The Relation Between Academic Engagement, School Connectedness, and Self-Regulated Learning on Academic Achievement

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THE RELATION BETWEEN ACADEMIC ENGAGEMENT, SCHOOL CONNECTEDNESS, AND SELF-REGULATED LEARNING ON ACADEMIC ACHIEVEMENT

by

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A Thesis Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Science

Major: School Psychology

The University of Memphis

December 2023
Abstract

The purpose of the current study was to examine the relation between self-regulated learning, school connectedness, academic engagement, and academic achievement among middle school students. Participants were 149 students from a public middle school in the mid-south region of the United States. Students completed a Qualtrics survey using the Self-Efficacy for Self-Regulated Learning Scale (SESRLS; Usher & Pajares, 2008), the Multidimensional School Engagement Scale (MSES; Wang et al., 2019), and the School Connectedness Questionnaire (SCQ; March & Randolph, 2020). Additionally, GPA data was calculated using their end of year science and math grades. Based on prior literature showing the ways that an engaged environment will build skills in self-regulated learning (Deci & Ryan, 1985, 2008; Ryan & Deci, 2000) as well as demonstrating how self-regulated learning mediates the association between school climate and achievement (Adams et al., 2015), it was hypothesized that self-regulated learning will mediate the association between engagement and achievement as well as connectedness and achievement. Path analysis was used to examine two competing models depicting the relations among the variables of interest in predicting academic achievement. Results revealed that self-regulated learning was not a significant mediator for the relation between engagement and achievement. However, school engagement was found to mediate the relation between SRL and both achievement areas. These findings indicate the importance of bolstering engagement skills in middle school students to support their academic achievement.
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The Relation Between Academic Engagement, School Connectedness and Self-Regulated Learning on Academic Achievement

A student’s ability to manage and regulate their own learning can be pivotal to their success in academics, especially as they are transitioning to middle school and support from parents and teachers starts to fade. Self-regulated learning (SRL) refers to the student’s ability to manage their own thoughts, actions, and environment during learning (Zimmerman, 2000). SRL can be a somewhat elusive construct as it combines various motivational processes, behaviors, and metacognitive skills (Zimmerman, 2000). Middle school students experience a large transition in expectations when it comes to academics. Their work becomes more complicated, they begin transitioning from classroom to classroom, and must adjust to learning from a multitude of teachers as opposed to staying with one or two teachers all day. It is the time when they must begin preparing for the expectations of high school and postsecondary education and learning skills that will lead to greater success down the road. Academic achievement in middle school has been shown to have larger effects on college and career readiness when compared to academic achievement assessed in high school (American College Test [ACT], 2008). As such it is necessary to review what factors in middle school can contribute to students’ academic success.

Although there is a wealth of knowledge about specific academic interventions that help bolster student’s academic success, less work has been done on the metacognitive structures that contribute to this success (Dweck et al., 2016; Cleary et al., 2021). Existing research shows that factors such as SRL, academic engagement, and school connectedness individually contribute to academic achievement (Casillas et al., 2012; Kuo et al., 2021; Mammadov et al., 2018; Moore et al., 2016), but there has been little research on how these three factors work together in this
process. This study aims to fill this gap and review both how these factors contribute to achievement individually, but also to examine the relations they have with one another.

**Self-Regulated Learning**

Work on SRL began with Bandura (1986) putting forth a model that described the importance of self-regulation to basic human functioning. From here education researchers have explored the way SRL helps students be successful within the classroom. This means looking at the way this metacognitive process contributes to academic achievement and success after leaving school. In the current literature, there has been a large push towards self-regulated learning, especially in the wake of virtual learning (Hong et al., 2021; Wong et al., 2021). SRL refers to students being able to take charge of their own education and become independent in their learning, a set of skills that was especially important during virtual learning when adults could not always be physically present with the student in order to facilitate this process. Although schools have made the transition back to in-person learning, the use of technology has not and likely will not end. This means that students will oftentimes be required to participate in certain tasks via the use of a tablet and will need to be able to navigate these items for themselves. This accentuates the importance of researching SRL in the present day and assessing this skill in students to determine where extra support may be necessary.

