused on the lesson. Item one did observe any significant differences, though a linear decline was observed with 3rd grade (*M* = 5.09) classrooms scoring the highest, followed by 4th (*M* = 4.50) and 5th (*M* = 4.42) grade classrooms. Significant differences were observed for item two between 3rd (*M* = 6.25, *SD* = 1.14) and 4th (*M* = 2.71, *SD* = 1.98) grade classrooms, as well as 3rd and 5th (*M* = 3.92, *SD* = 2.50) grade classrooms, $F(2, 28) = 8.29$, $p = .001$, η^2=.37. For the composite scores, significant differences were observed between 3rd (*M* = 5.63, *SD* = 1.15) and 4th (*M* = 3.50, *SD* = 1.39) grade classrooms, as well as between 3rd and 5th (*M* = 4.42, *SD* = 1.61) grade classrooms, $F(2, 29) = 5.81$, $p = .01$, η^2=.29 .

Metacognitive monitoring. Metacognitive monitoring was examined through two items (*N* = 2). These two items assessed whether teachers provided examples of the use of monitoring in learning (e.g. pausing and evaluating while working on a task) and whether teachers recognized (praised) students who appeared to be employing the strategy of monitoring. For item one, no significant differences were observed. Third grade (*M* = 4.50) scored the highest on this item, followed by 4th grade (*M* = 4.13) classrooms and 5th grade (*M* = 3.08) classrooms. For item two, no significant differences were observed between the classrooms. Third grade (*M* = 4.17) scored the highest, followed by 5th grade (*M* = 2.50) classrooms and 4th grade (*M* = 2.00) classrooms. Composite wise, no significant differences were recorded, though a linear downgrade was observed between the grades with 3rd grade (*M* = 4.33) scoring the highest, followed by 4th (*M* = 3.06) grade and 5th (*M* = 2.79) grade classrooms.

Self-Reflection Phase Self-Regulatory Processes

The self-reflection phase of the T-SRL contains seven items (*N* = 7) organized under the following processes: self-evaluation, causal attributions, self-satisfaction/affect, and adaptive/defensive reactions. These items helped examined aspects of the classroom that are believed to enhance reflective practices in students, which are important in terms of the development of student self-evaluation and student motivation.

Self-evaluation. Three items (*N* = 3) were used to assess practices associated with self-evaluation. More specifically, these items examined the extent to which teachers encouraged the practice of asking “how do we know”, whether teachers instructed students to “pause and think”, and whether teachers discussed the IB curriculum concept of reflection. For item one, significant differences were observed between 3rd (*M* = 6.67, *SD* = .49) and 5th grade (*M* = 4.08, *SD* = 2.78) classrooms, $F(2, 29) = 5.03$, $p = .01$, $\eta^2=.26$. This item also showed a steady decline between the grades with 3rd grade (*M* = 6.67) scoring the highest, followed by 4th grade (*M* = 5.13) and 5th grade (*M* = 4.08). For item two, significant difference were found between 3rd grade (*M* = 6.42, *SD* = .67) and 4th grade (*M* = 3.63, *SD* = 2.26) classrooms, as well as between 3rd and 5th grade (*M* = 4.08, *SD* = 2.43) classrooms, $F(2, 29) = 6.65$, $p = .004$, $\eta^2=.31$. Significant differences were also observed on item three between 3rd grade (*M* = 4.00, *SD* = 2.63) and 4th grade (*M* = 1.25, *SD* = .46) classrooms, $F(2, 29) = 3.63$, $p = .04$, $\eta^2=.20$. Of interest, 4th grade classroom’s average score (*M* = 1.25) on this item was lowest mean score recorded out of all of the items. Lastly, composite scores showed significant differences between 3rd grade (*M* = 5.69, *SD* = 1.00) and 4th grade (M = 3.33, SD = 1.22) classrooms and between 3rd grade and 5th grade (M = 3.72, SD = 2.27) classrooms, $F(2, 29) = 6.40$, $p = .01$, η^2=.31.

Causal attributions. Causal attributions were examined through two items (N = 2). These items assessed teacher practices that encouraged students to examine the reasons behind outcomes, including the practice of attributing errors to deficits in strategy use and not to the self. Item one observed statistically similar results across the grades with 3rd grade (M = 4.75) scoring the highest, followed by 4th grade (M = 3.50) and 5th grade (M = 3.25). Item two was also similar across the grades with 3rd grade (M = 4.73) scoring the highest, followed 4th (M = 3.00) and 5th (M = 3.00) grade classrooms. Composite wise, no significant differences were observed, though a linear decline in scores was observed starting with 3rd grade (M = 4.83), followed by 4th (M = 3.25) and 5th grade (M = 3.13) classrooms.

Self-satisfaction/Affect. This process was assessed through one item (N = 1) which focused on teachers' modeling of adaptive reactions to success and failure. No significant differences were observed across the grades with 3rd grade (M = 4.17) scoring the highest, followed by 4th grade (M = 3.38) and 5th grade (M = 3.08) classrooms.

Adaptive/Defensive. Adaptive and defensive self-reactions were assessed through one item (N = 1) which specifically focused on teachers addressing defensive reactions (e.g. helplessness, procrastination, task avoidance, disengagement) displayed by students. No significant differences were recorded across the grades with 3rd grade (M = 4.09) scoring the highest, followed by 5th grade (M = 3.42) and 4th grade (M = 3.00) classrooms.

Teacher Data

A total of eight (*N* = 8) semi-structured teacher interviews were conducted will all participating teachers. Interviews focused on teachers' beliefs of motivation and self-regulation of learning and how those beliefs influenced their teaching practices. Teacher beliefs (were also examined in terms of how those beliefs were perceived to align with the IB curriculum. Lastly, teachers' were asked about their teaching styles, types of feedback they provided students, and challenges that students face when learning math.

Table 4

Frequencies of teachers' reported practices associated with SRL processes and IB curriculum.

	Forethought Frequency	Performance Frequency	Self-reflection Frequency
Observed	*6*	*7*	*6*
Number of processes mentioned			
Zero	2	1	2
One	3	3	4
Two	3	3	1
Three	-	-	1
Connection to IB curriculum			
Yes	1	-	4
No	7	4	4

Teachers' responses to question one were analyzed in terms of the three phases of the self-regulated learning model and whether teachers made connections between their responses and aspects of the IB curriculum. For example, out of the eight teachers, six (*N* = 6) mentioned forethought processes while discussing their beliefs of student self-regulation (e.g. goal setting, goal orientation). Out of the six teachers that mentioned forethought processes, three teachers (N = 3) mentioned one forethought process, while three teachers (*N* = 3) mentioned two forethought processes in their answers. Lastly, out of all the responses coded as forethought processes, only one teacher (*N* = 1) made a connection between that process and the IB program.

For performance processes, seven teachers (*N* = 7) discussed aspects of student self-regulation that were coded as performance processes. The number of processes mentioned per teacher was as follow: 1 process (*N* = 3), 2 processes (*N* = 3), and 3 processes (*N* = 1). Out of all the performance processes mentioned, none were discussed in terms of the IB program.

Self-reflection processes were mentioned by six teachers (N = 6) when discussing self-regulation. The number of processes mentioned per teacher was as follows: 1 process (N = 4), 2 processes (N = 1), and 3 processes (N = 3). Self-reflection processes were the most connected to aspects of the IB program with four teachers (N = 4) making this connection.

Table 5

Frequencies of teachers' reported practices associated with the four sources of self-efficacy and IB curriculum.

	Mastery Frequency	Vicarious Frequency	Social Frequency	Physiological/Affect Frequency
Observed	*5*	*4*	*1*	*1*
Number of processes mentioned				
Zero	3	4	7	7
One	3	2	-	1
Two	2	2	-	-
Three	-	-	1	-
Connection to IB curriculum				
Yes	0	0	0	1
No	8	8	8	7

Teachers' answer to question 2 were analyzed in terms of: (a) Bandura's four sources of self-efficacy, (b) number of examples provided for each source, and (c) whether examples given for each source were connected to aspects of the IB program. The four sources of self-efficacy were used to analyze teacher's understanding of student competence because they are the basis for the development of self-efficacy beliefs, with mastery experiences serving as the strongest source, followed vicarious experiences, social persuasions, and physiological state. In terms of mastery, five teachers (*N* = 5) discussed this source of efficacy in their responses. Out of these five teachers, three (*N* = 3) gave one example of this source while two teachers (*N* = 2) gave two examples. Lastly, no connections were made between mastery experiences and the IB program.

Four teachers (*N* = 4) mentioned vicarious experiences in their responses. Out of the four, two teachers (*N* = 2) mentioned one example of vicarious experiences while two teachers (*N* = 2) mentioned two examples in their responses. No connections were made between vicarious experiences and the IB program. Only one teacher (*N* = 1) mentioned social persuasions (e.g. direct encouragement, verbal persuasion that one possess the capabilities to master a given task) in their response, with this teacher providing three instances of this type of persuasion. Social persuasion was not connected to the IB program. Lastly, one teacher (*N* = 1) mentioned affective state in their response, with this teacher providing one example of this source of efficacy. This source of efficacy was connected to the IB program.

Table 6
Frequency of teachers' mentioned IB learner profile attributes when discussing teaching practice.

IB Learner profile attributes	Yes	No
Inquirers	6	2
Knowledgeable	4	4
Thinkers	7	1
Communicators	3	5
Principled	0	8
Open minded	4	4
Caring	0	8
Risk takers	1	7
Balanced	0	8
Reflective	4	4

Question three asked teachers how their beliefs regarding student self-regulation (of learning) and student competency fit with their teaching practices and components of the IB program. Responses were analyzed according to the 10 attributes of the IB learner profile. Frequencies for the connections made (teachers' responses and IB learner profile) are listed above. Out of the 10 attributes of the learner profile, "thinkers" and "inquirers" drew the most connections in terms of self-regulation and competency. Of interest, three attributes (principle, caring, balanced) drew no connections, with a fourth (risk-taker) only drawing one connection.

