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Effects of the Self-Regulation Empowerment Program (SREP) on middle school students' strategic skills, self-efficacy, and mathematics achievement☆

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ABSTRACT

The current study examined the effectiveness of an applied self-regulated learning intervention (Self-Regulation Empowerment Program (SREP)) relative to an existing, school-based remedial mathematics intervention for improving the motivation, strategic skills, and mathematics achievement of academically at-risk middle school students. Although significant group differences in student self-regulated learning (SRL) were not observed when using self-report questionnaires, medium to large and statistically significant group differences were observed across several contextualized, situation-specific measures of strategic and regulatory thinking. The SREP group also exhibited a statistically significant and more positive trend in achievement scores over two years in middle school relative to the comparison condition. Finally, SREP students and coaches reported SREP to be a socially-valid intervention, in terms of acceptability and importance. The importance of this study and critical areas for future research are highlighted and discussed.

1. Introduction

Educators and researchers have long recognized that student success in middle and high school goes beyond mere exposure to high quality instruction and mastery of basic academic skills, such as reading, mathematics, or writing. Student achievement is also determined by a host of interacting cognitive abilities (e.g., fluid reasoning, executive functions) and motivational and regulatory skills (DiPerna, Volpe, & Elliot, 2002; Fuchs et al., 2003; Graham & Harris, 2009). In recent years, self-regulated learning (SRL) and motivation principles have been thrust into the spotlight. Self-regulated learning, which is broadly defined as self-generated thoughts and actions that are proactively initiated and cyclically sustained to attain personal goals, has been identified as a core 21st century skill (Anderson Koenig, 2011) and is naturally embedded in national curriculum standards and initiatives, such as Common Core (White & DiBenedetto, 2015). Despite decades of research underscoring SRL and motivation as critical predictors of academic success, there is evidence that these variables are not routinely incorporated into classroom instruction nor do they serve as an integral component of academic support services or many academic-based interventions (Cleary, Gubi, & Prescott, 2010; Wehmeyer, Agran, & Hughes, 2000).

This lack of attention to SRL and motivation is particularly problematic for middle school students because of the unique set of

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demands, expectations, and challenges that they encounter when transitioning from elementary school (Grolnick & Raftery-Helmer, 2015). For example, unlike in elementary school when most students learn content area information or academic skills from one or two teachers, middle school students receive instruction from a myriad of teachers who will likely vary in their teaching styles and instructional approaches. Middle school students will also encounter more complex and rigorous courses and are typically expected to display more independent, self-directed learning outside of the school day (Cleary & Chen, 2009; Grolnick & Raftery-Helmer, 2015). Given that students also periodically encounter many other types of academic challenges, such as preparing for comprehensive unit tests in math, managing multiple homework assignments, or attempting to catch up with schoolwork after missing several days due to an illness, it is important for educators to recognize that all students will encounter some type of challenge during school. In fact, many of these students are likely to experience multiple and/or intensive challenges that concurrently operate and intersect.

The unfortunate reality, however, is that many students will struggle to effectively cope with and overcome these challenges because of maladaptive motivation profiles or mindsets (e.g., low self-efficacy, entity conceptions of ability), deficient metacognitive and strategic skills (Blackwell, Trzesniewski, & Dweck, 2007; Butler, Beckingham, & Lauscher, 2005; Dignath & Büettner, 2008), or inadequate feedback provided by others (Cleary et al., 2010; Hattie & Timperley, 2007). This combination of maladaptive SRL skills and ineffective forms of feedback makes it very difficult for some students to reflect adaptively and to figure out ways to overcome barriers to their learning. When also taking into account that youth from marginalized or disadvantaged backgrounds are prone to exhibit maladaptive motivation beliefs (e.g., self-efficacy, interest) and underdeveloped problem-solving or regulatory skills (Byrnes, 2003; Steele, 1997), there is a strong need to develop intervention programs that target these types of processes and populations. The primary purpose of the current study was to examine the extent to which a school-based academic intervention, Self-Regulation Empowerment Program (SREP), enhanced the regulatory skills and mathematics achievement of a group of academically at-risk youth in an urban middle school.

1.1. Need for integrating academic and psychological intervention supports

The types of intervention support services that academically at-risk students receive in middle school often vary across school districts. Although the large majority of public schools provide instructional programming and support services for students with disabilities, such as resource room and related services (e.g., counseling), the quality and the availability of other remedial or supportive academic programs is much less uniform. For example, whereas some middle schools may exhibit the capacity and infrastructure to offer different types of instructional supports or study skills programs to students who struggle, not all school districts are as fortunate. Many schools, particularly those in urban, less affluent neighborhoods, do not have the financial or personnel resources to provide such programming. Of even greater concern are findings from research showing that many K-12 schools do not frequently provide SRL and motivation intervention supports and services to students (Cleary et al., 2010).

The overall lack of SRL and motivation supports in schools is interesting given that there are intervention approaches available to address these issues (Butler et al., 2005; Cleary, 2015; Dignath & Büettner, 2008; Hattie, Biggs, & Purdie, 1996). In terms of motivation, which can be defined as goal-directed behavior that is self-initiated and sustained (Schunk, Meece, & Pintrich, 2014), interventions targeting specific motivation beliefs, such as self-efficacy (i.e., enhancing students' beliefs in their capacity to perform specific behaviors), growth mindset (i.e., cultivating a belief that intelligence and ability can be improved), purpose for learning (i.e., enhancing students' perceptions of the meaningfulness or value of learning), and attribution re-training (i.e., getting students to attribute failure to controllable factors), have been shown to exert positive effects on student behavior and academic outcomes (Bandura, 1997; Blackwell et al., 2007; Borkowski, Weyhing, & Carr, 1988; Dweck & Leggett, 1988; Good, Aronson, & Inzlicht, 2003). Along the same lines, study skills or strategy instruction, which entails teaching students knowledge and procedures about how to learn or acquire information, has also been a topic of interest among educators and researchers (Dunlosky, Rawson, Marsh, Nathan, & Willingham, 2013; Gettinger & Seibert, 2002; Pressley & Harris, 2008). Although different labels have been used to describe strategic processes, such as study skills, cognitive strategies, and regulatory or metacognitive strategies, several meta-analyses and review articles have shown that students who become more knowledgeable and skilled in using tactics and strategies during learning tend to improve their academic outcomes (Dunlosky et al., 2013; Hattie et al., 1996; Pressley & Harris, 2008).

Researchers have also noted that motivation or strategy instruction alone is often not as effective as when combined with metacognitive or regulatory training (Cleary & Platten, 2013; Dignath & Büettner, 2008; Montague, Enders, & Dietz, 2014). In their comprehensive review of SRL interventions implemented with school-aged populations, Dignath and Büettner (2008) concluded that interventions that combined strategy instruction with reflection activities (metacognition) tended to produce the largest effect sizes. Although most contemporary SRL interventions tend to integrate cognitive strategy instruction and metacognition training, relatively few of them attempt to address all three areas (motivation, strategy use, metacognition) in a comprehensive way as part of authentic learning experiences. A few of the more notable applied SRL intervention programs that address all three components include Guthrie and colleagues' Concept-Oriented Reading Instruction (CORI; Guthrie et al., 2004), Graham and Harris's Self-Regulated Strategy Development (SRSD; Graham & Harris, 2009), and Montague's SolveIt (Montague et al., 2014). These intervention programs have received much empirical support with each being linked to a core academic skill: reading (CORI), writing (SRSD), and mathematics problem-solving (SolveIt).

To our knowledge, however, very few applied academic intervention programs exist that are specifically structured to help middle and high school students reflect on the course-specific and day-to-day academic challenges that inhibit their learning. There is also a paucity of applied intervention programs that provide students with intensive motivation and SRL coaching and feedback needed for them to learn, practice, and revise their strategic attempts to succeed (Butler et al., 2005; Cleary & Platten, 2013). The Self-Regulation Empowerment Program (SREP) is a school-based, SRL academic intervention program developed to address these issues.

1.2. Overview of SREP

SREP is a comprehensive psycho-educational intervention program designed to help academically vulnerable and at-risk middle and high school students develop effective strategic and regulatory patterns of thinking and action to overcome low motivation, poor self-awareness, deficient strategic skills, and below-average academic performance. Broadly speaking, SREP coaches provide individualized, in the moment coaching and feedback to: (a) increase student awareness about the reasons why they are struggling in a particular class, (b) enhance their knowledge and skills in using strategies to remedy these problems, and (c) help them adapt and refine these strategies as they attempt to improve or make progress in school (Cleary & Platten, 2013).

1.2.1. Theoretical foundation

SREP is an intervention largely grounded in social-cognitive principles, although it does draw from constructivist and other paradigms. In terms of social-cognitive theory, SREP emphasizes the importance of reciprocal determinism, contextualized learning, observational learning, and self-efficacy enhancement. Thus, SREP recognizes that although there are many contextual and environmental influences on student behavior, those effects are often mediated through students' beliefs and attitudes. SREP coaches also devote much attention to modeling and guided practice of various learning and regulatory strategies (Cleary & Platten, 2013). That is, they explicitly explain and demonstrate how to use strategies to address challenges and provide students with extensive opportunities to practice and refine these strategies over time. Finally, given the central role of personal beliefs and other types of cognition in social-cognitive models, SREP coaches devote much attention to enhancing student efficacy about performing well in school and to helping them restructure maladaptive beliefs following failure (e.g., attributing poor performance to ability or uncontrollable factors).