SRL is a complex process that can be described as consisting of three dimensions: strategy use, motivation, and metacognition (Cleary, 2018; Zimmerman, 2000). Strategy use refers the student’s ability to utilize resources and procedures to enhance their learning and to control their own thoughts, behaviors, and emotions within the learning environment (Dunlosky et al., 2013; Zimmerman & Schunk, 2011). Motivation refers to the process through which
students initiate and sustain behaviors that pertain to their learning. Finally, metacognition refers to an individual’s awareness and control over their thinking (Flavell, 1979; Zimmerman, 2000).

Although strategy use, motivation, and metacognition help students develop their regulatory functioning, a narrower range of components may be found within each dimension. This may include behaviors such as goal setting and attainment, self-monitoring of progress, time management, and adaptability (Zimmerman, 2002). Within each of these components a large array of behaviors may be assessed, depending on the age of the students in question and the instructional tools used. Finding strict definitions for specific behaviors associated with SRL can be troublesome, as it is defined differently in the literature. For example, there will be higher expectations for a student in middle school to monitor their own grades than for an elementary age student. As technology changes the types of behaviors associated with SRL may look differently. For example, writing in a planner may have been the gold standard way to show that a student is organized, but in some schools today it may be more typical for a student to make a note on their tablet, or add a homework alarm to a digital calendar, as opposed to using pen and paper. Therefore, it may be more beneficial to look at SRL more broadly, focusing on the three large dimensions discussed above, as opposed to focusing on more specific behaviors.

An important distinction to make when looking at SRL is to understand that many students understand what the self-regulatory strategies they should be using are, but they may not view themselves as being able to effectively use these strategies. In other words, a person’s self-efficacy of self-regulated learning is an important predictor for their ability to use these strategies (Usher & Pajares, 2008). Therefore, it is a necessary and common practice to assess SRL through the use of self-report measures so that the students can describe the way they perceive their own self-regulated learning behaviors. SRL has been found to correlate closely with academic
achievement. When students report higher levels of SRL behaviors, they have been shown to score higher on measures of achievement in a variety of academic subjects (Cleary et al., 2020; Garrels & Palmer, 2019; Boekarts, 1997; Cleary & Zimmerman, 2004). In sum, SRL is an important component that may be contributing to academic achievement, making it worthy of closer examination. SRL at its core requires the student to initiate and maintain the behaviors independently. Additionally, it may be beneficial to consider what other factors may play a role in enhancing SRL in students to increase the types of behaviors that they would benefit them academically.

**Academic Engagement**

Academic engagement refers to the student’s ability to demonstrate sustained and direct participation in school, as well as the observable and unobservable qualities of interactions with peers and academic activities (Skinner & Pitzer, 2012). Appropriate engagement can help students rebound from setbacks and maintain motivation in school (Skinner et al., 2008). When students in secondary education have appropriate levels of engagement, they are better prepared for a successful transition into adulthood (Wang & Holcombe, 2010). This denotes the importance of directly encouraging school engagement and using it as a tool to promote other factors that are necessary for later success in life, such as academic achievement and self-regulated learning. Middle schoolers are facing multiple life transitions, many of them are going to a larger school and taking different types of classes, as well as managing issues outside of school such as puberty and developing and maintaining healthy relationships. This means that supporting them and helping to bolster academic engagement during these formative years may be pivotal in supporting the students as they matriculate through the education system.
It is accepted in education research literature that for a student to be successful in school, they must be able to deal with hardships and bounce back from them effectively. This skill leads to more success down the line and is known as academic resiliency. When students are shown to be resilient in schools, this means they are able to learn from mistakes and failures and recover in a way that shows growth in academic areas. Both self-regulated learning and academic engagement have been identified as two of the factors that contribute to this kind of resilience (Skinner et al., 2020). It is believed that when students show strong academic engagement, they have more energy and motivation to continue working hard and moving forward on their goals as opposed to giving up when facing adversity. Likewise, with self-regulated learning, students who are able to monitor and manage their own academic goals are more likely to continue working when faced with difficult academic tasks or when hitting a roadblock outside of school that impacts their academic activities (Zimmerman, 1990; Zusho, 2017).