Question four asked teachers to describe their instructional style in mathematics. Teacher's instructional styles were considered in terms of the following characteristics: mastery oriented, performance oriented, guided/social feedback, and self-reflection. Of the four orientations, teachers most often discussed their instructional styles in terms of mastery—which can be described as an emphasis on learning, improvement, and the mastering of skills over time. Out of all of the styles described, only one teacher made a connection between a particular style (self-reflection) and the IB curriculum.

Question 5: *What type of feedback do you typically provide students? How is it provided*? Similarly as in question 4, teachers reported that they provided mostly process /mastery feedback particularly during practice episodes. This type of feedback focuses on the processes (e.g. the parts or steps) that make up a task and how progress is made through the mastery of the parts/steps.

Question 6: *In your opinion, what is the greatest challenge that students experience during math?*

This question elicited a total of 25 responses from the teachers. While some perceptions of student challenges were unique to particular teachers (e.g. students' fear of math, student memory issues, lack of student self-monitoring), four smaller areas of agreement emerged from the data along with one larger theme. One area of agreement was described as having to do with students' characteristics. This was explained in terms of students' lack of confidence, students' identity, and students who displayed fixed mindsets (where students view ability/intelligence as a fixed/innate characteristic). A second area of agreement revolved around parents. This challenge was discussed in two ways: parents who do not support their students from home and parents who provide misguided (incorrect) direction when assisting their students with school work. A third area of agreement was discussed in terms of the challenge that students face when working on word problems/problem solving. The fourth area of agreement revolved around students' lack of a strong mathematical foundation. This challenge was attributed to two areas of deficit: poor prior teaching and students' lack of pre-requisite skills, both of which go hand in hand.

The larger theme that emerged in terms of the greatest challenge students face during math was constructed from eight different points of data. Overall, these points can be synthesized in terms of a lack of higher order thinking in math. For example, one teacher pointed out that students need to understand that math can be done in more than one way. This sentiment was reflected by two other teachers who were concerned with the practice of rote learning/memorization that too often occurs in math. This type learning was described as problematic in that it encouraged students to learn the "concrete" aspects of math and not the more abstract/higher order aspects of math. An illustration of this lack of abstract thinking was given in terms of students who can get an answer—yet cannot articulate how or why they got that answer. This challenge was also echoed by other teachers who were concerned that students lack a deeper knowledge of the content as well as lack critical thinking skills that are necessary for a higher order understanding of math.

Student Data

A descriptive case study approach was used to analyze students' self-regulatory processes in math. Analyses of the microanalytic measurement approach provided qualitative and quantitative data for reporting differences in self-regulatory processes across the three math achievement levels. Examination of the teacher perceptions' of their students' self-regulation were reported using Pearson r correlations.

Table 5 provides the means and standard deviations of the teachers' ratings of the three achievement groups. As seen in Table 5, descriptive results indicate that teachers generally viewed high math performers with higher levels of engagement in self-regulation than average and low performers.

Table 5
Means and Standard Deviations of Teacher Ratings of Students' Self-Regulation by Achievement Level

Student (*N* = 9)	Self-Regulation Phases					
	Forethought		Performance		Self-Reflection	
	M	*SD*	*M*	*SD*	*M*	*SD*
High Achievers (*n* = 5)	4.30	.55	4.73	.32	4.15	.42
Average Achievers (*n* = 3)	4.18	.51	4.21	.28	3.67	.33
Low Achievers (*n* = 1)	2.88	-	3.36	-	3.22	-

Student Self-Regulatory Functioning in Specific Math Problem Solving

Forethought phase. Regarding *strategic planning*, students were shown a specific math problem and then asked about having a plan to solve it. Six out of nine students reported having a strategic plan to solve the presented math problem. In addition, two students in third grade had no plan and one low achieving student in fifth grade failed to mention a strategic plan (i.e. look back at notes, solve it). For this item, the numbers of strategies mentioned by students were counted. Students (n = 3) without a plan reported no strategy.

Regarding *self-efficacy beliefs*, all students reported a high level of self-efficacy for solving the math problem. Students were asked to rate their self-efficacy and outcome expectations on a 0 to 100 scale. In terms of *outcome expectations*, eight students were very sure that they could solve the problem (*M* = 97.5, *SD* = 3.66) and one student in third grade indicated a moderate level (55 out of 100). When asked why they believe they can solve the math problem, seven students responded a general focus and two students had a specific focus. An example of a specific focus is explaining the steps to solve the problem, while a general focus response would be talking about being confident or good at using strategies. Regarding *task interest*, most students (*n* = 7) were interested in learning more about similar math problems. A slight pattern emerged showing that older students (*n* = 3) were more interested in doing similar math problems than compared to younger students (*n* = 1). When asked about their *goal orientation*, all students mentioned that a mastery goal orientation was more important than a performance goal orientation.

Performance phase. Regarding plan implementation, seven students indicated using their original plan to solve the math problem and one fifth grade student had mentioned setting a new plan. When asked about whether they were checking their progress, seven students mentioned that they were checking. All seven responses were valid monitoring, with various responses such as these: “I did it in my head, and then I checked to make sure the right name of food [from the problem]” and checking work using a drawing.

Self-Reflection phase. Regarding *self-evaluation*, students were immediately asked after they finished the math problem whether they achieved their goal to solve the math problem.

Seven students responded having achieved their goal to solve the math problem. Interestingly, students varied in responses when asked about how they knew they achieved or did not achieve their goal. Responses included the following: using a correct strategy (e.g. multiplication) (n = 2), effort (e.g. showing work) (n = 1), and making an incorrect calculation (n = 2). Responses that did not fit with these were indicated as other (i.e., mentioning that they did a good job, feeling confident) (n = 4).

Regarding *causal attribution*, seven students responded using strategies as the main reason why they were successful or failed on the math problem. The strategies mentioned varied across students. For example, a strategy that some students reported was checking one's work. In addition to checking, they mention that "I need to show my work, check, put more than one sentence, and explain everything" and "read the question, be careful, do it, then go over it." One student (third grader) from the average group indicated not knowing basic math skills last year thus attributed his outcome to ability. Another student (fifth grader) from the low achieving group attributed learning to effort. Regarding *satisfaction*, eight students were very satisfied with their overall performance on the math problem (M = 98.13, SD = 3.56) and one fourth grade student (average achiever) that received partial credit for solving the math problem reported being moderately satisfied (50 out of 100). Regarding *adaptive*/*defensive inferences*, students were asked what they needed to do to perform well on the next math problem. Eight students provided adaptive inferences, with seven students indicating strategies and one fifth grade student responding effort. The same third grader who attributed failure to ability responded to this item with do not know.

Table 7

A Case Study Representing Three Fifth Grade Students' SRL Processes

Self-Regulatory Processes	Question	Participant Names		
		Amy (high achiever)	Cindy (average achiever)	Greg (low achiever)
Strategic Planning	Do you have a plan in mind to solve this problem? What is it?	"First, multiply the denominator. For that problem it's 72, then do the numerator, reduce, and figure out how many times 12 goes into 72."	"Just multiply it."	"I did my multiplications of 12 to see if it can be reduced."
Strategy use	Are you using your plan to solve the problem? Do you have a new plan?	"Yes, I did."	"Yes, but now it's big. Maybe there is more?"	"Look back at notes, solve it. "
Self-Monitoring	Are you checking to see if you are getting the answer you thought you would?	"I did some of it in my head and then on paper to check."	"Yes, I check by working backwards"	"Yes, I have the steps; first multiply then reduce."
Self-Evaluation	Have you achieved your goal to solve this math problem? How do you know?	"Yes, confident I got the problem right. My goal is to get it right or to learn from it. 100 usually means you are confident."	"Yes, because I did the work, looked for mistakes."	"Yes. Multiplication, I wrote my facts out, then followed the steps."
Attributions	What is the main reason why you were successful or failed on this math problem?	"I knew how to do it. X is a very good teacher. (S)he taught me how to do it. Makes sure I didn't memorize it but learned it, because you can forget if you memorize it."	"Well, because I checked my work"	"I took my time, rethink, and I'll see if I got this answer correct or not."
Adaptive/ Defensive Inferences	What do you need to do to perform well on the next math problem?	Strategy	Strategy	Effort

Reports of teachers' ratings of their students' self-regulation

Students' reports of self-regulated learning were compared with teachers' reports of their students' engagement in self-regulation. Results indicate that high achieving students were rated more highly by their teachers in various SRL processes within each self-regulatory phase than compared to average and low performers. Particularly, high achieving students surpassed average achievers, who in turn surpassed low achievers in setting goals, utilizing strategies, monitoring of one's own learning, seeking help, using higher level thinking, and motivation. In spite of the small sample size there was a significant positive correlation between math problem solving and teacher reported task analysis, $r = .79$, $p < .05$, and math interest, $r = .79$, $p < .05$. A similar pattern of results emerged for math problem solving and strategy use, $r = .74$, $p < .05$, and strategy implementation, $r = .75$, $p < .05$. A stronger relationship was found between math problem solving and self-evaluations, $r = .89$, $p < .001$. Thus, students who reflected on their performance and evaluated it were more likely to solve the math problem correctly.

Using a microanalytic approach, the present study showed that math students in third, fourth, and fifth grades report using various processes of self-regulation within Zimmerman's three-phase model of self-regulation. Findings showed that high achievers engage in more strategic thinking before, during, and after math problem solving than average and low achievers. These results are fairly consistent with previous research on science learning in high school students (DiBenedetto & Zimmerman, 2010) and test preparation in college students (Kitsantas, 2002). In addition, findings supported earlier studies using a microanalysis with high school and college athletes (Cleary & Zimmerman, 2001; Kitsantas & Zimmerman, 2002). Furthermore, a case study of fifth graders was conducted to provide more insights about the differences in self-regulation among different achievers. Finally, comparison of teachers' and students' reports of self-regulation showed that high achievers differed from average and low achievers.

