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Can a self-regulated strategy intervention close the achievement gap? Exploring a classroom-based intervention in 9th grade earth science

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ABSTRACT

The purpose of this paper was to examine the value of teaching self-regulated strategy use to Minority 9th grade students in earth science. Our conceptual framework drew from Zimmerman's (2000) theory of self-regulated learning and Darling-Hammond's concept of "opportunity gap" (2010). We designed an intervention for the classes of two of four 9th grade science teachers in one high school and examined the utility of the intervention for improving the performance of both Majority (White and middle class) and Minority students (non-White and/or economically disadvantaged). Our guiding questions were: Does making strategic learning explicit in the classroom promote learning and performance as measured by classroom and standardized achievement? Can SRL interventions close the achievement gap between Minority and Majority students? Findings suggest the SRL intervention had differential effects depending on 1) the teacher's fidelity to the intervention (Capella et al., 2009) and 2) the social status of the student in the school. Specifically, Minority students appeared to benefit more from the strategy intervention than their Majority peers. In the discussion we make explicit connections to Bourdieu's (Swartz, 1997) theory of cultural capital and argue self-regulated learning strategies are a type of internalized habitus that can be developed in academic settings.

1. Introduction

Ladson-Billings (1997) argued math and science literacy represents the "new civil rights battleground" (p.698) with access to math and science careers creating new forms of participation in society and unrivaled economic opportunities. After years of interventions and programs designed to encourage Minority students to pursue careers and coursework in science, technology, engineering, and math [STEM], only modest gains have been made in closing the achievement gap and increasing the pipeline of future scientists and engineers (Ball & Alvarez, 2004; Education Trust, 2006; Tate, 1997). Even when underrepresented students are successful in math and science, findings suggest their confidence and interest decline as they move to and through high school (Clewell, Anderson, & Thorpe, 1992; Jacobs, Lanza, Osgood, Eccles, & Wigfield, 2002; Pinder & Blackwell, 2014). Moreover, colleges face problems retaining students in STEM majors (Jacobs, 2005). Several studies indicate that insufficient preparation of K-12 students for STEM fields may be to blame for this difficulty (Museus, Palmer, Davis, & Maramba, 2011). Studies suggest disparities in school district funding, curricular tracking of racial and ethnic minorities into less rigorous courses (Davis, Chang, Andrzejewski, & Poirier, 2010, 2014), unqualified teachers, low teacher expectations, stereotype threat, oppositional culture, and premature departure from high schools contribute to this inadequate preparation. We argue that even when school districts attempt to remove these structural barriers to behavioral engagement in science (Davis et al., 2010, 2014), gaps in achievement may remain as a function of differences between Majority and Minority students' internalized habits of academic engagement.

The purpose of this paper was to examine the efficacy of a self-regulated learning [SRL] intervention designed to promote 9th grade students' goal setting, monitoring, and reflection on their classroom participation and test preparation in science. In the following sections we review the literature on SRL, particularly the development of SRL skills during adolescence. Consistent with Zimmerman (2000), we argue the development of SRL skills represents a pinnacle achievement of adolescence. Moreover, we drew from Darling-Hammond's (2010; see also Milner, 2012) ideas regarding opportunity gaps to argue that children entering high school who have had limited opportunities to internalize academic SRL habits would be at risk for underachievement and failure. We describe a classroom-based intervention designed to

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explicitly teach and create opportunities for 9th grade students to engage in SRL within the context of their science class.

2. Theoretical and conceptual framework

There are many models of SRL (e.g., Boekaerts & Corno, 2005; Winne, 1995; Zimmerman, 2000). In this study, we relied on Zimmerman's (1998, 2000, 2002) three-phase model of SRL. We broadly defined self-regulation as "the process whereby students personally activate and sustain behaviors, cognitions, and affects that are systematically oriented toward the attainment of goals" (Pintrich & Schunk, 2002, p. 408). In other words, students who are self-regulated learners promote their own learning by choosing strategies that will help them master content and by attending to thoughts and feelings that support sustained interaction with learning activities. Zimmerman (1998, 2002) outlined six critical questions, indicative of six dimensions, students must ask themselves about the learning activities in which they are engaged: *Why* am I learning this? *How* will I learn this? *When* will I learn this? *What* am I learning now? *Where* will I be most successful when learning this? and *Who* can help me learn this? Scholars agree that in order to understand how students enact each dimension we must draw from the literature on self-efficacy and goals, learning strategies, time management, self-reflection, environmental management, and help-seeking (Boekaerts & Corno, 2005; Winne, 1995; Zimmerman, 2000). Because students who are self-regulated learners choose to engage in behaviors and to endorse beliefs and feelings that promote engagement or involvement in learning activities even when they are feeling unmotivated, SRL is often equated with sustained, lifelong learning motivation (Brophy, 2004; see also the "continuing impulse to learn" by Oldfather & Dahl, 1994).