As the academic engagement literature has developed, this concept has expanded and is now commonly considered to be a multidimensional construct encompassing four factors: emotional, behavioral, cognitive, and social engagement (Bae & Debusk Lane, 2018; Lei et al., 2018; Skinner et al., 2008; Wang et al., 2010; Linnenbrink-Garcia et al., 2011; Wang et al., 2010; Wang et al., 2019). Unique facets of school engagement are represented by each of these four factors. Emotional engagement represents a student having a positive identity with their school, in addition to their affective responses such as value, enjoyment, and interest in school (Finn, 1989; Wang et al., 2010; Wang et al., 2019). Behavioral engagement refers to positive classroom conduct and participation skills such as staying on tasks and contributing to academic and nonacademic activities (Fredricks et al., 2004; Wang et al., 2019). Next, cognitive engagement represents the ability to exert the necessary effort for understanding complex ideas as well as the
production of high-quality work (Fredericks et al., 2004; Wang et al., 2019). The final and newest factor, social engagement, refers to a student’s social interactions in the classroom such as working with peers, in addition to reviewing the quality of those social relationships (Linnenbrink-Garcia et al., 2011; Wang et al., 2010; Wang et al., 2019). This factor in particular has been associated with higher achievement within middle school students (Ryan & Patrick, 2001; Farrington et al., 2012; Shin & Ryan, 2012; Wang et al., 2018; Wang et al., 2019).

However, Wang et al. (2019), found that behavioral, cognitive, and emotional engagement explained more variance in the global factor of engagement compared to social engagement. This suggests that the social dimension of school engagement is likely distinct from the academic dimensions.

The construct of engagement has proven to be very nebulous in the current literature. Terms are often used interchangeably (i.e., school engagement, academic engagement, academic participation), and may be defined in a variety of ways and to include various subscales (i.e., behavioral, cognitive, emotional, social). Additionally, it is not always clear in the research which aspect of engagement is doing the most heavy lifting when it comes to academics. However, some researchers argue that the best definition of engagement is behavioral engagement (Li et al., 2010) because it is more clearly defined and observable, while other aspects of engagement may be better subsumed under other constructs (i.e., cognitive engagement better defined as self-regulated learning). Behavioral and emotional engagement are most commonly studied among middle school students (Bae & Debusk Lane, 2018; Lee, 2016). Behavioral engagement has often been studied in relation to grit and growth mindset (O’ Neal et al., 2019), both of which have been shown to impact achievement (Duckworth et al., 2007; Duckworth et al., 2010; Duckworth et al., 2007; Duckworth & Quinn, 2009). Further, it has been
demonstrated that behavioral engagement plays an important role in academic success for students (Lei et al., 2018).

Broadly speaking, academic engagement has been positively correlated with academic achievement in the literature (Connel & Wellborn, 1991; Dennie et al., 2019). Research has often examined how a specific factor or combination of factors of engagement contributed to academic achievement (Bae & Debusk Lane, 2018; Lee, 2016). Additionally, the contribution of academic engagement to achievement in a specific subject such as science has been examined (Lee, 2016). However, little to no research has examined the multidimensional model of academic engagement and how it applies to academic achievement in math and science with middle school students. This paper serves to partially fill that gap by examining the indirect link between academic engagement and achievement.

**School Connectedness**

In a similar vein to academic engagement, there is school connectedness. Although this factor overlaps in some ways with academic engagement, school connectedness more closely examines the ways in which a student feels supported by the adults in the school. Specifically, school connectedness looks at to what extent a student believes that the adults in a school care about their learning as well as them as individuals (Centers for Disease Control and Prevention [CDC], 2009). The CDC has found that when students feel more connected to their school, they are more likely to engage in healthy behaviors and to be successful academically. School connectedness is viewed as a protective factor, with teacher support decreasing the likelihood of a student engaging in health risky behaviors (i.e., substance use, violence, suicidality, delinquency) but having no effect once the behaviors have begun (McNeely & Falci, 2004). Essentially, once a student has begun engaging in behaviors that would be deemed risky to their health, school
connectedness does not work to ameliorate or decrease these behaviors. This demonstrates the importance of promoting and maintaining positive teacher relationships early on in a student’s career to help promote positive academic and health-related outcomes.