Constructivist principles are also embedded into SREP. For example, because SREP is typically administered in small student group formats, peer-mediated learning experiences are naturally emphasized. Students have frequent opportunities to collaborate with their classmates during SREP sessions regarding their strategic thinking and behaviors. Further, although SREP coaches model and explain how to use learning and regulatory strategies, they encourage students to adapt these strategies as needed to make them more personally relevant and meaningful. Thus, SREP embraces the fact that students can benefit from both direct instruction and the construction or co-construction of personally-relevant strategies.

At the theoretical core of SREP is the notion of an SRL cyclical feedback loop. In a general sense, SRL is a multi-dimensional construct that involves an integration of several key dimensions of functioning including motivation, strategy use, and metacognition. Most contemporary theorists view SRL as a dynamic and fluid process characterized in terms of a goal-directed, cyclical feedback loop; that is, a process through which individuals plan, use, and continually adapt or refine various types of self-control strategies (e.g., attention enhancing, self-instruction, use of learning strategies, environmental structuring) to optimize achievement and goal attainment (Efklides, 2014: Pintrich, 2000; Winne & Hadwin, 1998; Zimmerman, 2000). Using a social-cognitive lens, Zimmerman (2000) operationalized this process in terms of three sequential, related phases: forethought, performance, and self-reflection. Forethought phase processes, which include goal-setting and strategic planning, precede action or learning attempts and set the stage for individuals' purposeful use of self-control strategies (e.g., task strategies, self-instruction) during learning or the performance phase. It is within the performance phase that individuals also intentionally monitor strategy effectiveness and track their progress towards personal goals. In the final phase, self-reflection, individuals use self-monitored information and/or feedback from external sources (e.g., teachers) to make judgments about the quality of their learning and to identify the factors underlying their successes or failures. The types of self-judgments that students make are important because they impact whether the students will make the necessary adjustments to enhance learning when struggling. A central focus of SREP is to immerse students in multiple cycles of regulatory thinking and action (i.e., weekly feedback loops and unit exam feedback loops) on an ongoing basis in order to help them overcome personal challenges they experience when attempting to learn (see Fig. 1).

1.2.2. Instructional characteristics of SREP

The SREP program adheres to a flexible or semi-structured protocol approach to instruction that is administered to small groups of students multiple times per week, typically over the course of 3–4 months. Although extensive details about the characteristics of SREP modules are provided elsewhere (Cleary & Platten, 2013; Cleary, Platten, & Nelson, 2008), we address a few core principles that guide all SREP activities.

The instructional modules and guidelines used in SREP are divided into three broad categories: (a) foundational, (b) strategy learning and practice, and (c) self-reflection. The foundational modules are administered in sequence during the first four or five sessions of the program. They are designed to build rapport with students, to engage them in interactive activities to learn foundational knowledge and concepts in SRL, and to introduce them to the most essential worksheets and monitoring forms used in the program.

The strategy learning and practice category, which represents approximately 60% - 70% of SREP sessions, provides explanation, modeling, and guided practice opportunities for students to use different strategies to directly enhance their learning (e.g., draw pictures when solving mathematics problems) or enable them to effectively manage their thoughts, behaviors, and learning contexts (e.g., self-quizzing, self-motivation, help-seeking, time management). To guide strategy instruction and adaptation, SREP coaches adhere to a structured weekly instructional format represented by the acronym RAPPS (Review, Analysis, Practice, Plan, Self-direction; see Method section).

The final SREP instructional category involves the *self-reflection module*. This module is administered after students receive feedback about their performance on a target learning activity (e.g., test grades). Unlike the foundational modules, which are only

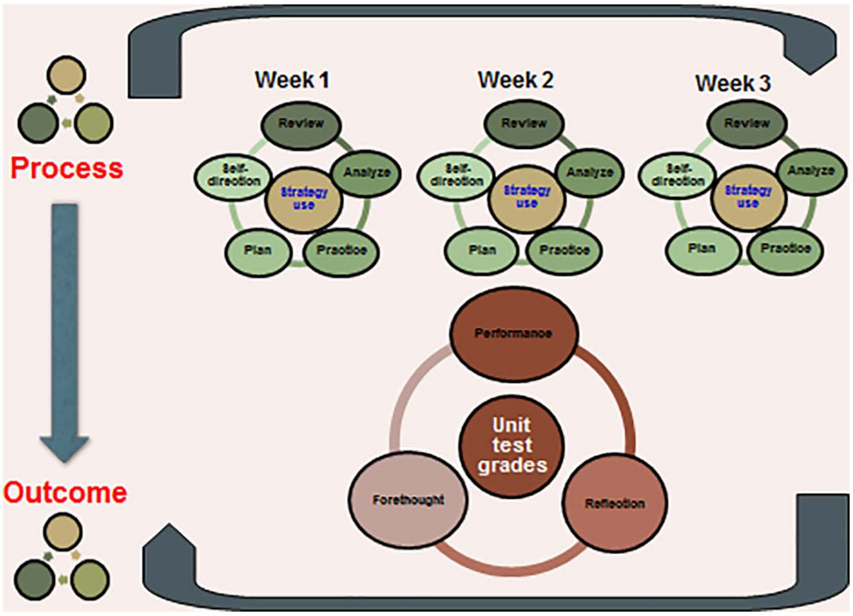

Fig. 1. Depiction of Weekly Feedback Loops embedded within Unit Test Feedback Loops. This figure illustrates a "feedback loop embedded in a feedback loop" concept. Students learn to engage in cyclical regulatory thinking about their use of strategies on a weekly basis. These weekly loops are embedded within a broader cycle of regulatory thinking and action regarding mathematics test performance outcomes.

administered at the beginning of SREP, the self-reflection module is administered whenever students receive performance feedback. During this module, the SREP coach guides students through a highly systematic process of self-reflection that encourages students to reflect on and discuss perceptions of their performance.

1.2.3. Purposes and rationale

To date, a couple of studies have implemented SREP with secondary school students (Cleary & Platten, 2013; Cleary et al., 2008). Both of these studies targeted 9th grade high school students in urban schools who exhibited marginal to adequate academic skills (based on standardized academic tests) but failing or near failing grades in Biology classes. Utilizing a mixed models pretest-posttest case study design, Cleary and colleagues reported that SREP students exhibited an average z-score gain of 0.56 on classroom-based exams, with z-scores ranging from small (0.24) to very large (1.50; Cleary et al., 2008; Cleary & Platten, 2013). Based on reliability change index scores and qualitative analysis, the authors indicated that SREP students also exhibited statistically significant and clinically important shifts in SRL and self-efficacy during the course of the program and that the highest performing students tended to exhibit the most adaptive SRL processes (Cleary & Platten, 2013; Cleary et al., 2008). Although these studies yielded promising empirical support for SREP, the internal validity was questionable due to a lack of randomization of participants and inadequate comparison groups. The current study addressed these limitations by utilizing a more rigorous research design within a middle school context in the area of mathematics.

Using a true experimental design with two conditions, we examined three broad research questions: (1) Do SREP students exhibit more adaptive self-efficacy, self-reported use of SRL strategies, casual attributions, adaptive inferences, and test preparation tactics at posttest and a 2-month follow up than students receiving an existing school-based, mathematics remedial program called What I Need (WIN)?; (2) Is the pattern of mathematics achievement scores exhibited by SREP students across two years of middle school similar to that of the comparison group?; and (3) Do SREP students and coaches convey positive perceptions of SREP regarding its acceptability of procedures and importance of effects? Based on prior research (Cleary & Platten, 2013; Cleary et al., 2008) and because SREP was specifically designed to impact the quality of students' strategic thinking and action, we hypothesized that SREP students would outperform WIN group students across their SRL skills and self-efficacy at both posttest and follow up. In terms of mathematics achievement, we were specifically interested in examining trends in students' achievement of curriculum-related content information during the academic year in which SREP was implemented (7th grade) and the following year (8th grade). We did not make any specific a priori hypotheses regarding when achievement group differences might emerge; rather we hypothesized that the SREP group's overall pattern of achievement would be more positive and adaptive than the comparison group. Finally, in terms of social validity, we anticipated that SREP students and coaches would perceive SREP as highly beneficial and important.

Another important component of the design of the current study was the use of a multi-method approach to SRL assessment. Three types of SRL measures were emphasized: student self-report questionnaires, a free-response hypothetical scenario, and free-response SRL microanalytic questions. Although most SRL intervention studies have not typically included multiple methods of SRL assessment, such an assessment approach is an important methodological feature given that different SRL measures tend to capture unique aspects of SRL (Butler, 2011; Winne & Perry, 2000). For example, whereas self-report questionnaires and rating scales target

SRL as a more global, de-contextualized entity, other more contextualized measures are better suited to capture SRL processes relative to specific academic situations (Zimmerman & Martinez-Pons, 1986) or at particular moments during an activity (SRL microanalysis, Cleary, 2011). SRL microanalytic procedures are emphasized in this study and are considered to be highly contextualized, situation-specific assessments. For this approach, students are asked to provide responses to questions about specific SRL processes (e.g., goal-setting, monitoring, attributions) in relation to authentic learning activities (e.g., as they prepare to write an essay) or situations (e.g., when receiving a test grade from their teacher). Thus, in this study, we used self-report questionnaires to broadly assess students' reported regulatory behaviors, a hypothetical scenario to assess their reported SRL behaviors relative to test preparation, and SRL microanalytic measures to target their attributions (i.e., perceptions of the causes of a test grade) and adaptive inferences (i.e., conclusions about what needs to be done to improve) as they reflected on an authentic course exam.