SUMMARY OF FINDINGS AND IMPLICATIONS

Classroom Context

One of the key contributions of Phase I was the development of the Teacher Self-Regulatory Learning (T-SRL) observational instrument designed to capture classroom practices believed to enhance students' self-regulatory practices. Constructed within the framework of Zimmerman's (2008) three phase model of self-regulated learning, the final version of the T-SRL consists of 32 items that assess 14 self-regulatory processes: goal setting, strategic planning, self-efficacy, outcome expectations, task interest/value, goal orientation, task strategy, self-instruction, attention focusing, metacognitive monitoring, self-evaluation, causal attributions, self-satisfaction/affect and adaptive/defensive reactions.

The T-SRL observation tool is an interesting addition to the research area of self-regulated learning and provides a new approach to collecting data about teacher practice and its impact on student learning. Understanding teachers' strengths and identifying areas of weakness in the cyclic process of self-regulation could have a significant impact on student outcomes. This instrument provides a way to determine what areas of professional development might be helpful to teachers. Self-regulation research is well developed and research has shown how important the development of self-regulation is for students.

Overall, using the T-SRL instrument to assess teachers' ability to communicate self-regulation practices to students can provide valuable information about classroom processes and help to identify areas where teachers can work to help their students increase their self-regulatory practices, resulting in better academic engagement and increased learning. Sample items of the instruments are depicted in Poster at the end of Phase II description.

Teacher in Context

Using interview data it was revealed that teachers were aware of the IB curriculum elements and thoroughly implemented them in the classrooms observed. One aspect of the IB curriculum that was discussed was inquiry-based learning. This form of learning was understood in terms of developing self-initiated learning. One teacher described this method of learning in terms of "tools" which students can use to further their own learning by pursuing topics that interest them. Similarly, being a "risk-taker" was also associated with student self-initiative. The use of learner profile was also discussed in terms of student self-regulation. Teachers mentioned that the learner profile was used in goal setting, feedback, and in the monitoring of progress.

Within the context of math, a couple of teachers discussed the role of the IB practice of group work in the development of student efficacy beliefs. For instance, one teacher mentioned how one of her students was surprised that she was in the same math group as another "student", which helped that student reexamine her/his efficacy beliefs. Math groups were also discussed in terms of allowing students teach of other, which if properly scaffolded, can help develop students' efficacy beliefs in that they can see how similar peers are able to understand and teach mathematical concepts to each other.

The IB practice of reflection was also discussed by a number of teachers. Some teachers used this emphasis by creating reflection journals which prompted students to reflect on their learning (e.g. "What did you learn? How did you learn this?"). One teacher also discussed the use of reflection packets which were sent home on the weekends with the hope that reflections would be shared with parents.

Teachers also engaged in various self-regulatory processes. Below, we provide examples of self-regulatory processes with each phase of self-regulation.

Forethought

One teacher discussed the importance of the "process of learning" in terms of helping her students become self-regulated learners. According to this teacher not only should learning be discussed in terms of a process, learning should also be discussed in terms of "working through the process". Both of these statements are consistent with the forethought processes (strategic planning) that emphasize breaking down learning into its components. Other forethought processes discussed included the use of goal setting. One teacher mentioned the practice of student-led conferences where goals were set and reviewed. Another teacher mentioned using parent conferences to discuss and set goals.

Performance

A number of practices were described by teachers that can be understood in terms of performance phase processes. Among these, the practice of monitoring was discussed by a number of teachers. This was discussed in terms of helping students monitor themselves in terms of knowing when they don't understand something. The use of agendas and teacher created calendars were also mentioned as tools in helping students keep track of their performance. One teacher mentioned the use of color "tags" to help indicate when they did or did not understand something.

Self-reflection

Practices associated with reflection were also mentioned by the teachers. One teacher viewed reflection as an attribute that well rounded students possess evidenced by the fact that these students know how they got their answer. Another teacher mentioned the use of reflection as a way to get students to monitor themselves in terms of matching up with various IB learner profile attributes. By reflecting of these aspects of the IB program, students can see which areas they are strong in, which areas they need work on, and which areas they like. Collectively, these findings provide valuable knowledge to help teachers instill self-regulated learning in their students.

Student in Context

Although the student sample size was small, the findings of the current investigation have important implications for teachers. First, it was found that the use of SRL microanalysis in academic domain allows teachers to gather context-specific information about how students' forethought, performance, and self-reflection are interconnected (Zimmerman, 2000). For example, students who set process-oriented goals demonstrate not only greater motivation to persist in tasks, but also more strategic use, and adaptive reflections of their performance. In contrast, students who set outcome-oriented goals exhibit less motivation, demonstrate fewer strategies, and make more maladaptive reflections of their performance (Cleary & Zimmerman, 2001; Kitsantas & Zimmerman, 2002). Teachers, thus, should emphasize to their students to set process goals rather than outcome goals because process goals are crucial to the development of self-regulation in learning.

In addition, teachers should provide guidance for when and how to use strategies. For example, teachers can advise students to set goals before doing math homework and to think about strategies beforehand (strategic planning). In preparing students for doing math homework and studying for math tests, teachers should help students to develop a repertoire of self-regulated strategies. Furthermore, teachers should instruct students to set new goals after getting back a math test. This form of self-reflection is important because it allows students to evaluate their performance. Particularly, teachers should educate students on making adaptive evaluations of performance that are based on the process of learning rather than on outcomes (Bembenutty, Cleary, & Kitsantas, 2013).

PHASE II OVERVIEW

The aim of Phase II was to (i) develop and modify survey measures to assess specific classroom practices that lead to self-regulatory competency from both the student and teacher perspectives and (ii) examine the predictive power of these influences on students' self-efficacy for learning and development of self-regulation. A newly developed student self-regulation scale was used in tandem with already developed and validated measures of the constructs of interest (e.g. sources of self-efficacy, self-efficacy for self-regulation, and academic engagement). Students also responded to several items assessing their perceptions of the classroom environment and perceptions of teachers' behaviors that enhance self-regulatory processes. The goal was to have a large scale data from a broad range of PYP classroom across the United States.

METHODS

Participants

Students. Three hundred fifty-five students in grades 3, 4, and 5 were sampled from 17 IB world schools in the U.S. The types of schools these students came from varied from Urban, Suburban, and Rural environments, where 76.3% of the students were in public schools and 11% of the students were in Title I schools. Students' age ranged from 8 to 12 (mean = 9.5); 61.1% of the students were Caucasian, 11% Asian, 10.1% Hispanic, and 8% African American. There was an equal representation of both female (n = 179) and male students (n = 176).

Teachers. A total of 64 teachers participated in phase II. Participating teachers reported teaching grades 3 through 5 with an average of 13.8 years of teaching experience (*SD* = 7.60). In terms of IB teaching experience, teachers reported an average of 5.88 years (*SD* = 3.90) of experience. Teachers reported an average age of 42 years (*SD* = 9.80). In terms of demographics 58 teachers were female and 6 male. The majority of the teachers were Caucasian (n = 52). Forty teachers held a Master's degree and 22 a Bachelor's degree.

Student Measures

In addition to demographic items, seven scales were used with all participating students. One scale measuring elementary students' self-regulation was developed by the researchers for this study. All other scales had items that were modified for readability and appropriateness for elementary grade students. Items unless otherwise noted below were scored on five point Likert scales anchored with 1 (Never) and 5 (Always) asking student how often they completed certain tasks or how much a statement described their behaviors.

Personal Data Questionnaire. Students were asked to report their grade, age, and gender.

Elementary Plan, Practice & Reflect Scale (EPPRS) (Miller & Kitsantas, 2013). The EPPRS scale was developed based on the findings from classroom observations of IB PYP classrooms as well as student interviews. In these student directed learning PYP classrooms, students were likely to engage in goal setting and use strategies while working on math concepts. A total of 28 items were initially crafted based on previous work with older students and teacher rating scale items. The initial pool of items was pilot tested with elementary students. Twelve items were selected based on student feedback as well as information from the classroom observations and student interviews. The number of items was intentionally kept low because of the age of the students participating in the study. Many items that would typically work well with older students are inappropriate for the elementary level classroom. The measure uses a 5 point Likert scales anchored with "Never" and "Always" asking students to rate how often they engage in self-regulatory activities when doing homework or studying for math class.

Behavioral & Emotional Engagement. Six items from the Engagement Versus Disaffection with Learning Measure (Skinner, Kindermann, & Furrer, 2009) were adapted for the elementary age sample. Three items measures behavioral engagement (α = .79) and three items measured emotional engagement (α = .83).

Cognitive Engagement. Three items from the Metacognitive Strategies Questionnaire (Wolters, 2003) were used (α = .72). These items have been used previously as measures of cognitive engagement and were selected because of their references to strategy usage.

Student Perceived Responsibility Scale (Zimmerman & Kitsantas, 2007). Twelve items (α = .76) were used to assess student perceptions of responsibility in school. Items gaged whether students viewed certain actions in terms of students' responsibility or teachers' responsibility. Sample items include: "Who is more responsible for a student getting a good grade on a test?" and "Who is more responsible for a student focusing in class?"

Student Self-Regulation Rating Scale for Math (Kitsantas, 2013). Twelve items (α = .77) were created to assess student self-regulation practices within the context of math homework. Items asked students to describe how often they performed certain actions. Sample items include: "I wait to the last minute to start studying for upcoming math tests" and "I look over my math homework assignments and check my understanding".

Student Perceptions about Teachers (Kitsantas & Miller, 2013). Nine items (α = .80) were used to assess student perceptions of teacher practices believed to facilitate self-regulated learning in students. Items asked students if they agreed with the stated items. Sample items include: "If I don't understand something, my teacher explains it another way" and "My teacher takes the time to summarize what we learn each day".

Student Cultural Openness (adapted from Kelley & Meyers, 1995). A six item scale (α = .71) was constructed to assess students' cultural openness. Items were adapted from the Cross-Cultural Adaptability Inventory (Kelley & Meyers, 1995). Items examined students' perceptions of relating to people different than themselves, understanding people who are different than themselves, and learning from people different than themselves. For example, item four asked students “When I meet people who are different from me, I am interested in learning more about them”. Items followed a 6 point Likert scale format, with a score of 1 indicating *definitely true* and a score of 6 indicating *definitely Not true*.