Although school connectedness has not been examined extensively in the education research literature, it has an important role in supporting a student’s mental health, and in their ability to show resilience in an academic setting. For students who have had at least one adverse childhood experience (ACE), school connectedness was shown to provide a buffer that reduces instances of suicidal behavior in both middle and high school students (Lensch et al., 2020). Additionally, when looking at populations experiencing severe poverty, higher rates of school connectedness have been associated with lower rates of association with “deviant peers” for students transitioning to middle school (Moritz Rudasill et al., 2013). These findings suggest that encouraging and supporting school connectedness may be even more important at schools with higher rates of poverty or gang activity. School connectedness may act as a necessary social support for students in middle school as they are continuing to develop social bonds that will help shape them as they grow up. In the past year, the CDC has begun reviewing data on the mental health of students throughout the course of the Covid-19 pandemic. This research reflected the importance of school connectedness, as students that reported higher levels of school connectedness had lower rates of suicidal thoughts and thoughts of sadness (CDC, 2021). However, this data collection also showed that only 47% of students felt close to people during the pandemic (CDC, 2021). As schools continue to transition back to traditional classroom settings and adjust to the changes that have come from the pandemic, this research shows the importance of supporting school connectedness in all students.
Much of the research that has been conducted on school connectedness has been in populations with higher rates of ACEs, such as low-income families and foster children (Lensch et al., 2021; Areba et al., 2021; Moritz Rudasill et al., 2013). This is likely due to school connectedness being seen as a protective factor that may help prevent adverse outcomes in the future. Additionally, school connectedness has been shown to not only benefit behavioral outcomes in communities in which ACEs are high, but also to contribute to higher levels of academic achievement as indicated by grades (Somers et al., 2020; Battistich et al., 2004). Additionally, studies in the UK have linked a strong sense of belonging in schools to better outcomes in both behavior and academics (Cockerill, 2019). Finally, school connectedness has been shown to correlate with graduation rates, those with higher levels of connection to their school in eighth grade are more likely to graduate from high school in addition to being less likely to use drugs or engage in criminal activity (Bond et al., 2007).

**Connecting the Factors**

Adams et al. (2015) proposed a new model of looking at SRL by reviewing the climate of the school and determining whether a strong self-regulation climate explained school-level variation in self-regulated learning. This model used schools as their unit of analysis, reviewing the context of the schools and determining if the climate supported student trust in faculty, faculty trust in students, and an academic emphasis. It was determined that these three factors combined to create a self-regulatory climate (which was confirmed through confirmatory factor analysis). Within this model, the self-regulatory climate of the school accounted for 96% of the variance in self-regulated learning and 88% of variance in math achievement (Adams et al., 2015). Additionally, research supports that bolstering a student’s own natural internal processes through a supportive and engaging environment (i.e., one that supports academic engagement
and connectedness) can increase self-determined and self-regulated behavior which will assist in the advancement of learning (Deci & Ryan, 1985, 2008; Ryan & Deci, 2000). Although the terminology is different, the emphasis on trust in school personnel maps closely onto the concept of school connectedness, and the academic emphasis is comparable to qualities associated with academic engagement. This is not a perfect fit, but the overlap in these concepts supports that both academic engagement and school connectedness may contribute to a model that supports self-regulated learning, and therefore supporting academic achievement. In fact, Adams et al. reported that self-regulated learning acts as a mediator between the self-regulatory climate and math achievement, which supports the models used in this study.