2. Method

2.1. Sample

Students selected to participate in this study were recruited from all four sections of 7th grade algebra classes located in the same middle school in an urban school district. Two teachers each taught two sections of these classes. To be eligible for SREP, the students had to meet multiple criteria: (a) mathematics report card grades below a B average, (b) New Jersey Assessment of Skills and Knowledge (NJASK) standardized mathematics test score in the range of 185–215 (marginal to proficient), and (c) teacher nominations regarding deficiencies in motivation or regulation. Because these criteria were similar to those used in prior applications of SREP (Cleary & Platten, 2013; Cleary et al., 2008), we were better able to draw conclusions regarding the effects of SREP for this particular group of students. From an initial pool of 111 7th grade students, 50 students met criteria. However, because six of these students could not participate in the program due to scheduling conflicts and two additional students were removed after the start of the study due to leaving the school district, the total final sample was 42 students. The participating sample was 45.2% Black, 28.6% Hispanic, 11.9% White, 7.1% Asian, and 7.1% Biracial. The sample was 40.9% female, and 43.2% received either free or reduced lunch (see Table 1 for a breakdown of demographics across treatment conditions).

2.2. Measures

2.2.1. Self-regulatory processes

2.2.1.1. Self-Regulation Strategy Inventory-Self-Report (SRSI-SR). The SRSI-SR is a 28-item self-report measure designed to examine the frequency with which students engage in various adaptive and maladaptive regulatory behaviors. Recently, confirmatory factor analysis showed that this scale possesses three primary subscales: Managing Behavior and Environment (MBE), Seeking and Learning Information (SLI), and Maladaptive Regulatory Behaviors (MRB; Cleary, Dembitzer, & Kettler, 2015). In the current study, we only administered the MRB subscale because it has been shown to be a more robust predictor of student achievement than the two adaptive scales and because it has been shown to be sensitive to change resulting from SRL interventions (Cleary & Chen, 2009; Cleary et al., 2008). Further, the school administrators wanted to minimize the number of survey items that students would be asked to complete. The MRB subscale assesses the extent to which students exhibit negative or maladaptive regulatory behaviors including procrastination, avoidance, and forgetfulness. Example items include, “I avoid thinking about math when the work gets too hard” and “I give up or quit when I do not understand something.” Students responded to this measure using a five-point Likert scale ranging from 1 (*almost never*) to 5 (*almost always*). High scores on the MRB indicate that students frequently exhibit maladaptive behaviors when completing mathematics-related tasks. The coefficient alphas at pretest, posttest, and follow-up in the current study were 0.85 (pretest), 0.78 (posttest), and 0.87 (follow-up). These values are consistent with prior research (Cleary, Callan, Malatesta, & Adams, 2015; Madjar, Kaplan, & Weinstock, 2011).

2.2.1.2. Hypothetical test preparation scenario. We administered a free-response hypothetical test preparation scenario to students.

Table 1
Demographic characteristics of SREP and WIN conditions.

Characteristics of Instruction	SREP (n = 22) n (%)	WIN (n = 20) n (%)
Ethnicity		
Black	10 (45.5%)	9 (45%)
Hispanic	7 (31.8%)	5 (25%)
White	3 (13.6%)	2 (10%)
Asian	2 (9.1%)	1 (5%)
Biracial	0 (0%)	3 (15%)
Gender		
Male	13 (59.1%)	11 (55%)
Female	9 (40.9%)	9 (45%)
Free/Reduced Lunch	10 (45.5%)	9 (45%)
NJASK	200.3	201.5

Note. NJASK = New Jersey Assessment of Skills and Knowledge.

Students were asked to write down all of the things they would do when placed in the situation of preparing for a comprehensive mathematics class exam. This scenario was a variation of one included as part of the Self-Regulated Learning Interview Schedule (SRLIS), a structured, individualized interview designed to assess students' use of SRL strategies across multiple learning contexts or school-based situations. Unlike the SRLIS, however, we customized the wording of the scenario to mathematics and asked students to provide written responses in a group format rather than oral responses during an individual interview. In order to help ensure that students would openly express their ideas in this type of format, they were told that their written responses would not be shared with their teachers or classmates.

Each student response was coded independently by two raters into one or more categories based on prior SRL assessment research. The first category of *self-regulation learning strategies* included four subcategories related to various strategies identified by Zimmerman and Martinez-Pons (1988), including *study tactics* (e.g., "To use Kahn Academy to practice" and "To memorize formulas"), *self-management of study session* (e.g., "To make a plan to study a few days before the test" and "To think about how best to study"), *help seeking* ("To ask my teachers about the problems that confuse me"), and *volition/performance control* (e.g., "To reward myself if I study for 30 minutes" and "To tell myself to keep studying when I am bored"). The remaining categories included *general study behaviors* (e.g., "To try hard" or "To focus"), and *do not know/none*. To avoid bias in coding, the second and third authors were blinded to treatment condition and performed the ratings independently. All disagreements were resolved through collaboration with the primary author. The percent agreement between coders for all student responses before collaborative efforts to resolve discrepancies was 85%, which surpassed estimates obtained in prior research (80%; Zimmerman & Martinez-Pons, 1986). Consistent with prior research with the SRLIS and microanalytic research, a frequency count of strategy use for each student's responses was used as the metric for this measure. Higher scores suggested a greater number of strategies included in the response.

2.2.1.3. Microanalytic attributions. Consistent with microanalytic assessment methodology (Cleary, 2011), a single-item measure was administered to assess student perceptions of the causal determinants of their performance on a particular mathematics course exam. Following their most recent mathematics exam at posttest and follow-up, students were asked, "What are some of the reasons why you may have gotten a(n) (insert grade) on this test?" All responses were coded independently to one of several categories by the two aforementioned raters. The *self-regulation learning strategies* and *general studying* categories were identical to those used for the hypothetical test preparation scenario. Additional attribution categories included *classroom-related behaviors* ("I paid attention during class lectures"), *test-taking skills* ("I just froze during the test"), *math ability* ("I am not very good at this"), *specific mathematics task skills* ("I have difficulty with these types of word problems"), *teacher skill* ("The teacher is very disorganized"), *don't know* and *other*. In addition to content validity, several studies have shown this single-item attribution measure to reliably differentiate achievement groups, to correlate with other SRL processes in expected directions, and to serve as a sensitive measure to treatment change (Cleary, Zimmerman, & Keating, 2006; DiBenedetto & Zimmerman, 2010). Similar to the coding procedures used with the hypothetical test preparation scenario, the second and third authors rated all student responses and were blind to treatment group condition to avoid any potential bias. The two coders independently coded student responses, yielding a percent agreement of 87%, which corresponds well with prior reliability estimates across different domains (Cleary, Callan, & Zimmerman, 2012). Similar to the test preparation measure, the metric used for the attribution measure was a frequency count of the number of adaptive, controllable attributions included in the response (e.g., SRL categories, classroom-related behaviors, and math task skills).

2.2.1.4. Microanalytic adaptive inferences. The adaptive inference microanalytic measure was also adapted from prior research (Cleary, Callan, et al., 2015) and targeted the conclusions that students made regarding what they needed to do in order to perform well on future course exams. Following the attribution question, the students were asked, "What do you need to do to improve or to perform well on your next test?" The coding scheme used for this measure was identical to that used with the attribution measure except for the removal of the teacher skill category (not relevant to the question). A frequency count was also used as the metric for this measure and thus high scores reflected a greater number of adaptive strategies reported by the student. Research has shown this single-item measure to correlate with other regulatory measures and achievement and to be highly sensitive to SRL interventions (Cleary & Zimmerman, 2001; Cleary et al., 2006). The overall percent agreement between the two coders across all student participants was acceptable, 90.5%, and consistent with coding schemes used in other microanalytic research (Cleary et al., 2006; Kitsantas & Zimmerman, 2002).

2.2.1.5. Self-efficacy for self-regulated learning scale. A 7-item measure of self-efficacy was used to gauge students' perceptions of competency to perform specific regulatory behaviors in mathematics class (Usher & Pajares, 2008). Collectively, these items address student efficacy to direct attention and concentration, recall information, structure an effective home study environment, and manage their time regarding schoolwork. All items were worded to reflect mathematics contexts, such as, "finish your math homework on time" and "arrange a place to study math at home where you won't get distracted." Similar to the MRB subscale of the SRSI, students used a 5-point Likert scale ranging from 1 (*not well at all*) to 5 (*very well*) to provide their efficacy judgments. Prior research has demonstrated this 7-item measure to exhibit a unidimensional structure that is equivalent across gender and developmental level (Usher & Pajares, 2008). The coefficient alphas for this scale were 0.76 (pretest), 0.72 (posttest), and 0.85 (follow-up) in the current study, which are largely consistent with estimates of reliability for this measure in prior research (0.78 to 0.84; Pajares & Graham, 1999; Usher & Pajares, 2008).