2.1. The importance of SRL

For decades, teachers and researchers have wondered what accounts for some students' success in school. One method of inquiry was to identify the characteristics that separate 'good students,' those who stay and succeed, from 'non-achievers' who fail and may eventually drop out (Borkowski & Thorpe, 1994; Zimmerman, Bonner, & Kovach, 2002). Findings suggest that SRL, and its components, represent key differences between good students and non-achievers (Borkowski & Thorpe, 1994). That is, good students tend to be self-regulated learners whereas non-achievers do not. This does not, however, suggest that SRL is a static trait. Rather, it is a dynamic process that is domain-specific (Winne & Perry, 2005).

Self-regulation has been shown to be important and effective for success in the domains of health, athletics, and education (Cleary & Zimmerman, 2004). In education, self-regulation predicts student achievement regardless of general mental ability (Pape, Zimmerman, & Pajares, 2002), and teaching self-regulation strategies has been linked to higher levels of motivation and achievement (Cleary & Zimmerman, 2004). As Zimmerman (2002) noted, self-regulation is not attributable to students' intelligence. Rather, it is how students use their own cognitive abilities in order to generate successful academic strategies. Thus, there is consensus among SRL scholars that the use of self-regulatory processes during studying can help all students become 'smart learners' (Zimmerman et al., 2002) and that SRL is a "developable aptitude" (Winne, 1996, p. 330).

In order to engage in SRL, students need to possess a 'tool kit' of tactics and strategies (Newman, 2002; Winne, 1996) and they need to understand how to adapt them to new learning situations. Although many tactics and strategies are applicable across contexts, there is evidence to suggest that SRL does not necessarily transfer. That may be because these strategies are cognitive and social as well as motivational, including students' judgments of the value of the material and the value of self-regulation in mastering the material; presenting SRL strategies in context may support students' SRL by helping them to see the context-specific utility of SRL tactics and strategies (Schunk & Ertmer, 2005). In a given context, self-regulated learners are able to set goals, select appropriate skills, monitor performance, create support structures, manage time, evaluate methods, make causal attributions, and adapt the methods they choose (Zimmerman, 2002). They are also able to engage in self-appraisal and self-management, and they use skills to analyze their comprehension and learning to make a determination regarding whether they are moving toward or away from their goals (Boekaerts & Corno, 2005; Paris & Paris, 2001). Self-regulated learners do this by implementing different problem solving techniques and knowing when and how to evaluate the effectiveness of these strategies. They set goals that are challenging and attainable, and they are more focused on understanding than task completion. Self-regulated learners know how to manage their resources, including time, and they are more persistent in goal completion and adaptive in their attitudes (Paris & Paris, 2001). These processes do not work in isolation but together in a cycle that both motivates students to be self-regulatory and solidifies the characteristics of the self-regulated learner (Zimmerman, 2002). This cycle includes thoughts, attributions, and behaviors and how students use these to set, plan, and alter goals and behaviors (Cleary & Zimmerman, 2004).

In order to assist students in developing self-regulation skills, Zimmerman (2000, 2002) identified three phases of self-regulation that work in conjunction with one another to promote more self-regulation. The first phase, *goal setting and strategic planning*, revolves around task analysis and self-motivation and centers on what students do before engaging in learning activities, such as note taking and studying. Self-regulated students in this phase identify the problem, the desired outcomes, and thoughtfully develop plans of action for reaching the goals they have set for themselves (Cleary & Zimmerman, 2004). In this phase, students also examine their beliefs about learning, their ability to learn, and their expectations for reaching their goals. Self-efficacy, outcome expectations, intrinsic interest, and the value students place on reaching their goals all affect what students will do, or think themselves capable of doing. Hadwin, Winne, Stockley, Nesbit, and Woszczyna (2001) argued that context matters as it influences the quality and character of students' study behaviors. In addition to students' perceived familiarity with instructional methods and their personal goals, they found college students varied their selection of study strategies depending on whether they were reading for learning, preparing to write a paper, or preparing for a midterm.

The second phase, *strategic implementation and monitoring*, involves the use of self-control and self-observation strategies and occurs when student are actively engaged in completing learning activities (Cleary & Zimmerman, 2004). Students in this phase exhibit self-control by picking and using the specific strategies they identified in the first phase. They also observe and monitor their strategy use and how effective the strategies are in reaching their goals. In this phase, self-regulated students are very proactive and they guide themselves by engaging in self-talk to direct their learning and understanding. This phase is extremely important as it allows students to collect information that assists them in evaluating their efforts and strategies for future success. During this phase students who are not self-regulated, fail to engage in self-observation tasks and they do not understand how to accurately monitor their understanding. These students often do not know that they are missing vital information, yet they remain confident about their comprehension of the tasks (Kiewra, 2002).

During the third phase, *strategic outcome monitoring*, students evaluate their performance based on personal goals or standards, assess the degree to which their chosen strategies were beneficial, and make attributions about their outcomes. This phase occurs after the learning activity has been completed, when students make judgments about their efforts and outcomes. In this phase, students analyze whether the strategies they chose need to be modified for future learning situations (Cleary & Zimmerman, 2004). At this point, self-regulated learners tend to make judgments based on the strategies they chose, whereas