To our knowledge, no research to date has examined the connection between SRL, academic engagement, and school connectedness. This is an important gap in the literature given that, individually, these factors contribute to academic achievement across ages. Understanding how SRL, academic engagement, and school connectedness work together will provide a more well-rounded picture of students’ experiences within a classroom as well as their internal beliefs regarding their education. Additionally, looking at middle school age students will provide an important glimpse at what factors may be most important at this pivotal age. As research has shown, middle school achievement, and other metacognitive factors are important predictors of substance use, mental health diagnoses, and dropout rates later in life (ACT, 2018: Bond, 2007), so by focusing this study on this population we will be able to address the various factors that may play the largest role in success for the students moving forward.

**Purpose of the Study**

The purpose of the current study was to identify the relation between self-regulated learning, school connectedness, academic engagement, and academic achievement among
middle school students. Specifically, self-regulated learning was examined as a potential mediator for the relation between school connectedness and academic engagement and later math and science achievement (see Figures 1 & 2). Additionally, a comparison model was examined depicting school connectedness and academic engagement as mediators for the relation between SRL and achievement (see Figures 3 & 4). These factors have been supported in research to contribute to student achievement, but mediating relations have not been thoroughly explored. In a model that combined factors similar to both school connectedness and engagement, self-regulated learning was identified as an important mediator between school climate and achievement in math (Adams et al., 2015). Additionally, previous research has shown that an engaging school environment can increase self-regulated learning behaviors in students (Deci & Ryan, 1985; 2008, Ryan & Deci, 2000). This indicated that school environment (i.e., level of engagement and connectedness) may play an important role for the relation between SRL and achievement as well. It is hypothesized that SRL will act as a mediator for the relation between engagement and achievement as well as between connectedness and achievement. Based on the literature highlighting the role of the engaged and connected environment, it is also hypothesized that engagement and school connectedness will act as mediators for the relation between SRL and the achievement outcomes. It was important to examine both mediation models to provide clarity on the ways in which these factors work with one another with regard to achievement. The proposed models will be examined for math and science achievement separately. In doing so, we aim to guide schools in how these factors can best be supported for students. The following research questions guided this study:

1. Does self-regulated learning mediate the association between school connectedness and academic achievement in math and science?
2. Does self-regulated learning mediate the association between academic engagement and academic achievement in math and science?

3. Does school connectedness mediate the association between self-regulated learning and academic achievement in math and science?

4. Does academic engagement mediate the association between self-regulated learning and academic achievement in math and science?

**Methods**

**Participants**

A total of 149 students from a public middle school located in the mid-south region of the United States participated in this study. Data were pulled from an existing data set, and selected measures represent a subset of items from a larger study examining factors that support academic achievement among middle school students. Individuals who were enrolled in regular education curriculum were invited to participate. Participants were in sixth grade \((n=69)\), seventh grade \((n=28)\), or eighth grade \((n=52)\). Students reported their identities as 31.5% African American or Black, 4.0% Asian or Pacific Islander, 4.0% as Biracial, 47.9% European American or White, 2.0% as Latinx or Hispanic, 0.7% as North African or Middle Eastern, 4.2% Other, 4.0% preferred not to answer, and 3.4% of participants did not respond to this item. Students who identified as “Other” self-reported as “Mediterranean” \((n=1)\), “brown” \((n=1)\), “a mix of Caucasian and Latinx” \((n=1)\), “half Indigenous American and half Italian” \((n=1)\), and “Native American” \((n=1)\). Students identified as girls \((n=74)\), boys \((n=68)\), gender fluid \((n=2)\), or preferred not to answer \((n=5)\). Due to this survey being completed by students, there was no information on socioeconomic status that was recorded. However, a review of the Tennessee Department of Education (TN DOE) website showed that 10% of the students in this school are
considered economically disadvantaged, meaning they qualify for the free and reduced lunch program (TN DOE, 2022).