2.2.1.6. Social validity. An 11-item self-report questionnaire was used to assess student perceptions of acceptability and utility of the specific instructional program they received (i.e., SREP condition). The questionnaire was a slight modification of a social validity questionnaire used in prior research (Cleary et al., 2008). In addition to customizing the wording of some questions to fit the context of the current study, two additional questions were added to more adequately address the range of experiences and purposes of SREP ("I am trying a lot harder in school because of the SREP program"; "I would want to take the same SREP program next year if it was offered"). Similar to the earlier version, the current measure utilized a 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*), with higher scores representing greater levels of perceived acceptability and importance of outcomes. The coefficient alpha for this measure was 0.92 at both posttest and 2-month follow-up, which surpasses estimates from prior research (0.86; Cleary et al., 2008).

At the completion of the study, SREP coaches were also asked to complete a 13-item teacher version of the social validity measure using the same Likert format and similar items. Example items included, "The SREP program helped students to think about themselves in a more positive way" and "I would recommend that other schools should use SREP." Although prior research has not yet examined the reliability of this measure, the estimate of alpha for the current study was 0.81.

2.2.1.7. Mathematics achievement. Student scores on standardized, district-wide quarterly mathematics exams were used to measure mathematics achievement at six time points across two years of middle school: three assessments in 7th grade (1st quarter (pretest); 3rd quarter (posttest); and 4th quarter (2-month follow up)) and three assessments in 8th grade (1st quarter, 2nd quarter, and 3rd quarter). These exams, which were created by the middle school mathematics specialist and approved by the district supervisor in mathematics, targeted students' understanding of the grade-specific and quarter-specific standards consistent with the district-approved curriculum. The specific content areas for the six quarterly exams were as follows: ratios and rational numbers (7th grade – 1st quarter), geometry (7th grade – 3rd quarter), statistics and probability (7th grade – 4th quarter), number system, expressions and equations (8th grade – 1st quarter), expressions and equations, functions (8th grade – 2nd quarter), and geometry (8th grade – 3rd quarter). The specific questions for each quarterly exam were selected by the mathematics specialist in the district and included a range of question types and difficulty levels. All students who participated in the study took identical exams in each respective quarter because they were enrolled in the same mathematics courses. Student raw scores on this test were converted to z-scores to provide a common metric for interpretation and to facilitate comparison of results with prior SREP studies.

2.3. Design and procedures

A pretest-posttest control group design with a 2-month follow-up was utilized to examine the effects of the intervention on students' SRL processes and self-efficacy, while a two-way simple mixed design was used to assess the pattern of quarterly exam scores exhibited by the SREP and WIN groups over two years. Because all participants were 7th grade students sampled from sections of two mathematics teachers, we utilized a stratified randomization procedure (i.e., students from each teacher were randomly assigned to treatment condition) to ensure that the two groups had an equal number of students from each teacher (i.e., 11 students from each teacher were in each condition).

The treatment conditions included a SREP intervention group and a comparison group, the latter of which received an existing school-based mathematics remedial support program called What I Need (WIN). Students in each condition received the same number of 30-min instructional sessions (i.e., 28 sessions) during the 2nd and 3rd quarters of 7th grade. Given that the class schedule at the middle school operated on a 6-day schedule (A and B days) and because the sessions could only be administered on either an A or B day, the sessions ranged in frequency from 1 to 3 days per week. Further, the average instructional time of the treatment and comparison group sessions was approximately 25 min; thus, each group received an estimated total of 12 h of remedial instruction that was beyond that of their daily allotment of 60 min of regular mathematics instruction.

Both groups received identical assessment measures at all phases of the project. Specifically, the SRSI-MRB subscale, self-efficacy measure, microanalytic attributions, and microanalytic adaptive inferences were administered at pretest (end of 1st quarter), posttest (end of 3rd quarter), and 2-month follow-up (end of school year) during 7th grade. The hypothetical test preparation scenario and the social validity measures were administered at posttest and 2-month follow-up only. Because one of our primary objectives was to examine the pattern of mathematics achievement in the two groups across two years in middle school, we gathered quarterly exam data across the 7th and 8th grades. It should be noted that the quarterly exam for the 2nd quarter of 7th grade was not used because it was administered a few weeks after the study began, whereas the quarterly exam for the 4th quarter of 8th grade was not used due to a large amount of missing data observed across the entire grade. Finally, because the participating school district did not allow survey data collection for their students by outside researchers, the school staff collected data and then provided de-identified student data to the authors for analysis and evaluation. All procedures for this study were approved by the university Institutional Review Board as well as the Board of Education of the target school district.

2.3.1. SREP condition

Four coaches administered SREP in groups of 5–6 students each. SREP sessions were customized to the students' mathematics class and content, but the majority of the sessions focused on developing students' SRL strategic thinking and action rather than remediation of specific mathematics skills. The overall intent of SREP instruction is to enhance students' SRL and motivation skills as well as their content area knowledge and skills (see Cleary & Platten, 2013); however, due to the abbreviated nature of the instructional sessions in this study (25 min), there was less opportunity to focus on mathematics content instruction. Approximately 20% of SREP instructional time was devoted to actual mathematics content. The SREP coaches utilize pre-established modules and an instructional format as a guide for sessions. The foundational modules of SREP were administered during the first 4–5 sessions. These modules focus primarily on introducing students to key SRL processes (e.g., attributions, goal-setting, task analysis) and to adaptive mindsets consistent with SREP principles, such as "success in school is a controllable phenomenon" and that "developing one's repertoire and skills in using strategies will lead to progress and improvement."

Following the foundational modules, the SREP coaches used the RAPPS (Review, Analysis, Practice, Plan, Self-direction) instructional format to engage students in a weekly cycle of strategic action and reflection, characterized by frequent modeling and guided practice of learning and regulatory strategies. The Review (R) step occurred during the first SREP session of a given week and involved a review or check-in with students regarding challenges they experienced when using strategies during the prior week as well as any other difficulties or challenges that emerged since the last SREP session. The overriding goal of the *R* step was for the SREP coach to learn about how students were progressing in using strategies and to cultivate open and supportive discussions about the successes/challenges in using strategies taught during SREP. Following this step, the SREP coach engaged students in Analysis (A), which was characterized by a discussion of upcoming content/activities/tests in the target course and specific challenges or concerns that students wanted to address in the coming week. The first two steps of RAPPS took approximately 5–8 min to complete, with the remainder of Day 1 and the majority of instruction for the remainder of the week focusing on student Practice (P). It is during this third step that the SREP coach discussed, modeled, and then provided students with practice opportunities to use specific strategies to address challenges that they encountered (e.g., self-quizzing, content area strategies). The fourth step, Planning (P), occurred during the last 5 min of the final SREP session each week. The SREP coach prompted and helped students make a strategic plan regarding the specific strategies or tactics that they would use and practice at home before coming to SREP the following week. The last step in the RAPPS approach, Self-direction (S) differed from all other steps because it was completely under the control of the student and occurred outside the context of SREP sessions. The ultimate purpose of this final step was for students to actively make decisions about when and how to implement their strategic plan and to also monitor their use of these strategic behaviors. From a theoretical lens, the RAPPS instructional approach promoted a type of weekly feedback loop in that the coach guided students' planning and task analysis, practice and use of learning strategies, and reflection about the quality with which they learned every week.

The SREP coaches engaged students in this process of weekly planning, practice, and reflection until students received feedback about their grade on a unit exam in mathematics. When students received this grade, the coach administered the self-reflection module. The focus of this module was to guide students through a highly systematic process to uncover their perceptions regarding how they performed, the reasons why they performed that way, and the things that they might need to change or adapt prior to the next test. The primary instructional tool used during this module was the Self-Regulation Graph (see Cleary & Platten, 2013). As part of this graphing approach, students learned to evaluate their performance in terms of personal goals or prior test grades and to develop empowering and adaptive ways to think about their performance, even in the face of failure or struggle. Ultimately, the SREP coach used the data presented on the graph (i.e., test grades, test goals, strategic plan) to steer student thinking about failure and success to variables that are controllable and most linked to success, namely their effort in using learning and regulatory strategies emphasized during SREP (Borkowski et al., 1988; Cleary & Zimmerman, 2001; Clifford, 1986).

From a conceptual lens, reflection about test performance is a key aspect of a second feedback loop (i.e., unit test feedback loop) that subsumes several of the weekly feedback loops mentioned earlier (see Fig. 1). Thus, it is during this unit test feedback loop that students plan and think about future test performance, track how well they used the learning strategies taught each week during RAPPS, and ultimately reflect on how well they performed on the exam. In a simplistic sense, whereas as the weekly feedback loops (RAPPS) immerse students in the process of how to learn effectively, the unit test feedback loop helps students evaluate whether their use of those processes or strategies led to successful outcomes.

2.3.2. SREP coach training

A key aspect of this study was that it represented a collaborative effort between the researchers and the school district to create sustainable intervention practices. Unlike prior iterations of SREP that utilized trained graduate research assistants, the primary author trained school staff (an assistant principal, two counselors, and a school psychologist) as SREP coaches to deliver the program. These individuals received approximately 15 h of professional development workshop training on topics ranging from SRL theory, SREP procedures, and mathematics and regulatory strategies. The workshops were provided at the target school before the SREP or WIN classes were initiated and included didactic lectures and break-out group sessions. The SREP coaches were also provided 10 coaching sessions after the study had begun. These coaching sessions lasted between 45 and 60 min and were held approximately two times per month. These sessions provided coaches with a forum to discuss their successes and challenges when administering SREP and to refine their skills in administering SREP activities.