Sources of Self-Efficacy. The four sources of self-efficacy were measured using a 14-item scale (α = .82) developed by Lent, Lopez, & Bieschke (1991) and later adapted by Usher & Pajares (2006). The scale was modified to pertain to mathematics and reduced from a pool of 24-items. Three items addressed mastery experience (e.g., “I always do my best work in math.”), four addressed vicarious experience (e.g., “I admire people who are good at math.”), four addressed social persuasions (e.g., “People often tell me that I am a good math student.”), and three addressed physiological states (e.g., “I am nervous when I work on math.”). Responses for the scale ranged from 1 (*Not at all true*) to 4 (*Completely true*).

Mathematics Self-Efficacy. This 8-item measure (α = .84) used to assess students’ self-efficacy in mathematics was adapted from Joet et al. (2011). The scale included four items to assess students’ domain specific beliefs about math (e.g., “I can solve math problems”) and four items to assess students’ task-specific self-efficacy in numeracy (e.g., “I know how to write numbers in digits and in words”) and computation (e.g., “I can add two three-digit numbers”). Responses for the scale ranged from 1 (*Not at all true*) to 4 (*Completely true*).

Teacher Measures

Three scales, two of which were developed specifically for this study were used in addition to demographic items with all participating teachers.

Teacher Demographics. 17 items were used to assess teacher demographics. These items included gender, years teaching experiences, educational background, and information about the school in which the teacher was working (e.g. class size, title I status, etc.)

Teacher Practices to Support Student Engagement in Math (Miller, 2013). Fifteen items ($\alpha = .83$) were created to assess teacher practices believed to support student engagement. Sample items include: “In math class, I encourage my students to express their preferences and opinions” and “I help students learn to monitor their own progress in math”.

Teacher Self-Regulation Scale (Kitsantas & Miller, 2013). 48 items were created; 24 of the items were to assess teacher activities that promote student self-regulation ($\alpha = .86$) and 24 items ($\alpha = .89$) were to assess teacher’s own self-regulation. Sample items were preceded by the stem “how often do you carry out the stated activities”. Sample items include: “how often do you encourage students to break down tasks into parts?” and “how often do you gain student attention by connecting the lesson to students’ experiences or interests?”

SELF for Teachers (Kitsantas, 2013). Ten items ($\alpha = .93$) were created to assess teacher’s self-efficacy beliefs regarding their teaching practices. Scale items asked teachers to select how confident they felt between 0 – 100% in terms of their ability to carry out a specific teaching practice. Sample items include: “When your students don’t understand a concept in math, can you clarify it by using other methods” and “When describing a complex concept in math, can you relate it to real-world examples that students will understand?”

Procedure

Student and teacher participants were recruited via their in-school IB PYP coordinator. The IBO Research Department provided a letter of introduction to the study as well as email address of PYP coordinators from IB world schools in the United States that have been accredited by the IBO for at least 2 years at the time of survey. IB coordinators were asked to contact their grade 3, 4, and 5 teachers and invite them to participate in the study. In turn, these teacher contacted the parents of their students and informed them of the study and asked them to have their students complete the online survey. The majority of students completed the survey online at home with the consent of their parents. One school elected to complete the surveys online at school after collecting written parental consent. Both student and teacher participants were asked to complete online surveys about their classroom experiences, their perceptions of the classroom environment, their interest and confidence in learning mathematics, learning strategies, and how they view themselves as part of a global community.

RESULTS

Measure Development

An exploratory factor analysis using principal components extraction and varimax rotation was performed on the 12 items that were created for the student self-regulated learning scale. This scale was created for this study as there is no current scale in existence that is appropriate for grade 3 through 5 students. The authors piloted the items and revised items before this initial larger scale examination of the scale.

It was hypothesized that there would be three factors: (a) forethought (b) performance, and (c) self-reflection – found within the data; however only two factors were extracted explaining approximately 47% of the variance in the items. Factors were extracted for Eigenvalues greater than 1. Three items were dropped from the factor solution because of low communalities (< .5); the three items that were removed were "I can tell when I don't understand a math concept," "I make pictures or diagrams to help me learn math concepts", and "I quiz myself to see how much I am learning in mat math during studying". These items were poorly worded for student comprehension or inappropriate for the grade levels surveyed. All nine remaining items correlated strongly with the extracted factors with factor loadings ranging from .48 to .74. Four items made up the planning subscale (α = .81) and five items make up the action subscale (α = .78).The items were averaged to form composite scores for each factor.

Additional analyses were carried out to examine the discriminant and concurrent validity of the constructs. First correlations were examined between other constructs including measures of engagement. It was hypothesized that student's planning (forethought) strategies should correlate positively with cognitive engagement and at a weaker level with emotional engagement. Student actions in carrying out those plans (performance) should correlate positively with both cognitive engagement and behavioral engagement indicators. As can be seen in Table 8, correlations between the newly developed student self-regulation sub scales are in expected patterns. Furthermore, a one-way ANOVA was conducted to determine if there were differences between grade levels on scores on the EPPRs subscales. No significant differences were found between grade levels in planning strategies, $F(2,352) = 1.71$, $p > .05$; there were significant differences in action strategies, $F(2, 352) = 3.60$, $p < .05$ with Tukey post hoc tests indicating that grade 5 students self-reported increased frequencies of performance strategies ($M = 4.1$, $SD = .76$) than grade 3 students ($M = 3.88$, $SD = .71$). Independent t-tests were used to examine gender differences on both subscales; both planning, $t(353) = 2.74$, $p <. 05$ and practice, *t*(252) = 2.62, $p < .05$ were statistically significant with females reporting higher frequencies of planning and practice than male students.

Descriptive statistics

Mean, standard deviation and correlations of the primary constructs of interest are included in table 8 for students and table 9 for teachers.

Table 8

Descriptive Statistics-Students

	1. Mastery Exp.	2. Vicarious Exp.	3. Social Pers.	4 Physio. Resp.	5. Engage.	6. Math Self-Eff.	7. Plan	8. Action
2	.32							
3	.66	.41						
4	.42	.09	.35					
5	.68	.49	.64	.39				
6	.65	.29	.55	.46	.60			
7	.36	.37	.38	.16	.52	.30		
8	.43	.33	.38	.27	.54	.45	.59	
Mean	3.23	2.98	3.09	3.14	3.13	3.52	3.18	4.00
SD	.63	.59	.72	.80	.57	.50	.85	.70

Note: all correlations > .10 significant at $p < .001$

All relationships were in the expected direction. Strongest relationships were found between engagement and math self-efficacy (r = .60) and between mastery experiences and social persuasion (r = .66) as well as between mastery experience and math self-efficacy (r = .65). These moderate positive relationships are in line with the literature and indicate expected relationships for the highly collaborative learning environments of the PYP classrooms. Students' math self-efficacy is influenced by their experiences with math in class as well as by their peers with whom they are working on class activities.

Table 9

Descriptive Statistics-Teachers

	1. Support Student Engage.	2. Teacher Support Student Self-Reg.	3. Teacher Self-Reg.	4 SELF
2	.42			
3	.40	.58		
4	.28	.52	.50	
Mean	6.27	5.98	5.88	89.39
SD	1.14	.58	1.06	7.18

Note. All correlations significant at $p < .001$

Regarding teacher variables there are moderate positive relationships between all measured constructs. Teachers who report that they engage in self-regulation for their own classroom planning are also more likely to encourage self-regulation among their students ($r = .58$).

Predictive Analyses

Students' sources of self-efficacy should relate to their level of math self-efficacy. Prior research has indicated that mastery experience (e.g. an emphasis on learning, improvement, and the mastering of skills over time) is usually the strongest predictor of math self-efficacy as was found with the grade 3-5 elementary level students ($b = .24$, $\beta = .43$, $p < .001$). Social persuasion (b = .12, β = .17, $p < .001$) and physiological state (b = .14, β = .22, $p < .001$ were also significant predictors of math self-efficacy although not as strong as mastery experience.

Students' perceptions of their teachers and math self-efficacy predicted both students' planning and students' action, subscales of the elementary students self-regulation measure. Students' perceived responsibility for learning was not significant in either model. Coefficients are listed in table 10. Students that perceived that their teachers used instructional strategies that supported self-regulatory practices influenced their own use of action and planning strategies. Students with higher levels of math self-efficacy were more likely to report usage of planning and action self-regulation strategies.

Table 10
Regression of Plan and Action

	Plan		Action	
Predictor	b	β	b	β
Students Perceptions	.46*	.33*	.36*	.31*
Student Perceived Responsibility	.01	.01	-.05	-.04
Math Self-Efficacy	.32*	.19*	.51*	.36*
R^2	.19		.29	

*p<.001

SUMMARY OF FINDINGS AND IMPLICATIONS

Measurement development

The preliminary findings in the development of the EPPRS are promising in terms of assessing two of the three phases of the cyclical self-regulatory process. Results support the factors of planning and practicing; however more work is needed in the development of items to assess the self-reflection phase. Based on our findings from the first phase of this research, we are not surprised that this phase did not emerge from the factor analysis. The self-reflection items are difficult to write at an appropriate level for students this age. Furthermore, although being a reflective learner is an attribute that is stressed in the IB PYP curriculum, the enactment of this principle was generally more superficial than is required for the self-regulatory process. For example, most teacher would ask students to “stop and think” or “take moment to reflect” but few teachers gave specific instructions on what to think about and what the topic of reflection should be beyond assessing a very general reaction (e.g. “what did you do well today?”). Upon talking with students, the researchers found that students were unsure of what to do with this information and it requires further intervention from teacher to explain to students how to use information from their successes and failures to inform their future planning and goal strategies. This ‘completion of the cycle’ must be emphasized in order for students to fully benefit from the cyclical function of using outcomes from the practice or performance stage to influence future planning.