**Measures**

*The Self-Efficacy for Self-Regulated Learning Scale (SESRLS; Usher & Pajares, 2008)*

The Self-Efficacy for Self-Regulated Learning Scale (Usher & Pajares, 2008) was used to measure the students' perceptions of their self-regulated learning skills. This scale consists of seven items (see Appendix for items) and examined how the student perceives their own abilities to manage their schoolwork, and to what extent they employ beneficial strategies such as independent studying. Students responded using a six-point Likert scale ranging from 1 = Not well at all to 6 = Very well. The seven items on this scale were summed and then averaged to form one unidimensional construct of self-efficacy of self-regulated learning. This measure showed strong concurrent validity with other factors commonly associated with self-regulated learning such as self-efficacy (.34 ≤ r ≥ .57), self-concept (.42 ≤ r ≥ .67), and task goal orientation (.40 ≤ r ≥ .60; Usher & Pajares, 2008). The alpha value for the SESRLS scale in this study was found to be .83. Additionally, this measurement model was found to be invariant across elementary, middle, and high school and gender.

*Multidimensional School Engagement Scale (MSES; Wang et al., 2019)*

The MSES measures aspects of student-reported school engagement and disengagement including behavioral, emotional, cognitive, and social dimensions. However, only the school engagement scale will be included in this study, which consists of 19 items scored on a Likert Scale with responses from 1= not at all like me to 5 = very much like me. School engagement items included four behavioral, five cognitive, five emotional, and five social questions (see Appendix for items). Each set of dimension questions will be combined to produce four mean
scale scores (i.e., Behavioral, Cognitive, Emotional, and Social). These scales will then be summed and averaged in order to create an observed variable of School Engagement. McDonald’s ω and ωH are the reliability reported by the scale developers due to the use of a bifactorial models. The standardized coefficient for school engagement was reported to be .81. This study found a comparable coefficient alpha (α = .91). The Global School Engagement factor loadings were reported to be all statistically significant with loadings above .30 (M = 0.58, range = .40–.79). Specific dimension factor loadings are reported lower than the global school engagement factor. However, the variances were split among the global and individual dimension factors and all variances of the specific factors (i.e., behavioral, emotional, social, and cognitive) are reported to be significant (Wang et al., 2019).

**School Connectedness Questionnaire (SCQ; Marsh & Randolph, 2020)**

The School Connectedness Questionnaire will be used to measure the students’ perceptions of their own school connectedness. This scale examines the extent to which the student feels that adults and peers at their school care about their overall wellbeing and success. A three-point Likert scale with responses from 1 = True to 6 = Not true at all are used for all items. The SCQ consists of three Teacher Bonding & Attachment items, four Peer Bonding & Attachment items, and three School Engagement items (see Appendix for items). Each set of dimension questions will be combined to produce three mean scale scores (i.e., Teacher Bonding & Attachment, Peer Bonding & Attachment, and School Engagement). These scales will then be summed and averaged to create the observed variable of school connectedness. Cronbach’s α for the SCQ dimensions ranged from .51 to .80 (Marsh & Randolph, 2020). The lowest reliability was for School Engagement (α = .51); however, when using the GLB to account for skew due to smaller sample sizes the reliability was found to be .64. The variances were split among the
global and individual dimension factors and all variances of the specific factors (i.e., Teacher Bonding & Attachment, Peer Bonding & Attachment, and School Engagement) are reported to be significant (Marsh & Randolph, 2020) supporting the use of both the global and individual dimensions. When reviewing Cronbach’s alpha for this study, our data yielded a slightly larger coefficient ($\alpha = .69$) and did not change when School Engagement was removed. Although this variable was slightly below the typically accepted value of .70, it closely approximated the minimal standards.

**Academic Data**

Information from school records will be used to report current grades in all subject areas. Grades were provided by the participating school via second quarter report cards. Report cards were included for Social Studies, Mathematics, Science, and English Language Arts. Grades consisted of either A (cumulative score ranging 93-100), B (cumulative score ranging 85-92), C (cumulative score ranging 75-84), D (cumulative score ranging 70-74), and/or F (cumulative score ranging 0-69) for participating middle school students. Grades were converted to a GPA score, re-coded on a four-point scale by researchers, and then added and averaged to calculate a grade point average for individual subject areas. For the purpose of this study and to remain consistent with prior research, fourth quarter GPAs for math and science will be used as the endogenous variables for this study.