In terms of treatment integrity checks, trained graduate students attended approximately 25% of the SREP sessions that occurred following the foundation modules. Common components that were assessed across all RAPPS sessions included the extent to which the coaches: modeled or discussed specific strategies, provided strategy practice opportunities, and linked strategy instruction to mathematics activities. However, there were unique components associated with SREP sessions, depending on when the session occurred (i.e., first, second, or last session of a given week), as well as for sessions that involved the self-reflection module (e.g., the coach prompting students to use the Self-Regulation graph). Two graduate students were present for every treatment integrity observation and exhibited an agreement rate of 100%. To calculate the treatment integrity, we divided the total number of instructional practices observed during the sessions by the total number of practices that were expected. Across all session observations, the overall percentage of treatment integrity was approximately 98%.

2.3.3. WIN condition

The comparison WIN condition received the same number of instructional sessions and hours of instruction that were provided to

SREP students. The WIN class is a naturally-occurring remedial program at the target school that provides additional content-area instruction to students struggling in that particular content area (e.g., mathematics). This class was taught by both regular education 7th grade mathematics teachers. These teachers provided direct instruction in core mathematics concepts addressed in the regular classroom context. They also provided students with opportunities to practice solving problems that were personally challenging, and structured opportunities for students to ask questions and to work collaboratively with peers on homework problems. This exclusive focus on mathematics during WIN sessions was in direct contrast to SREP sessions, which focused on mathematics problems or concepts approximately 20% of the time. Both 7th grade regular education mathematics teachers were together for these sessions in order to facilitate the provision of individualized mathematics support to all students. The WIN teachers and students did not receive any training in SREP or SRL practices.

2.4. Data analysis plan

In order to answer our three core research questions, a combination of descriptive and inferential statistics was used. Because we did not need to control for any pretest score (i.e., except for microanalytic attributions), we used independent *t*-tests to examine group differences in SRL and self-efficacy at posttest (end of 3rd quarter in 7th grade) and 2-month follow-up (end of 4th quarter in 7th grade). For the microanalytic attribution subscale, we used ANCOVA procedures. Further, given that we established a priori, directional hypotheses regarding these group differences, one-tailed tests with a significance level of $p < 0.05$ were used for all analyses unless otherwise noted.

To address the pattern of achievement scores of the two conditions over time, we used profile analysis. Specifically, we used a two-way mixed model design with one between factor (treatment group) and one within factor (time) to examine the interaction between treatment group and time. All quarterly exam raw scores (based on a traditional scale from 0 to 100) were transformed to z-scores (based on the overall mean from students taking the same classes) to allow us to create a common metric for interpreting the group performance on each of the exams (i.e., the normative standing on each exam). The use of z-scores also enabled us to compare student performance in this study to other SREP investigations.

3. Results

3.1. Data screening and preliminary analyses

Before conducting any formal analyses, we screened for missing data, outliers, and issues with normality and kurtosis. In terms of missing data, two students from the comparison group were removed from the dataset because of their extremely sporadic school attendance and corresponding missing data across several of the measures at posttest and follow-up. Based on power analysis for the independent *t*-tests, our sample of 42 students was large enough to detect a large effect using a *p* value of 0.05 for a one-tailed test with a desired power level of 0.80. Across all SRL measures, the percentage of missing data points was extremely low (never exceeded 0.05% for any item). Missing values were replaced using mean averages for the given item given the extremely small proportion of missing values observed in the dataset (Tabachnick & Fidell, 2007). In terms of the quarterly exams, there were a few students with missing data. Given the nature of our within group analyses, we elected to remove them prior to conducting this analysis (SREP, $n = 21$; WIN, $n = 16$). Based on school records, these students did not take some of the exams either because they moved to a different school in 8th grade or because they enrolled in a different type or level of mathematics class in 8th grade. Based on power analysis, a total sample size of 24 is needed to detect a medium sized within-between interaction effect using a *p* value 0.05 with the desired power level of 0.80. Thus, across both sets of primary analyses, our study was designed to detect medium to large effects.

We used SPSS 24.0 to conduct all statistical analyses. Preliminary analyses were conducted to examine pre-intervention group differences across gender, SES, prior achievement, out of school suspensions, attendance, and all of the dependent variables used in the study. No initial group differences were observed across any of the measures except for the microanalytic attributions measure ($t(40) = 2.85, p < 0.05$). On this measure, the WIN students reported a statistically significant greater number of strategies than the SREP students (opposite of expected treatment effects). Finally, correlations among all dependent measures gathered at posttest are

Table 2
Pearson correlations among posttest SRL, motivation, and achievement variables.

Measures	1	2	3	4	5	6	7
1. SRSI	–						
2. Self-efficacy	− 0.62*	–					
3. Causal attributions	− 0.14	0.09	–				
4. Adaptive inferences	− 0.09	0.08	0.01	–			
5. Test preparation	− 0.04	0.12	0.03	0.50*	–		
6. Social validity	− 0.27	0.37	0.17	0.35*	0.38*	–	
7. Quarterly exam	− 0.12	0.04	0.03	0.29	− 0.10	− 0.05	–

Note. Correlations are based on post-test measures. The SRSI subscales included all negatively worded items; high scores on this subscale reflect frequent displays of maladaptive behaviors. SRSI = Self-Regulated Strategy Inventory.
* $p < 0.05$.

Table 3
Descriptive and inferential statistics for group differences in SRL and motivation beliefs.

	SREP (n = 22)			Comparison (n = 20)			Inferential tests		
	Pretest *M* (*SD*)	Posttest *M* (*SD*)	Follow-up *M* (*SD*)	Pretest *M* (*SD*))	Posttest *M* (*SD*))	Follow-up *M* (*SD*)	Pretest *t*-test	Posttest *t* -test	Follow-up *t*-test
SRSI	2.60 (0.86)	2.77 (0.67)	2.97 (0.78)	2.54 (0.97)	2.40 (0.83)	2.76 (1.08)	0.21	1.59	0.73
Self-efficacy	2.82 (0.77)	2.91 (0.67)	2.78 (0.76)	3.04 (0.78)	3.05 (0.82)	2.96 (1.00)	0.91	0.61	0.67
Causal attributions	0.00 (0.00)	0.64 (0.66)	0.32 (0.48)	0.30 (0.47)	0.11 (0.31)	0.05 (0.22)	2.85*	7.31[a]*	3.56[a]*
Adaptive inferences	0.36 (0.58)	0.73 (0.83)	0.41 (0.59)	0.40 (0.60)	0.37 (0.48)	0.10 (0.31)	0.20	1.70*	2.10*
Test preparation	NA	1.82 (0.85)	1.14 (0.83)	NA	1.20 (0.089)	1.25 (0.72)	NA	2.29*	0.47

Note. The study scenario measure was only administered at posttest and 2-month follow-up. SRSI = Self-regulated Strategy Inventory.
[a] ANCOVA procedures were used (*F*-value reported).
* $p < 0.05$.

presented in Table 2.

3.2. Group differences across SRL and self-efficacy

Table 3 displays the means and standard deviations across SRL and self-efficacy measures at pretest, posttest, and 2-month follow-up. When using the independent *t*-tests, if the assumption of homogeneity of variance was violated, Welch's *t*-test was reported. In general, the results were mixed and varied across dependent measures. At posttest and 2-month follow-up, no group differences were observed for self-efficacy (posttest, $t(40) = 0.61$, $p = 0.55$; 2-month follow-up, $t(40) = 0.67$, $p = 0.51$) or students' maladaptive regulatory behaviors (posttest, $t(40) = 1.59$, $p = 0.12$; 2-month follow-up, $t(40) = 0.73$, $p = 0.47$).

For the hypothetical test preparation scenario and the two microanalytic questions (attributions and adaptive inferences), however, a fairly consistent pattern of statistically significant group differences emerged. At posttest, significant group differences were observed for microanalytic attributions, $F(1,39) = 7.31$, $p < 0.05$, $n^2 = 0.15$, microanalytic adaptive inferences, $t(39) = 1.65$, $p = 0.05$, $d = 0.53$, and the test preparation scenario, $t(40) = 2.29$, $p < 0.05$, $d = 0.71$. All the posttest effects were in the range of medium to large. The posttest results were maintained at 2-month follow-up for both attributions, $F(1,39) = 3.56$, $p < 0.05$, $n^2 = 0.08$, and adaptive inferences, Welch's $t(32.25) = 2.16$, $p < 0.05$, $d = 0.66$, but not for the test preparation scenario, $t(40) = 0.47$, $p = 0.64$. Broadly speaking, SREP students were significantly more likely to make judgments about their mathematics test performance in terms of strategy use (i.e., make strategic attributions) and to conclude that strategic changes to their study approaches were necessary (i.e., adaptive inferences). They also were able to generate more comprehensive strategic plans regarding test preparation activities than the WIN students, although this latter effect was not sustained at 2-month follow-up.