In conclusion, although several studies have examined the effects of self-regulated learning with secondary and postsecondary students, evidence exists that elementary school students also benefit from the self-regulation of learning. Given the importance of developing good habits for learning, especially during the formative years of elementary education, more research is needed on developing instruments to assess student SRL in elementary settings, particularly how they engage in self-evaluation and self-react to outcomes. The instrument developed in this study could assist teachers and researchers in assessing student SRL in the classroom and in designing effective instructional interventions to teach students how to self-regulate.

Preliminary data from phase II across approximately 22 classrooms has provided evidence of the relationships between constructs of mathematics self-efficacy and self-regulation among elementary level students. Because of the dearth of information of on these constructs at the elementary level, the contributions of this study to the literature are significant. Furthermore, we replicate previous studies that were completed on an international scale (Joet, Bressoux & Usher, 2012) that found that mastery experience is the best predictor of mathematic self-efficacy. In our sample we also found that social persuasion was a strong predictor of efficacy, which we attribute to the collaborative nature of the typical PYP classroom.

PHASE III OVERVIEW

Three high self-regulated learning classrooms were selected from the quantitative data in phase II of the study. These classrooms were selected based on student reported self-regulated learning and math self-efficacy. All three classrooms were identified by high mean levels of math self-efficacy, self-regulation, and positive perceptions of their teacher. The IB coordinators in each school were contacted and notified that one of their teachers had been identified from the previously reported data as exemplary. The selected teachers were then contacted by email and asked to participate in a telephone interview. Furthermore, one local school who also participated in Phase I of the study also was selected based on student interviews and observer report. The focus of this phase was to use a qualitative case study approach to identify best practices of high self-regulatory classrooms through validation and verification of these practices in high self-regulation classrooms. Research questions addressed both the classroom context and the teacher in context.

Research Questions

Classroom Context. What are the instructional practices in high functioning self-regulatory PYP elementary classrooms used to facilitate student self-efficacy for learning and self-regulatory competence? How do teachers promote and support student self-regulation in elementary school classrooms? Do certain classroom methodologies (e.g. inquiry based learning, use of themes, in-depth investigations, cooperative learning) facilitate or increase students' motivation and use of self-regulatory processes?

Teacher in Context. How do teachers' beliefs about motivation and self-regulation influence classroom practices in high functioning self-regulatory classrooms?

METHODS

Participants

Four teachers participated in phase III of the study. All four teachers were female and ranged in age from 36 to 56 years of age. Two of the teachers were Caucasian, one African American, and one American Indian. All four teachers had multiple years of teaching experience ranging of 4 to 28 years (mean = 10 years). One of the teachers was in her second year of teaching in a PYP school and the other three had from 4 to 6 years teaching experience with the PYP curriculum. In terms of the school environment, one school was urban, two were suburban and one was rural. One of the schools was a Title I school. One school is a French language Immersion and another one is a Spanish immersion school.

Procedure

Each teacher was contacted at a pre-arranged time by telephone. All three teachers interviewed via telephone gave permission for audio recording of their interview. The local teacher was interviewed in her classroom and the interview was also audio recorded. Before beginning with interview questions based on the research questions, teachers were asked to describe their classroom setting. The interview questions posed to each teacher were developed from the three phase model of self-regulation (Zimmerman, 2000). In this semi-structured interview style, teachers were asked a question about one of the phases (planning, performance and reflection) and multiple follow up questions were posed so that the interviewer could interpret the teacher's response. Graduate students transcribed the audio recordings and coded the teachers' responses. Two graduate students and the two researchers coded the transcripts achieving a minimum 85% reliability score across codes. Like coded sections of the transcripts were compiled and examined for similarities in order to provide descriptions of best practices as described by the participants.

RESULTS

The results are summarized in the following sections: teachers' summary of their classrooms, planning, performance, and reflection. Within each primary stage of the self-regulatory process, themes were identified that were common to all four teachers responses.

Teacher classrooms and characteristics

Each of the teachers had very different characteristics with which they described their classrooms. Teacher A teaches in a dual language school and has a class for a week, and then they rotate to the Spanish teacher for a week. Students have two weeks of English instruction and then one week of Spanish instruction. Teacher B teaches math to 59 students, but has a base class of 20 students, seven of which were English Language Learners (ELL). Teacher B teaches fourth grade to a new group of students with a wide range of ability levels, from low performing to high performing. Teacher C teaches in a French immersion school and has 20 students that are taught math and science in French. Finally teacher D teaches students within many demographics including English Language Learners, and students who lack background experiences and knowledge.

Planning

Enhancing Student Cognitive Processes

Three teachers discussed the need for students to set goals, but to also reflect on the goals they set. When setting goals, teacher A described how units began with student goal-setting stating, "Whenever we start a new unit or new topic, so that's how I start. And that's how, I ask them what do you want to learn here? From there I come to know about their goals." She went on to explain that ongoing assessments are another way for Teacher A to explain to students, "where they are right now and how they are achieving their goals." Therefore, Teacher A uses reflection from both the student and teacher perspective to assess whether or not students are meeting their goals. Teacher B also described how she uses assessments as to have students show what they do and do not know. She explained this and stated, "I want my students to think this is what I am really good at, and this is what I need to work at. We look at what do we know, where do we need to go to grow and get to the next step." In addition, teacher B described the importance of having students not only set goals, but listen to each other's goals. She explained, "Everyone listens to each other's goals but their [math] partner shares their partner's goals so they have to show they are listening and work together to help with that goal." Therefore, teacher B uses student goal-setting as well as student collaboration as a way for students to create and reflect upon their goals, as well as those of their math partners. Further, she described how she would often ask students how they planned to meet their goals as a way for students to reflect and think about the goals they set. Additionally, she stressed the importance of students understanding goals and explained, "I want them to understand obtainable goals and the process and importance of learning." Teacher C echoed a similar conception of the obtainable of goals stating that she explained to students, "Let's not focus on you're A or 100%, let's focus on understanding some of these concepts." Therefore teachers A, B and C stressed the need for students to set obtainable goals that were focused on more than simple achievement, but were centered around the process of learning. Teacher D uses a performance-based goal for the class as a whole. She vocalizes that each student has a goal of achieving 88% or higher on their end of the unit math tests. She has a great amount of confidence in the students stating "88% is reasonable for every child, so it's a class goal". If a student achieves this goal they get a math award for those who don't, teacher D uses words of encouragement and a discussion of their effort, and what needs to be involved to achieve this goal.

Enhancing Student Motivational Beliefs

Finally, teachers A, B and C discussed the desire and necessity to increase student motivation for math. Teacher B stated, "I want to install an intrinsic motivation and try to vocalize what I think they are doing well." She explained that having students feel like they are doing well is motivating, and hopefully over time that motivation will become intrinsic to the students. Teacher C also stated that student intrinsic motivation is ideal, and that she wanted students to be more focused on their learning and less on their scores. She stated, "I would rather they be less focused on the numeric value of the overall test, and more focused on the components of the test, which they succeeded at, and the components of the test that they have a weakness." Further, Teacher A discussed

> Especially the low performing kids, when they get, they have the motivation of they can do well and they can work harder, then they can understand better, so it goes much connected with that, but once they achieve that motivation then they want to learn more and more, and they like their math class.

She described how motivation and achievement are connected and when motivation increases, achievement can also increase. In addition, Teacher A explained that building up students' self-confidence is motivating and therefore students' participation can increase. She articulated, "Just building up their confidence, just take it easy and try to do your best on it, and think about it. Making them think that math is not too hard for them." Teacher C described motivation in similar terms and stated that building confidence is an important component of student motivation. She also stated, "So if I can get them to understand what the relevant, what the important part of this hour was, then I think that that is good. Relevancy is really important." Teacher C explained that relevancy was an important component of student motivation, if students could see the relevance in math and science class than they would be more motivated to learn.

Enhancing Student Motivational Beliefs: Relevancy

Additionally, all four teacher described how math instruction needed to focus on real-life application in order to improve motivation and achievement. Teacher B described how she applies math concepts to student's real life to help students become, "really reflective on where you use math and why it's important." She went on to describe how she uses the unit on time to have students notice when they use time in school and at home and then to share these examples with other students in class. Further Teacher B explained, "I really encourage "aha" moments for them and how to use math in the real world. I really notice when they are making applications not just in the classroom but also outside the classroom world." Teacher A articulated the same beliefs about math and stated, "we use math a lot, so I feel that math is very important for our lives" and explained how she makes connections to everyday life for students in the decimal unit. When teaching students about decimals, teacher A explained how she teaches students about money and asks them how they use decimals in their lives. Teacher C discussed how math concepts are not always interesting, but explained, "If you think about it [mode] in isolation it means nothing, but let's pull it apart, what's the real life application for it ." She went on to explain that if students are able to draw connections to their everyday lives they become more engaged and excited to work through math concepts. Teacher D described a similar view as teacher B about encouraging and enjoying the "Aha" moment for a child. She discussed her mindset of such importance for relating math to real world situations and stated, "I hope that in life they can apply this math, I still check in on my prior students to see what connections they are making from the math classroom to real world". Also to reinforce this, teacher D uses real life lessons in her teachings. She shared about bringing her class to the cafeteria to show relevancy for their money unit and buying lunch on a daily basis.

Performance

Collaborative Learning

All of the teachers stressed the importance for math instruction to not solely occur with individual students, but rather through collaboration between students. Teacher B emphasized collaboration and discussed that students had consistent math partners that helped with language and mathematics support. Working with both English and Spanish students she explained, "It is so important to give them language partners for kids who need extra support. When they learn it in Spanish they will encourage English speakers and vice versa." Therefore, Teacher B uses collaboration not only based on math achievement, but language proficiency as well. Teacher D emphasized partner and group work in her lessons by stating "They would work together to line up from greatest to least". She went on to explain depending on the confidence levels of students, they go about solving problems in particular ways. The end result is that group work supports many approaches to a problem. Teacher C described how she rarely has students just working in their desks, but rather has them moving around and working together to foster motivation and engagement. She stated, "I think collaboration is important at this young age, making learning personal." Teacher C continued and explained how the social component to learning makes things fun for students and creates a more comfortable environment. Supporting this idea, Teacher A articulated, "We try to collaborate a lot with each other. We try to learn from each other." She went on to explain that students often have different strategies that other students may not know and so working together offers students a way to learn from one another and see different ways of thinking.