**Procedure**

Data were collected in December 2021 (i.e., end of the second quarter) following the approval of the University of Memphis Institutional Review Board (#PRO-FY2020-559). Approximately two weeks before survey administration, the school’s administration distributed parental consent forms electronically via email. After obtaining electronic consent via email,
participants were assigned an ID number by the school’s research administrator, which corresponds to their survey. All measures were administered electronically via a password secured online survey program called Qualtrics. This program required that the students have a link to access the survey. In addition to the measures selected for this study, the survey encompassed student assent, a statement of confidentiality, demographic information including age, racial identity, gender identity, format of learning (i.e., virtual or in-person), and grade. The administration order of the measures (MSES, SCQ, and other instruments) were counterbalanced across participants. The computer-based survey was completed online during a homeroom meeting designated by school administration. Teachers were given a sheet of paper with each participants ID # and name and the link to the survey. Students had approximately 30 minutes to complete the survey. Participating students’ course grades (i.e., English Language Arts, Math, Science, and Social Studies) were provided by the school, and data from the first and fourth quarter were used in this study. Identification numbers were used in place of names in the data files, and then transferred to the primary investigator via secured OneDrive folder.

**Analytic Approach**

Self-regulated learning, school connectedness, and academic engagement, and student academic success in math and science as indicated by GPA served as the observed variables of interest in this study. The structural relations among these factors were examined using path analysis. In the proposed model, self-regulated learning served as a mediator for the relation between school connectedness and academic engagement and the outcome of interest, academic achievement (see Figure 1 and 2). Additionally, a comparison model was analyzed which used both behavioral and school engagement as mediators for the relation between self-regulated learning and academic achievement (see Figure 2 and 3). Fourth quarter science or math GPA
were modeled separately. Additionally, gender, race/ethnic identity, and grade were used as covariates for GPA. Analyses were conducted in MPlus version 8, and maximum likelihood estimation with robust standard errors (MLR) was used to handle any missing data and to account for any multivariate outliers or violations of normality. When using the ratio of cases to parameters to consider the adequacy of the sample size for path analysis, 20:1 is recommended and values falling under 10:1 are considered less ideal (Kline, 2016). For the proposed model, a ratio of approximately 11:1 is available suggesting that the sample size ($N = 149$) was adequate.

As advised by Kline (2016), several fit indices were used to evaluate model fit and to determine whether the proposed models provided an adequate fit to the observed data. Specifically, Steiger-Lind root mean square error of approximation (RMSEA; Steiger, 1990) with its 90% confidence interval, the chi-square and degrees of freedom, Bentler comparative fit index (CFI; Bentler, 1990), and weighted root mean square residual (WRMR; Bentler, 1990) was examined. The model chi-square tests the null hypothesis and is a badness of fit test, so a significant chi square test indicates a poor model fit. Using a 90% confidence interval, RMSEA measures the fit between the population covariance matrix and the model, with values > .10 indicating poor fit values, values between .05 and .08 suggesting reasonable error of approximation, and < .05 indicating a close approximate fit (Browne & Cudeck, 1993; Steiger, 1990). The Comparative Fit Index (CFI) compares the fit of an independent model to the fit of the indicated model of interest, implying all the variables in the model are uncorrelated. Thus, the CFI indicates how much the model of interest is better than the independent model, with values of > .95 indicating good model fit. Lastly, the Akaike Information Criteria (AIC; Akaike, 1998), and the Bayesian Information Criterion (BIC; Schwarz, 1978), were used to compare fit between non-nested models. Lower AIC and BIC values indicate a better fit, and 10 or more
point difference provides evidence for superior fit of one model over another (Kass & Raftery, 1995).