3.3. Patterns of mathematics achievement over time

A two-way mixed model, with treatment (SREP, WIN) as the between-subject factor and time (six assessment scores) as the within-subject factor, was used for the profile analysis. Using a Greenhouse-Geisser correction for the observed sphericity (Mauchly's $W(14) = 0.46$, approximate $\chi^2 = 25.93$, $p = 0.027$), a treatment x time interaction was found to be statistically significant, $F(3.77, 131.91) = 2.93$, $p = 0.03$, $n^2 = 08$. That is, the trajectory or the pattern of achievement scores across 7th and 8th grade for the SREP condition was distinct from that of the WIN group (see Fig. 2). To explore the nature of this interaction, we conducted tests of simple

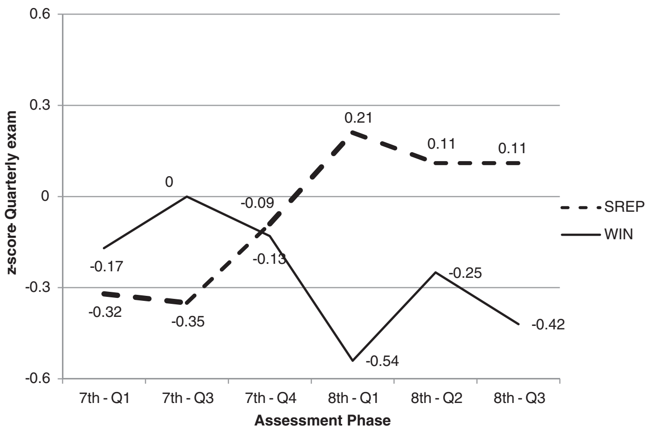

Fig. 2. Patterns of mathematics achievement for SREP and WIN groups across six assessment phases. Achievement performance is depicted in terms of z-scores for quarterly exams.

Table 4
Descriptive and inferential statistics for quarterly mathematics exam scores.

Achievement assessment point	SREP (n = 21) M (SD)	WIN (n = 16) M (SD)	t-test
7th grade (1st quarter) – Pretest	− 0.32 (0.77)	− 0.17 (0.79)	0.59
7th grade (3rd quarter) – Posttest	− 0.35 (1.03)	0.00 (0.98)	1.06
7th grade (4th quarter) – Follow up	− 0.09 (0.59)	− 0.13 (0.83)	0.17
8th grade (1st quarter)	0.21 (0.86)	− 0.54 (1.18)	2.23*
8th grade (2nd quarter)	0.11 (0.90)	− 0.25 (0.99)	1.18
8th grade (3rd quarter)	0.11 (0.89)	− 0.42 (0.85)	1.82

Note. Quarterly mathematics exam scores reflect transformed to z-scores.
* $p < 0.05$.

effects using Bonferroni-corrected *t*-tests to examine group differences at each assessment point. The results showed that the SREP and WIN groups differed significantly ($p < 0.05$) at the 4th assessment point (8th grade - 1st quarter) only (see Table 4 for group difference *t*-test results at each assessment point).

To examine the nature of the overall within-group effect for each of the two conditions, we conducted separate within-subject analyses. For the SREP group, a statistically significant and medium effect was observed, $F(5,100) = 2.29$, $p = 0.05$, $\eta^2 = 0.10$, with a linear effect accounting for the majority of the overall within-subject effect; $F(1,20) = 6.05$, $p = 0.02$. Descriptive analysis of the SREP quarterly exam data revealed a shift towards the classroom average at the end of 7th grade (follow up; $M_{z\text{-}score} = -0.09$) and then above average performance across all 8th grade assessments (1st quarter, $M_{z\text{-}score} = 0.21$; 2nd quarter, $M_{z\text{-}score} = 0.11$; 3rd quarter, $M_{z\text{-}score} = 0.11$; see Table 4 and Fig. 2).

The overall pattern of quarterly exam scores for the WIN group was quite distinct from that of the SREP group. First, the WIN group did not show a statistically significant within-group effect over time; $F(5,75) = 1.05$, $p = 0.395$. Further, descriptive analysis of the six data points revealed a consistent level of mathematics achievement characterized by below average performance on five of the six quarterly exams time (see Table 4 and Fig. 2).

3.4. Social validity perceptions of SREP

Finally, we used descriptive statistics to examine student perceptions of the importance and acceptability of SREP. In general, SREP students' perceptions of the program were highly positive regarding the acceptability and value of the instructional procedures (e.g., students would recommend program to their classmates who struggle) and the overall importance of program effects (e.g., increased confidence, increased repertoire of strategies to learn). This result was obtained both at posttest ($M = 4.15$, $SD = 0.53$) and 2-month follow-up ($M = 4.10$, $SD = 0.61$). Six of the items yielded average scores of 4.3 or higher (see Table 5). In reviewing these six items, two of them pertained to enhanced awareness ("SREP helped me to become more aware of the reasons why I sometimes struggle in school" and "SREP helped me realized that I can change or improve how I do in school"), two items pertained to the value of strategies taught in the program ("The strategies that my SREP coach taught me were very important" and "The SREP coach taught me strategies that will help me manage things in school better"), and two items referenced the overall value of the program ("Going to SREP was a waste of my time" and "I would recommend SREP to a friend who was struggling in school").

The four SREP coaches were also asked to complete the teacher version of the social validity scale at the conclusion of the study (Cleary et al., 2008). Descriptively, the results revealed that all coaches had very positive perceptions of SREP regarding its utility in helping students improve their functioning and the overall acceptability of the procedures ($M = 4.59$, $SD = 0.25$). The overall variability of the coaches' responses across items was extremely small, which further supports the premise that all four coaches

Table 5
Descriptive statistics of SREP student responses to social validity measure.

Social validity question	Post-test M (SD)	2-month follow-up M (SD)
1. The strategies that my SREP coach taught me were very important	4.3(0.57)	4.4(0.79)
2. SREP helped me to become more aware of the reasons why I sometimes struggle in school	4.3(0.77)	4.3(0.70)
3. The SREP coach taught me strategies that will help me manage things in school better	4.4(0.73)	4.3(0.72)
4. I think about myself in a more positive way because of SREP	3.7(0.88)	3.8(1.11)
5. I would recommend SREP to a friend who was struggling in school.	4.4(0.73)	4.3(1.03)
6. SREP forced me to do a lot of extra work that was not very important[a]	3.9(1.06)	3.7(1.16)
7. I would want to take the same SREP next year if it was offered	4.0(0.95)	4.2(0.92)
8. SREP helped me realize that I can change or improve how I do in school	4.3(0.84)	4.2(0.87)
9. I am trying a lot harder in school because of SREP	3.9(0.81)	4.0(0.69)
10. I am more confident in my ability to study and prepare for tests because of SREP	3.8(0.92)	3.4(1.05)
11. Going to the SREP was a waste of my time[a]	4.6(0.66)	4.6(0.67)

[a] Reverse-coded.

viewed SREP in a comparable and favorable manner.

4. Discussion

This study was important for several reasons. It adds to the paucity of research examining the effectiveness of applied, field-based SRL interventions in middle school contexts (Butler et al., 2005). It also extends prior research by experimentally examining the effectiveness of SREP and by targeting a vulnerable population of students who were at-risk for underperforming in mathematics during the secondary school years. Although much more work is needed to document the effectiveness of SREP, our results support the general premise that SREP can lead to important changes in students' strategic thinking and that it may relate to shifts in students' learning and achievement. Further, because both students and teachers reported SREP to be a socially valid intervention, and school staff administered SREP to students rather than researchers, it appears that SREP offers some promise as a useful and feasible school-based academic intervention for academically at-risk middle school populations.

4.1. Shifts in SRL and mathematics achievement

A primary objective of this study was to examine group differences in student SRL processes and self-efficacy at posttest and at 2-month follow up. The general finding was that the effects of SREP relative to the comparison group varied based on the nature of the dependent measure. In short, SREP participants showed more adaptive SRL processes than the WIN students when situation-specific and fine-grained SRL measures were used, but no such differences emerged across broad, self-report questionnaires. That is, the SREP students displayed a more comprehensive array of strategic attributions and adaptive inferences following math test performance and displayed more comprehensive strategic approaches to a hypothetical test preparation scenario than the comparison group students. These group differences emerged at posttest, with the majority of them maintained at 2-month follow-up. In contrast, no group differences were observed on the self-efficacy measure or the student questionnaire targeting maladaptive regulatory behaviors.

The discrepant findings were somewhat unexpected given that initial SREP case studies showed that student responses to SRL questionnaires did in fact improve over time (Cleary & Platten, 2013; Cleary et al., 2008). However, when considering that prior research and this current study (see Table 2) revealed a fairly low level of correspondence between self-report questionnaires and more contextualized and event forms of SRL measurement (Cleary, Callan, et al., 2015; Winne & Jamieson-Noel, 2002), one cannot assume that observed changes for one type of SRL measure will also be observed in others. There are a couple of potential explanations for the lack of convergence among SRL measures. First, in contrast to self-report questionnaires, the hypothetical test preparation scenario and the microanalytic measures were situation-specific and contextualized. Thus, they may be better able to capture more nuanced shifts in students' strategic thinking (Cleary, 2011; Cleary et al., 2006; Zimmerman & Martinez-Pons, 1986). Another possibility is that the SRL measures were tapping different aspects of SRL. For example, whereas the self-report questionnaires (i.e., SRSI, self-efficacy) targeted the frequency and confidence with which students use SRL strategies during learning, the microanalytic and hypothetical scenarios focused more on student reflection, thinking, and knowledge of strategies linked to a specific situation.