Emphasis on Conceptual Understanding

Another area of importance that all teachers mentioned consistently throughout their interviews was the need for students to understand math conceptually. All teachers described the need for students to show their work, examine mistakes, and determine how to correctly redo problems. Teacher B described, “I like to go over the whole assessment and have kids come up and show their work. I give them a chance to ask questions about it, if they ask to redo it I’ll ask them how they would.” Moreover, Teacher C also described how she uses exit slips to serve the same purpose and to have students describe the concepts behind math problems. Teacher C also articulated that she always gave students the opportunity to reflect on and change things they got wrong on their assessments. She explained the rationale for this process as

> I want to be able to instill in them is when you take a test or a quiz and you get your grade back then it is not the end. What I would love for you to do, in a perfect world, would be to look at that problem and examine it and try to figure out how you got it wrong and be able to correct it.

Teacher C described that giving the points back to the students did not bother her, because students gaining conceptual information was more important than the points themselves. Further, Teacher A explained, “I truly encourage them…to write it down on the paper, whatever you are thinking I want you to write it down, and then go from there. Break it apart, write it down what did you understood from this problem.” Using the same method, Teacher C described how she focused on concept over product in an effort to move students away from memorization and to make students “think a little bit further.” Teacher A also described the need for students to understand the process over the answer and articulated

> So then I had to talk to them about it, that this is not important that I get the right answers, because this is important that you understand the topic…you have to learn this basic before, because it piles up, like building rocks. So I try to bring that back to them that this is not important that you get your answer right, you need to understand the concept.

Moreover, Teacher C explained, "Especially at this young age, it seems to me like we are teaching more involved math nowadays, so we have to break it down for them so it makes sense." She goes on to describe how students learn to understand math from a number sense when they focus on math from a concept over memorization standpoint. Teacher C went on to explain how "teaching isn't telling" and that she teaches through an "investigative approach." She described this and stated, "I almost never give them the actual answer. Because I want them to work through that as a process, it's so much more valuable; the extra time that it takes is worth it." Teacher D takes on a similar approach to teacher B and goes through every questions on the unit test after it has been graded and returned. She also has them write the answers out with her as she is reviewing the test to the class. Teacher D explained "Sometimes when they get all the information together then it goes in a cloud and doesn't come down onto paper." She feels transferring their math knowledge to paper is very difficult for her students, so they work on that together when reviewing.

Using Manipulatives

Both Teacher A and B articulated the need for math manipulatives to be used to improve students understanding of difficult math concepts. Teacher B explained, "Manipulatives are important for kids to build concepts by seeing and working with actual tools. They are not always auditory but handling the concepts and talking about it is key to work through learning modalities." Further, Teacher A described how math manipulatives help engage students because they are hands on activities. She goes on to describe, "I feel that [manipulatives] helps them a lot with the word problems to break it into parts and think about it and also having some hands on, some manipulatives in front of them to think about how they are going to solve it." Therefore, both teachers described how manipulatives are a good method by which students can engage and work through math concepts and word problems. In relation, teacher D never mentioned the use of manipulatives, however the explanations of her lessons support the importance of using manipulatives. She discussed a coin value lesson, where food was placed in a baggy and each student received one to figure out the total value of the bag.

Curriculum

Although all three teachers taught from different mathematics texts and resources, each described how beneficial the IB curriculum guidelines were to the success of their math instruction. Teachers C and D explained how a "spiraling curriculum" helped students to think through concepts in a multitude of ways because the curriculum will "spiral back around" to concepts more than once. Teacher B described a similar belief about the "IB" curriculum because it supports her beliefs about learning and "encourages kids to take charge of their own learning." Finally, Teacher A stated that the "Cognitively Guided Instruction" curriculum helped her to realize teaching was more about "guiding them [students]" and that teaching "should come from the kids." Thus, even though all three teachers used different resources for their instructional methods, each teacher reported their curriculum being integral in their teaching success. Teacher D describes how she is constantly thinking of how to use the curriculum and make it fun for the kids, so learning math is fun.

Reflection

Self-Evaluation

All four teachers discussed the importance of overall student reflection as a part of the learning process. Teacher C described the desire for students to "find a pattern" in their missed assignments and tests to help students learn to identify their own mistakes without teacher assistance. She depicted this need and stated, "[I have them think] what did they make the mistake and how can they rethink about it and try to re teach them to come back to the problem again." Teacher C went on to explain

> I think reflection is really important, I think we can never have enough of that, sometimes in a classroom we are in a time crunch to run through a lesson, and the reflection piece is so important, and they can learn so much from them, how they perceive the lesson, its informative and helps me to write and refine my lesson, and know what they know.

Although time is a constraint in teaching with reflection, Teacher C described how making time for reflection is critical to student success because of how much information students learn from reflection. Additionally, she explained how student reflection also helps her to refine her instructional techniques; thus, articulating how student reflection positively influences both the learning and teaching.

Further, Teacher A explained that students need to reflect on how they did on quizzes/tests in order to gain understanding. Although teacher B did not directly reference quiz and test scores she explained that when students are confused she often has students work together and stated, "I'll have another child explain it because it can help hearing it in different words." In addition, she used specific class time to have students reflect and stated, "One day a week we spend about 10-15 minutes reflecting on whatever unit of inquiry we are in…so they [students] write a few things about what trans disciplinary skills they are using, what are the key concepts, what are related concepts." Teacher D also wants students to reflect on their tests and the understandings of the concepts of the tests. Furthermore she explains "My goal is to get them to pass that test, these tests are very rigorous". This is why she feels the need to reflect on the tests and review every question, after they are graded so important.

Celebrating Growth

All three teachers described the need to focus on growth in relation to math achievement, and as a way to combat students' negative feelings/anxiety about math. Teacher B stated, "It's important for them to hear celebrations, so they hear their successes but it's not something they improve over night." She explained how celebrating student growth is important for students to "accept how they feel but try and help how they can see it in other ways." Teacher A had a similar experience with a student who had a negative preconceived notion about her math ability. In order to combat this student's negative beliefs, Teacher A articulated, "I just tried to place as many successes in her way as possible to change her opinion about it." She then went on to describe the success of this type of approach and how the student's mother thanked her at the end of the year for "changing her perspectives on math." Teacher D uses math awards for the students who achieve the 88% or higher on each unit tests so congratulate them for their efforts and achievement. Teacher C noted how she used warm-ups and whiteboards to have students answer questions and respond to problems in a low-risk environment. During these warm-ups Teacher C would offer students positive feedback such as, "magnifique, formidable, incroyable" to celebrate students' growth in a "cooperative group" environment. Finally, she went on to explain that this process is, "reassuring and confidence building, it's fun it's like a pat on the back."

SUMMARY OF FINDINGS AND IMPLICATIONS

Common themes across teacher interviews align very closely with the social cognitive perspective, which is complementary to the IB curriculum advocating learner responsibility. Below, we provide some guidelines for motivating students and creating a sense of responsibility as well as listing some principles for designing effective learning environments.

Principles for motivating students in the classroom: Many of the findings of this project were consistent with current findings from the motivational literature. In line with Schunk, Pintrich, and Meece (2008) research on cultivating motivated learners in the classroom, these exemplary teachers clearly mentioned that communicating to students that they possess the capacity to learn the material being taught and usefulness of the lessons in terms of the students' lives is a key to building student confidence and attracting their interest. In addition, these teachers emphasized ensuring that students work towards learning goals and that they receive process oriented feedback. Finally, all commented on the importance of modeling learning for their students with the goal to build greater self-efficacy and motivation.

Principles for creating perceived responsibility: Similarly, Schunk et al., (2008) proposed a number of precepts believed to develop personal responsibility in students. Some of these guidelines were directly observed while examining the context of the PYP classroom throughout this project. These precepts include: (a) the role of teachers in modeling personal responsibility for students; (b) allowing for autonomy in the classroom in terms of choices and linking such choices to consequences; (c) proper teacher modeling of internal attributions *(not blaming others for failures nor attributing success to luck*); and (d) the practice of setting goals and evaluating goals in terms of progress and strategy adjustment.

Principles for designing effective learning environments: Each of these principles was evident in researcher observations of highly a self-regulatory classroom and also through researcher interviews with exemplary teachers. As a result of the final phase of this study, we recommend these seven principles also as be representative of the best practices in elementary mathematics education resulting in highly efficacious students who self-regulate their learning.

1. *Create learning environments that allow students to experience ownership of their learning.* Students take responsibility for their own learning and learn to chart their progress and evaluate their own learning strategies.
2. *Provide opportunities for reflection.* The characteristics of an IB learner state that the learner will be reflective. Effective classrooms show evidence of this practice, asking students to think about what went well in the lesson, things that could be improved and what the students would do in the next mathematics lesson.
3. *Organize classrooms for collaboration and cooperation among students, teachers, and others.* All of the teachers we interviewed and observed frequently used collaborative learning with their students and spoke of their belief in allowing students to learn from each other.
4. *Use authentic tasks and problems.* Teachers used authentic tasks to attract student attention and make concepts relevant to their everyday lives. One instance comes to our mind when a teacher pulled a dollar bill from his wallet to link the math concept being taught to money. As the teacher walked around the class with the dollar bill (while explaining the math concept) students seemed to pay greater attention.
5. *Provide opportunities for practice of ways of thinking and learning.* Ways of thinking, in terms of the practice "how do we know" was a particular strength of the PYP classroom.

Numerous observations saw variations of new ways of thinking through the stem of "how do we know". This understanding for the importance of ways of thinking was also reflected in student interviews with one student explaining that it is more important to learn than just to get the problem right.

6. *Provide scaffolding to support student learning.* Scaffolding was observed during math instruction as teacher used small group instruction to provide varying levels of math problems to different groups of students. While observing the small group instruction, teachers would provide instruction, would have students attempt the problem, while observing students who continued to have difficulties. The teacher would then point to how other students solved the problem, and often times had the students show each other how they solved the problem.
7. *Create a culture of learning and respect for others.* This principle was quite a routine in the classrooms observed. An instance of this was observed when one teacher had students cheer whenever a student was called upon and answered a problem or question correctly. What was interesting is that the teacher did not instruct the students to do this, they did it without being reminded, which indicates that this norm was part of the classroom culture set up by this teacher.

CHALLENGES

Collecting data proved to be a challenging endeavor as finding schools willing to participate was a somewhat difficult task. A further challenge in working with the schools was that each school had a different protocol for working with researchers which slowed down the progress of the project. Variations in school district research policies made it so that aspects of the project (e.g. student interviews in Phase I) more challenging to complete as one school district would not allow students to be interviewed during school hours. Students could only be interviewed before or after school, with parents being responsible for their transportation to/from school. Furthermore, we were unable to get enough students to respond to surveys in Phase II because many parents did not provide consent for their children to participate in the study. Teacher participation in Phase III went very well and we were able to collect the data desired.

In closing, we would like to thank the IB organization for giving us the opportunity to conduct this research. We are looking forward to publishing these data and share our manuscripts and findings with your staff and teachers. We also would like to thank the IB Program Officers, Drs. Liz Bergeron and Olivia Halic whose support and guidance in implementing this project has been invaluable.

Appendix A

Teacher Interview Protocol Questions

Instructions for interviewers: Please use the script below to interview the IB PYP teachers. The questions presented in **bold** are for you to ask whereas the notes in *italics* are notes or prompts for your use in the interview.

We are interested in student self-regulation. Student self-regulation refers to the degree to which students set goals, show interest in learning, select strategies, monitor their progress, and self-evaluate to determine whether they are accomplishing their goals.

1. **What are your beliefs about student self-regulation?**

   If necessary prompt teacher on 3 areas- goals, strategies use, tracking progress, and reflections.

2. **Another area of interest is student competence or ability beliefs about their own learning (particularly to learn math concepts). What is your perspective about student competence beliefs?**

3. **How do these (questions 1 & 2) beliefs fit with your teaching practice and the components of the IB program?**

   Prompt for specific examples

4. **How would you describe your instructional style in teaching mathematics?**

5. **What is the type of feedback you typically provide students? How is it provided?**

6. **In your opinion, what is the greatest challenge that students experience during math?**

Appendix B

Teacher Interview Analysis Coding Scheme

Teacher Name:	Overall SR Index:	(Y= 1 N= 0)
		Connection to IB
1. What are your beliefs about self-regulation?	- Forethought processes Y / N - Performance processes Y / N - Self-reflection processes Y / N	Y / N Y / N Y / N
2. Another area of interest is student competence or ability beliefs about their own learning (particularly to learn math concepts). What is your perspective about student competence beliefs?	Four Sources of S-E - Mastery Y / N - Vicarious Y / N - Social Y / N - Physiological/Affect Y / N	 Y / N Y / N Y / N Y / N
3. How do these (questions 1 & 2) beliefs fit with your teaching practice and the components of the IB program?	IB Learner Profile - Inquirers Y / N - Knowledgeable Y / N - Thinkers Y / N - Communicators Y / N - Principled Y / N - Open-minded Y / N - Caring Y / N - Risk-takers Y / N - Balanced Y / N - Reflective Y / N	
4. How would you describe your instructional style in teaching mathematics?	- Mastery oriented Y / N - Performance oriented Y / N - Guide/Social feedback Y / N	Y / N Y / N Y / N

	- Self-reflection Y / N	Y / N
5. What is the type of feedback you typically provide students? How is it provided?	- Process/mastery feedback Y / N - Outcome/performance feedback Y / N	Y / N Y / N
6. In your opinion, what is the greatest challenge that students experience during math?	Open Coding	

Appendix C

Student Micro-Analysis Interview Protocol

1. What are you studying in math this week? Are you good at __________ (the task the student identified) Why?
2. Do you use an agenda to keep up with your list of things to do with your math work? If yes, when and how do you use your agenda?
3. Do you set goals before working on math homework or difficult math homework problems? Why?
4. How do you go about solving a math homework problem?
5. Do you break up math assignments into parts that you understand and to parts that you don't understand? Why?
6. Do you keep track of how well you are doing on homework or while preparing for a math test? If yes, how? If no, why?
7. Do you keep trying, on a math problem when you are having trouble solving it? How?
8. Do you ask questions in class when you do not understand a concept in math? If no, why?
9. Is there a specific place or time where you study for your math tests?
10. Do you check your work to correct any mistakes? How?
11. When you get back a math test score, do you use your score to set new goals?
12. Can you tell when you do not understand a concept in math? How do you know?

Please show the math problem to the student **BUT** do not attempt to solve it at this time**.**

1. Do you believe you can solve this math problem? Why?
2. How sure are you that you can solve this math problem correctly: (10) Not sure at all to (100) Very Sure.
3. Do you have a plan in mind to solve this problem? What is it?
4. How interested are you in learning more about similar math problems?
5. Is it more important to get this problem right or to learn from this problem?

Please have the student **SOLVE** the math problem, then ask the following questions:

6. Are you using your plan to solve this math problem? If no, why? Do you have a new plan?
7. Are you checking to see if you are getting the answer you thought you would?

Now that you have finished this math problem.

8. How satisfied, or happy, are you with your overall performance on this math problem? (10) *Not sure at all* to (100) *Very Sure*.
9. Have you achieved your goal to solve this math problem? How do you know?
10. What is the main reason why you were successful or failed on this math problem?
11. What do you need to do to perform well on the next math problem?

Appendix D

Coding Scheme for Microanalysis

Self-Regulatory Processes	Microanalytic Questions	Coding Scheme
	Forethought Phase	
Self-efficacy	What are you studying in math this week? Are you good at ___________ (the task the student identified) Why?	1=Good 0=Not good 1=Low self-efficacy 2=High self-efficacy
Strategic planning	Do you use an agenda or planner to keep up with your list of things to do with your math work? If yes, when and how do you use your agenda/planner?	0=No 1=Sometimes 2=Most times
Goal setting	Do you set goals before working on math homework or difficult math homework problems? Why?	1=Goal 0=No Goal Outcome Process-general Process-specific Do not know
Strategic planning	How do you go about solving a math homework problem?	Specific technique General technique Do not know
Task analysis	Do you break up math assignments into parts that you understand and to parts that you don't understand? Why?	1=Yes 0=No Specific focus General focus Specific technique General technique
Self-efficacy	Do you believe you can solve this math problem? Why?	1=Yes 0=No Specific focus General focus
Outcome expectation	How sure are you that you can solve this math problem correctly: (10) Not sure at all to (100) Very Sure.	Continuous scale (10) Not sure at all to (100) Very Sure.
Strategic planning	Do you have a plan in mind to solve this problem? What is it?	0=No plan 1=Not good plan 2=Good plan Count the number of strategies used/noted.

Task interest	How interested are you in learning more about similar math problems?	0=Not very interested 1=Somewhat interested 2=Very interested Don't know
Goal orientation	Is it more important to get this problem right or to learn from this problem?	Mastery goal orientation Performance goal orientation
	Performance	
Self-monitoring	Do you keep track of how well you are doing on math homework or while preparing for a math test? If yes, how? If no, why?	1=Yes 0=No Process/technique Non-process/technique
Motivation	Do you keep trying on a math problem when you are having trouble solving it? How?	1=Yes 0=No Specific process/technique General process/technique
Help seeking	Do you ask questions in class when you do not understand a concept in math? If no, why?	1=Yes 0=No
Environmental Structuring	Is there a specific place or time where you do your math homework or study for your math tests?	1=Yes 0=No
Plan implementation	Are you using your plan to solve this math problem? If no, why? Do you have a new plan?	1=Yes 0=No Valid plan Not valid plan Don't know
Self-monitoring	Are you checking to see if you are getting the answer you thought you would?	1=Yes 0=No Valid monitoring Not valid monitoring Don't know
	Self-Reflection	
Self-evaluation	Do you check your work to correct any mistakes? How?	1=Yes 0=No Process/technique Non-process/technique
Self-evaluation	When you get back a math test score, do you use your score to set new goals?	0=No 1=Sometimes

		2=Most times
Strategy use	Can you tell when you do not understand a concept in math? How do you know?	1=Yes 0=No Count the number of strategies
Self-satisfaction	How satisfied, or happy, are you with your overall performance on this math problem? (10) *Not sure at all* to (100) *Very Sure*.	Continuous scale (10) *Not sure at all* to (100) *Very Sure*.
Self-evaluation	Have you achieved your goal to solve this math problem? How do you know?	1=Yes 0=No Use of correct strategy Effort Incorrect calculation Other
Attribution	What is the main reason why you were successful or failed on this math problem?	Ability Effort Strategy Other
Adaptive/Defensive Inferences	What do you need to do to perform well on the next math problem?	Ability Effort Strategy Do not know