One of the more interesting findings in this study involved the pattern of achievement scores for the SREP and WIN groups across 7th and 8th grade. Although the two groups did not show statistically significant differences in mathematics achievement, except for the 4th assessment time point (8th grade, 1st quarter), the overall pattern of quarterly exam scores exhibited by the SREP participants was noticeably distinct from that of the WIN group. The SREP students exhibited a statistically significant and positive upward trend in their achievement over the two years. In descriptively examining their performance over time, SREP students exhibited a 0.26 z-score gain from posttest to follow up in 7th grade, and consistently above average performance in 8th grade. The magnitude of the gain scores displayed by SREP students in 8th grade was consistent with the average z-score gain of approximately 0.56 observed in prior research (Cleary & Platten, 2013; Cleary et al., 2008). That is, when using 7th grade pretest scores as the baseline, the average z-score gain scores across the three 8th grade assessment points were 0.53, 0.43, and 0.43, respectively. The WIN group exhibited a distinct profile of achievement scores. Their performance across the 7th and 8th grades reflected a largely below average level of achievement. Their average observed z-score gains in the 8th grade were −0.37, −0.08, and −0.25, respectively.

Although this overall pattern of achievement scores exhibited by the SREP and WIN groups is interesting, it should be viewed with some caution. Because we did not randomize students to mathematics classrooms in 8th grade and did not formally assess the extent to which SREP and WIN students received differential levels of instruction or support during that year, we cannot make claims regarding the causal link between SREP and the observed trends in mathematics achievement. There were two 8th grade mathematics teachers. Although they were both certified to teach middle school mathematics and were rated by school administrators as effective based on the Danielson Evaluation model, the distribution of SREP and WIN students to these classrooms was uneven. For example, of the 21 SREP students included in the achievement analysis, 62% (n = 13) were placed with Teacher A, whereas 38% (n = 8) were enrolled in Teacher B's classroom. For the WIN students, 44% (n = 7) were placed with Teacher A, whereas 56% (n = 9) were instructed by Teacher B. Thus, we do not know whether this differential placement influenced the achievement results. Further, because we were not able to administer the SRL measures in 8th grade, we do not know whether the observed change in SREP students' strategic thinking exhibited in 7th grade was maintained in 8th grade and whether these processes actually had an impact on students' 8th grade mathematics performance.

4.2. Perceptions of acceptability and importance of SREP

Social validity has been defined as the extent to which consumers of a given intervention, such as students, parents, and teachers, are satisfied with the intervention. Wolf (1978) conceptualized this concept in terms of three dimensions: significance of goals, acceptability of procedures, and importance of outcomes. Similar to previous iterations of SREP (Cleary et al., 2008) the significance of treatment goals was established as a collaborative effort and partnership between researchers and school administrators, teachers, and staff *prior* to implementing SREP. We assessed the other two dimensions of social validity, however, at the conclusion of the study by administering a self-report questionnaire to both students and SREP coaches. Overall, we found that SREP students and coaches rated the program as a highly acceptable and important intervention. These results are consistent with prior SREP research (Cleary & Platten, 2013; Cleary et al., 2008) demonstrating that students, parents, and teachers tend to view SREP as a supportive and potentially useful intervention for influencing student functioning.

We also conducted supplemental descriptive analysis of the student social validity measure given the connection between some of its items and other dependent measures administered in the study. For example, a couple of survey items corresponded closely with self-efficacy: "I am more confident in my ability to study and prepare for tests because of the SREP program" and "SREP helped me to realize that I can change or improve how I do in school." Interestingly, for these items, SREP students provided relatively high ratings ($M = 3.8$ and $M = 4.3$, respectively). Thus, on two items that reflected confidence or self-efficacy, SREP students expressed adaptive beliefs. Further, at a debriefing session with SREP coaches after the intervention and posttest measures were completed, SREP students were asked to write down ideas about how the program helped them as students. The large majority of their free responses included statements like "being more strategic" and "having much more confidence in myself." In short, based on student responses to the social validity items and the qualitative anecdotes, students did appear to exude greater confidence at posttest than they did at the outset of the study. Although the precise reason for the lack of significant group differences on the self-efficacy questionnaire is not entirely clear, it is possible that students simply felt that they were more confident in a general sense but not for engaging in particular types of behaviors reflected in the self-efficacy questionnaire used at pretest, posttest, and follow-up. It is also possible that they overestimated their regulatory skills at the outset of the study, a phenomenon that may have masked any shifts in their efficacy following the intervention.

Another important point about social validity was that the implementation of SREP represented a true collaboration between researchers and school personnel. That is, this study was grounded in the premise that creating sustainable and feasible interventions is an important objective in applied research. Prior to this project, all implementations of SREP involved the use of trained research assistants as SREP coaches. In the current study we trained school staff (i.e., an assistant principal, two counselors, and a school psychologist) to deliver SREP rather than "outsiders" to the school system. Due to our interest in creating a strong university-school district partnership, we wanted to create a situation in which school staff could take ownership of intervention implementation, and over time, infuse it as a natural component of their service delivery programming. In short, this study illustrated that it is not only possible to train and coach school staff to implement SRL interventions, but that these interventions may lead to important shifts in student functioning.

4.3. Limitations and areas of future research

The current study had several limitations that could be addressed in future research. In terms of methodology, the sample size was fairly small. Based on power analysis results, this study was capable of only detecting medium to large effects. Thus, there may have been some important effects that were not detected. The small sample size also prevented us from examining potential moderator variables in explaining the observed achievement effects, such as nesting effects for 8th grade mathematics teacher or the effects of specific SREP coaches.

From a measurement perspective, we included a variation of a hypothetical scenario that had been utilized in prior research (i.e., SRLIS). In our study, we used a group assessment format rather than an individual interview format utilized during validation of the SRLIS. Further, we only included two groups in this study; SREP and a comparison condition. This methodological feature prevented us from conducting a more nuanced evaluation or analysis of the effectiveness of different components of SREP. Finally, due to the logistical constraints of the middle school schedule, SREP could only be administered during a 30-min block of instruction. This systemic barrier prevented us from addressing content-related issues (i.e., specific concerns with mathematics) in a substantive way. Prior iterations of SREP (Cleary & Platten, 2013; Cleary et al., 2008) utilized an instructional model that included 40–50 min sessions. In that type of instructional format, SREP coaches were able to more readily integrate SRL principles (strategic thinking, motivation, metacognition) and content-related instruction in science. With this in mind, future research may want to include a SREP plus content remedial instruction condition to examine whether this combined condition leads to more immediate and robust improvements in student achievement than SRL instruction alone.

Finally, although a strength of this study involved the extension of SREP into middle school contexts for mathematics, we focused on only a single grade level of students (7th grade) who were fairly homogeneous (i.e., academically at-risk students who had grades below B′s in mathematics and who achieved marginal mathematics scores on standardized tests). Thus, the extent to which our results generalize to other populations/contexts is not entirely clear. To date, all prior iterations of SREP studies have focused on a similar type of student; those who exhibited marginal academic skills and below average performance in the classroom but who did not possess a disability. We believe that SREP is ideally suited for non-disabled youth struggling in school as well as for those with a learning disability and/or other disorders that involve executive functioning or other processing weaknesses, such as Attention Deficit Hyperactivity Disorder (ADHD).

It might also be of interest to test the effectiveness of SREP for enhancing the achievement and success of students who are performing at an adequate level in school but who aspire to enhance their grades and/or enroll in more advanced coursework. For example, in some school districts, there is an under-representation of African American and Latino students in more advanced mathematics classes, such as honors or accelerated. Because SREP has previously been implemented with disadvantaged students from diverse ethnic/racial and SES backgrounds, we believe that SREP has the potential to serve as an effective instructional approach for placing such students on a more rigorous and demanding academic pathway.