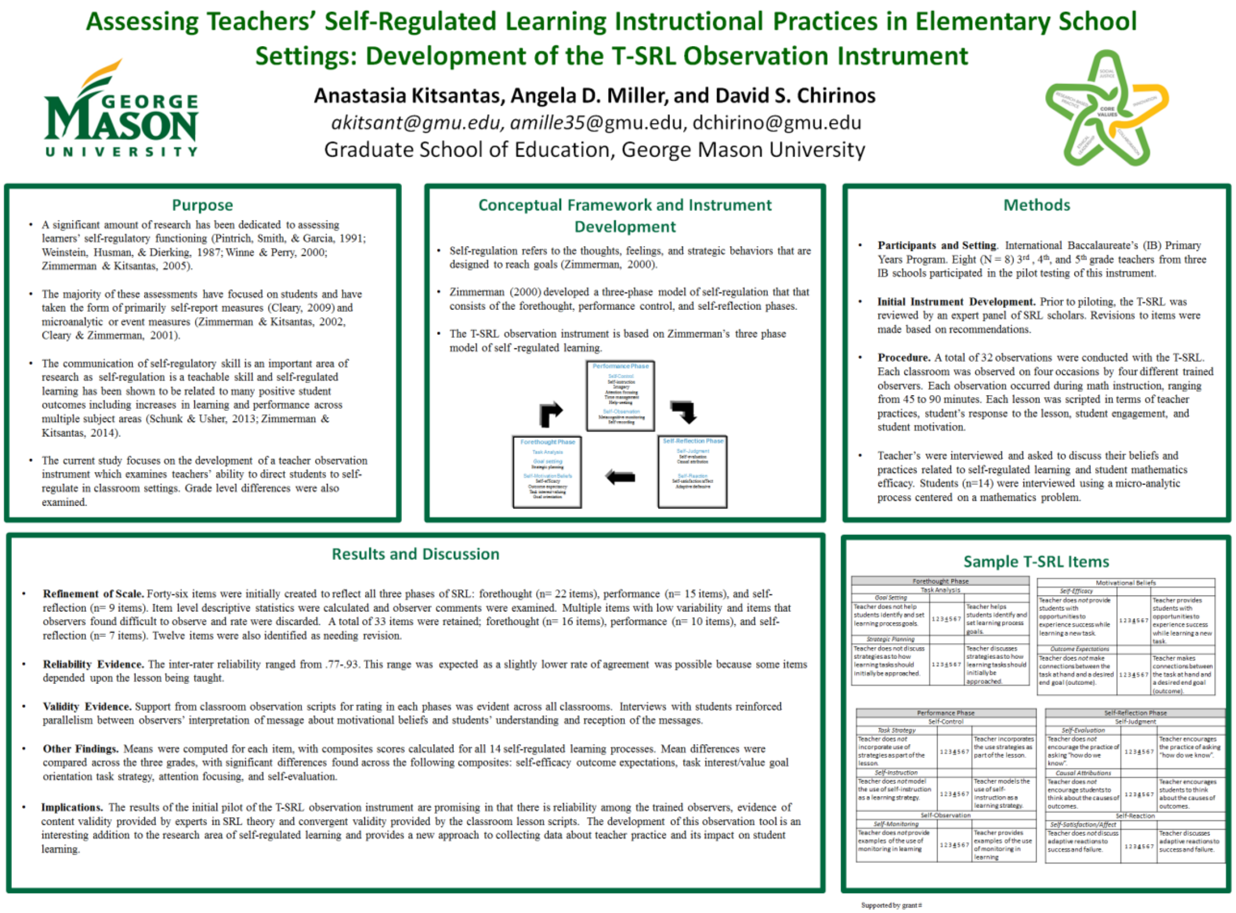
Appendix E

Student Cultural Openness

Read each statement carefully and choose the response that best describes you right now. Indicate your response by circling the appropriate number below the statement.

	Definitely true	True	Tends to be true	Tends to be NOT true	NOT True	Definitely NOT true
1. I can enjoy relating to all kinds of people.	1	2	3	4	5	6
2. I like being with all kinds of people.	1	2	3	4	5	6
3. I am not good at understanding people when they are different from me.	1	2	3	4	5	6
4. When I meet people who are different from me, I am interested in learning more about them.	1	2	3	4	5	6
5. I enjoy talking with people who think differently than I think.	1	2	3	4	5	6
6. When I meet people who are different from me, I expect to like them.	1	2	3	4	5	6

Appendix F



Assessing Teachers' Self-Regulated Learning Instructional Practices in Elementary School Settings: Development of the T-SRL Observation Instrument

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Purpose

- A significant amount of research has been dedicated to assessing learners' self-regulatory functioning (Pintrich, Smith, & Garcia, 1991; Weinstein, Husman, & Dierking, 1987; Winne & Perry, 2000; Zimmerman & Kitsantas, 2005).
- The majority of these assessments have focused on students and have taken the form of primarily self-report measures (Cleary, 2009) and microanalytic or event measures (Zimmerman & Kitsantas, 2002, Cleary & Zimmerman, 2001).
- The communication of self-regulatory skill is an important area of research as self-regulation is a teachable skill and self-regulated learning has been shown to be related to many positive student outcomes including increases in learning and performance across multiple subject areas (Schunk & Usher, 2013; Zimmerman & Kitsantas, 2014).
- The current study focuses on the development of a teacher observation instrument which examines teachers' ability to direct students to self-regulate in classroom settings. Grade level differences were also examined.

Conceptual Framework and Instrument Development

- Self-regulation refers to the thoughts, feelings, and strategic behaviors that are designed to reach goals (Zimmerman, 2000).
- Zimmerman (2000) developed a three-phase model of self-regulation that that consists of the forethought, performance control, and self-reflection phases.
- The T-SRL observation instrument is based on Zimmerman's three phase model of self -regulated learning.

Performance Phase
Self-Control
Self-instruction
Imagery
Attention focusing
Time management
Help-seeking
Self-Observation
Metacognitive monitoring
Self-recording

Forethought Phase
Task Analysis
Goal setting
Strategic planning
Self-Motivation Beliefs
Self-efficacy
Outcome expectancy
Task interest/valuing
Goal orientation

Self-Reflection Phase
Self-Judgment
Self-evaluation
Causal attribution
Self-Reaction
Self-satisfaction/affect
Adaptive/defensive

Methods

- **Participants and Setting**. International Baccalaureate's (IB) Primary Years Program. Eight (N = 8) 3rd, 4th, and 5th grade teachers from three IB schools participated in the pilot testing of this instrument.
- **Initial Instrument Development.** Prior to piloting, the T-SRL was reviewed by an expert panel of SRL scholars. Revisions to items were made based on recommendations.
- **Procedure.** A total of 32 observations were conducted with the T-SRL. Each classroom was observed on four occasions by four different trained observers. Each observation occurred during math instruction, ranging from 45 to 90 minutes. Each lesson was scripted in terms of teacher practices, student's response to the lesson, student engagement, and student motivation.
- Teacher's were interviewed and asked to discuss their beliefs and practices related to self-regulated learning and student mathematics efficacy. Students (n=14) were interviewed using a micro-analytic process centered on a mathematics problem.

Results and Discussion

- **Refinement of Scale.** Forty-six items were initially created to reflect all three phases of SRL: forethought (n= 22 items), performance (n= 15 items), and self-reflection (n= 9 items). Item level descriptive statistics were calculated and observer comments were examined. Multiple items with low variability and items that observers found difficult to observe and rate were discarded. A total of 33 items were retained; forethought (n= 16 items), performance (n= 10 items), and self-reflection (n= 7 items). Twelve items were also identified as needing revision.
- **Reliability Evidence.** The inter-rater reliability ranged from .77-.93. This range was expected as a slightly lower rate of agreement was possible because some items depended upon the lesson being taught.
- **Validity Evidence.** Support from classroom observation scripts for rating in each phases was evident across all classrooms. Interviews with students reinforced parallelism between observers' interpretation of message about motivational beliefs and students' understanding and reception of the messages.
- **Other Findings.** Means were computed for each item, with composites scores calculated for all 14 self-regulated learning processes. Mean differences were compared across the three grades, with significant differences found across the following composites: self-efficacy outcome expectations, task interest/value goal orientation task strategy, attention focusing, and self-evaluation.
- **Implications.** The results of the initial pilot of the T-SRL observation instrument are promising in that there is reliability among the trained observers, evidence of content validity provided by experts in SRL theory and convergent validity provided by the classroom lesson scripts. The development of this observation tool is an interesting addition to the research area of self-regulated learning and provides a new approach to collecting data about teacher practice and its impact on student learning.

Sample T-SRL Items

Forethought Phase		
Task Analysis		
Goal Setting		
Teacher does not help students identify and set learning process goals.	1 2 3 4 5 6 7	Teacher helps students identify and set learning process goals.
Strategic Planning		
Teacher does not discuss strategies as to how learning tasks should initially be approached.	1 2 3 4 5 6 7	Teacher discusses strategies as to how learning tasks should initially be approached.

Motivational Beliefs		
Self-Efficacy		
Teacher does *not* provide students with opportunities to experience success while learning a new task.	1 2 3 4 5 6 7	Teacher provides students with opportunities to experience success while learning a new task.
Outcome Expectations		
Teacher does *not* make connections between the task at hand and a desired end goal (outcome).	1 2 3 4 5 6 7	Teacher makes connections between the task at hand and a desired end goal (outcome).

Performance Phase		
Self-Control		
Task Strategy		
Teacher does *not* incorporate use of strategies as part of the lesson.	1 2 3 4 5 6 7	Teacher incorporates the use strategies as part of the lesson.
Self-Instruction		
Teacher does *not* model the use of self-instruction as a learning strategy.	1 2 3 4 5 6 7	Teacher models the use of self-instruction as a learning strategy.
Self-Observation		
Self-Monitoring		
Teacher does *not* provide examples of the use of monitoring in learning	1 2 3 4 5 6 7	Teacher provides examples of the use of monitoring in learning

Self-Reflection Phase		
Self-Judgment		
Self-Evaluation		
Teacher does *not* encourage the practice of asking "how do we know".	1 2 3 4 5 6 7	Teacher encourages the practice of asking "how do we know".
Causal Attributions		
Teacher does *not* encourage students to think about the causes of outcomes.	1 2 3 4 5 6 7	Teacher encourages students to think about the causes of outcomes.
Self-Reaction		
Self-Satisfaction/Affect		
Teacher does *not* discuss adaptive reactions to success and failure.	1 2 3 4 5 6 7	Teacher discusses adaptive reactions to success and failure.

Supported by grant #

Kitsantas, A., Miller, A. D., & Chirinos, D. S. (2014, October). *Assesing teachers' self-regulated learning instructional practices in elementary school settings: Development of the T-SRL observation instrument.* Poster session presented at the Advances in Educational Psychology Conference, Division 15, Educational Psychology, of the American Psychological Association, Fairfax, VA.

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