References

Anderson Koenig, J. (2011). *Assessing 21st century skills: Summary of a workshop*. Washington DC: The National Academic Presshttp://dx.doi.org/10.17226/13215.
Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York, NY: W.H. Freeman.
Blackwell, L. S., Trzesniewski, K. H., & Dweck, C. S. (2007). Implicit theories of intelligence predict achievement across an adolescent transition: A longitudinal study and an intervention. *Child Development*, *78*(1), 246–263.
Borkowski, J., Weyhing, R., & Carr, M. (1988). Effects of attributional retraining on strategy-based reading comprehension in learning-disabled students. *Journal of Educational Psychology*, *80*(1), 46–53.
Butler, D. L. (2011). Investigating self-regulated learning using in-depth case studies. In B. J. Zimmerman, & D. H. Schunk (Eds.), *Handbook of self-regulation of learning and performance* (pp. 346–360). New York: Routledge.
Butler, D. L., Beckingham, B., & Lauscher, H. J. N. (2005). Promoting strategic learning by eighth-grade students struggling in mathematics: A report of three case studies. *Learning Disabilities Research and Practice*, *20*(3), 156–174.
Byrnes, J. P. (2003). Factors predictive of mathematics achievement in White, Black, and Hispanic 12th graders. *Journal of Educational Psychology*, *95*, 316–326.
Cleary, T. J. (2011). Emergence of self-regulated learning microanalysis: Historical overview, essential features, and implications for research and practice. In B. J. Zimmerman, & D. H. Schunk (Eds.), *Handbook of self-regulation of learning and performance* (pp. 329–345). New York: Routledge.
In Cleary, T. J. (Ed.), (2015). *Self-regulated interventions with at-risk youth: Enhancing adaptability, performance, and well-being*. Washington, DC: American Psychological Association.
Cleary, T. J., & Chen, P. P. (2009). Self-regulation, motivation, and math achievement in middle school: Variations across grade level and math context. *Journal of School Psychology*, *47*(5), 291–314. http://dx.doi.org/10.1016/j.jsp.2009.04.002.
Cleary, T. J., & Platten, P. (2013). Examining the correspondence between self-regulated learning and academic achievement: A case study analysis [special issue]. *Educational Research International.*. http://dx.doi.org/10.1155/2013/272560.
Cleary, T. J., & Zimmerman, B. J. (2001). Self-regulation differences during athletic practice by experts, non-experts, and novices. *Journal of Applied Sport Psychology*, *13*(2), 185–206. http://dx.doi.org/10.1080/104132001753149883.
Cleary, T. J., Zimmerman, B. J., & Keating, T. (2006). Training physical education students to self-regulate during basketball free throw practice. *Research Quarterly for Exercise and Sport*, *77*(2), 251–262.
Cleary, T. J., Platten, P., & Nelson, A. (2008). Effectiveness of the self-regulation empowerment program with urban high school students. *Journal of Advanced Academics*, *20*(1), 70–107.
Cleary, T. J., Gubi, A., & Prescott, M. V. (2010). Motivation and self-regulation assessments in urban and suburban schools: Professional practices and needs of school psychologists. *Psychology in the Schools*, *47*(10), 985–1002.
Cleary, T. J., Callan, G. L., & Zimmerman, B. J. (2012). Assessing self-regulation as a cyclical, context-specific phenomenon: Overview and analysis of SRL microanalytic protocols. *Education Research International*, *1*.
Cleary, T. J., Callan, G. L., Malatesta, J., & Adams, T. (2015). Examining the level of convergence among self-regulated learning microanalytic processes, achievement, and a self-report questionnaire. *Journal of Psychoeducational Assessment*, *33*(5), 439–450.
Cleary, T., Dembitzer, L., & Kettler, R. (2015). Internal factor structure and convergent validity evidence: The self-report version of self-regulation strategy inventory. *Psychology in the Schools*, *52*(9), 829–844. http://dx.doi.org/10.1002/pits.21866.
Clifford, M. M. (1986). The comparative effects of strategy and effort attributions. *British Journal of Educational Psychology*, *56*, 75–83.
DiBenedetto, M. K., & Zimmerman, B. J. (2010). Differences in self-regulatory processes among students studying science: A microanalytic investigation. *The International Journal of Educational and Psychological Assessment*, *5*, 2–24.
Dignath, C., & Büettner, G. (2008). Components of fostering self-regulated learning among students. A meta-analysis on intervention studies at primary and secondary school level. *Metacognition and Learning*, *3*, 231–264.
DiPerna, J. C., Volpe, R., & Elliot, S. N. (2002). A model of academic enablers and elementary reading/language arts achievement. *School Psychology Review*, *31*, 298–312.
Dunlosky, J., Rawson, K., Marsh, E., Nathan, M., & Willingham, D. (2013). Improving students' learning with effective learning techniques: Promising directions from cognitive and educational psychology. *Psychological Science in the Public Interest*, *14*(1), 4–58.
Dweck, C. S., & Leggett, E. L. (1988). A social-cognitive approach to motivation and personality. *Psychological Review*, *95*, 256–273. http://dx.doi.org/10.1037/0033-295X.95.2.256.
Efklides, A. (2014). How does metacognition contribute to the regulation of learning? An integrative approach. *Psihologijske Teme/Psychological Topics*, *23*(1), 1–30.
Fuchs, L. S., Fuchs, D., Prentice, K., Burch, M., Hamlett, C. L., Owen, R., & Schroeter, K. (2003). Enhancing third-grade students' mathematical problem solving with self-regulated learning strategies. *Journal of Educational Psychology*, *95*(2), 306–315.
Gettinger, M., & Seibert, J. K. (2002). Contributions of study skills to academic competence. *School Psychology Review*, *31*(3), 350–365.
Good, C., Aronson, J., & Inzlicht, M. (2003). Improving adolescents' standardized test performance: An intervention to reduce the effects of stereotype threat. *Journal of Applied Developmental Psychology*, *24*(6), 645. http://dx.doi.org/10.1016/j.appdev.2003.09.002.
Graham, S., & Harris, K. R. (2009). Almost 30 years of writing research: Making sense of it all with the Wrath of Khan. *Learning Disabilities Research and Practice*, *24*, 58–68.
Grolnick, W. S., & Raftery-Helmer, J. N. (2015). Contexts supporting self-regulated learning at school transitions. In T. J. Cleary (Ed.), *Self-regulated learning interventions: Enhancing adaptability, performance, and well-being* (pp. 251–276). Washington, D.C.: American Psychological Association.
Guthrie, J. T., Wigfield, A., Barbosa, P., Perencevich, K. C., Taboada, A., Davis, M. H., ... Tonks, S. (2004). Increasing reading comprehension and engagement through concept-oriented reading instruction. *Journal of Educational Psychology*, *96*(3), 403–423. http://dx.doi.org/10.1037/0022-0663.96.3.403.
Hattie, J., Biggs, J., & Purdie, N. (1996). Effects of learning skills interventions on student learning: A meta-analysis. *Review of Educational Research*, *2*, 99.
Hattie, J., & Timperley, H. (2007). The Power of Feedback. *Review of Educational Research*, *77*(1), 81–112. http://dx.doi.org/10.3102/003465430298487.
Kitsantas, A., & Zimmerman, B. J. (2002). Comparing self-regulatory processes among novice, non-expert, and expert volleyball players: A microanalytic study. *Journal of Applied Sport Psychology*, *14*(2), 91.
Madjar, N., Kaplan, A., & Weinstock, M. (2011). Clarifying mastery-avoidance goals in high school: Distinguishing between intrapersonal and task-based standards of competence. *Contemporary Educational Psychology*, *36*(4), 268–279. http://dx.doi.org/10.1016/j.cedpsych.2011.03.003.
Montague, M., Enders, C., & Dietz, S. (2014). Effects of cognitive strategy instruction on math problem solving of middle school students with learning disabilities. *Learning Disability Quarterly*, *34*, 262–272.
Pajares, F., & Graham, L. (1999). Self-efficacy, motivation constructs, and mathematics performance of entering middle school students. *Contemporary Educational Psychology*, *24*, 124–139.
Pintrich, P. R. (2000). The role of goal orientation in self-regulated learning. In M. Boekaerts, P. Pintrich, & M. Zeidner (Eds.), *Handbook of self-regulation* (pp. 452–

502). Orlando, FL: Academic Press.
Pressley, M., & Harris, K. R. (2008). Cognitive strategy instruction: From basic research to classroom application. *Journal of Education*, *189*, 77–94.
Schunk, D. H., Meece, J. L., & Pintrich, P. R. (2014). *Motivation in education: Theory, research, and education*(4th ed.). Boston: Pearson.
Steele, C. M. (1997). A threat in the air: How stereotypes shape the intellectual identities and performance of women and African Americans. *American Psychologist*, *52*, 613–629.
Tabachnick, B. G., & Fidell, L. S. (2007). *Using multivariate statistics*(5th ed.). New York: Pearson.
Usher, E. L., & Pajares, F. (2008). Sources of self-efficacy in school: Critical review of the literature and future directions. *Review of Educational Research*, *78*(4), 751–796.
Wehmeyer, M. L., Agran, M., & Hughes, C. A. (2000). National survey of teachers' promotion of self-determination and student-directed learning. *The Journal of Special Education*, *34*, 58–68.
White, M. C., & DiBenedetto, M. K. (2015). *Self-regulation and the common core: Applications to ELA standards*. New York: Routledge.
Winne, P. H., & Hadwin, A. F. (1998). Studying as self-regulated engagement in learning. In D. Hacker, J. Dunlosky, & A. Graesser (Eds.), *Metacognition in educational theory and practice* (pp. 277–304). Hillsdale, NJ: Lawrence Erlbaum.
Winne, P. H., & Jamieson-Noel, D. (2002). Exploring students' calibration of self reports about study tactics and achievement. *Contemporary Educational Psychology*, *27*(4), 551–572. http://dx.doi.org/10.1016/S0361-476X(02)00006-1.
Winne, P. H., & Perry, N. E. (2000). Measuring self-regulated learning. In M. Boekaerts, P. Pintrich, & M. Zeidner (Eds.), *Handbook of self-regulation*. Orlando, FL: Academic Press.
Wolf, M. M. (1978). Social validity: The case for subjective measurement or how applied behavior analysis is finding its heart. *Journal of Applied Behavior Analysis*, *11*, 203–214. http://dx.doi.org/10.1901/jaba.1978.11-203.
Zimmerman, B. J. (2000). Attaining self-regulation: A social-cognitive perspective. In M. Boekaerts, P. Pintrich, & M. Zeidner (Eds.), *Self-regulation: Theory, research, and applications* (pp. 13–39). Orlando, FL: Academic Press.
Zimmerman, B. J., & Martinez-Pons, M. (1986). Development of a structured interview for assessing student use of self-regulated learning strategies. *American Educational Research Journal*, *23*, 614–628.
Zimmerman, B. J., & Martinez-Pons, M. (1988). Construct validation of a strategy model of student self-regulated learning. *Journal of Educational Psychology*, *80*(3), 284–290.