Standardized path coefficients were reported for each structural model. These path coefficients specify the proportion of the standard deviation unit that the dependent variable changes as a function of a one standard deviation change in the independent variable, making them similar to beta weights from regression analyses (Kline, 2016). Standardized coefficient effect sizes above .05 are considered small, values above .15 are considered moderate, and those above .25 are considered large (Kline, 2016). The direct contributions of both school connectedness and academic engagement to achievement in math and science, as well as any indirect contributions to achievement through self-regulated learning, were examined.

Results

Data Processing and Screening

Data were screened for accuracy of input, out-of-range values, skewness, kurtosis, univariate and multivariate outliers, missing data, multivariate normality, heteroscedasticity, and multicollinearity. Three univariate outliers were identified for self-regulated learning, school engagement, and math GPA (|z| > 3.29; Tabachnick & Fidell, 2019), and those scores were replaced with the next closest values. Skewness and kurtosis statistics (see Table 1) fell within acceptable limits (< |2.0|; Tabachnick & Fidell, 2019), and no multivariate outliers were identified based on Mahalanobis Distance (p <.001). Additionally, students’ Likert scale responses were screened for a positive and negative response style (i.e., the highest or lowest possible values across all questions). Data from one participant for the Multidimensional School Engagement Scale was flagged due to a positive response style (i.e., answered “5” for all questions) and was treated as missing data. Additionally, 7 cases were excluded because they did
not have valid ID numbers and therefore GPA data could not be related to their surveys, leaving a final available sample of 128 participants. Little’s MCAR test was not significant, $\chi^2 (9, N = 124) = 13.60, p = .137$, suggesting that data were missing completely at random. Pairwise plots were visually inspected for nonlinearity and heteroscedasticity and appeared to be within normal limits.

Correlations among the indicators (i.e., SRL, MSES, and SCS total scores) were examined for multicollinearity ($r > .80$), and values ranged from .45 to .70 (see Table 2). Of the three variables of interest, only SRL was found to significantly correlate with the outcome variable of science GPA ($r = .23$). However, both SRL ($r = .13$) and school connectedness ($r = .23$) were found to correlate significantly with math GPA. Both academic variables were found to correlate moderately with one another ($r = .49$), indicating that different skills may be required for each subject. Given the potential for conceptual overlap, correlations among the subscales that comprised the global engagement (behavioral, cognitive, emotional, and social engagement) and school connectedness (teacher belonging and attachment, peer belonging and attachment, and school engagement) composite scores were also examined to ensure that the measures selected were conceptually distinct. Subscales within the MSES correlated more closely with one another (range .41-.66) and the MSES total score (range .79-.83) than with the SCS subscales and total score (range .24-.56). In contrast, the correlations among the SCS subscales were significant but weak (range .20-.25) and were more closely related to the MSES subtests than each other (range .24-.56). This indicates a weak overall conceptual framework for the SCS measure. As such, it was decided that the school engagement subscale would be used in place of the SCS composite.
When reviewing the correlations in this study, the full construct of academic engagement was not found to correlate with either of the academic outcomes. In fact, the only subscale of the global engagement measure that was found to correlate with achievement was behavioral engagement. In addition to this finding and based on prior literature indicating that behavioral engagement has a more direct impact on a student’s academic achievement (Li et al., 2010; Bae & Debusk Lane, 2018; Lee, 2016), it was decided that the behavioral engagement subscale of the MSES would be used in place of the composite score. The items comprising the school engagement subscale and the behavioral engagement subscale were reviewed for similarity and were found to be sufficiently distinct (see Appendix). The moderate correlation found for these variables (.40) also suggests that the subscales represent distinct but related constructs.

**Path Analyses**

**SRL Mediation Model**

The mediation effect of SRL on the relation between school engagement and behavioral engagement on academic achievement was examined using a path analysis. Fourth quarter science or math GPA served as the academic achievement variables of interest and were modeled separately. Additionally, gender, race/ethnic identity, and grade served as covariates for GPA. Model fit indices suggest that both the science and math model provided an adequate fit to the observed data (see Figure 1 and 2). The direct path from behavioral engagement to SRL (.50) and from school engagement to SRL (.33) were both significant. These results indicate that behavioral and school engagement contribute uniquely to self-regulated learning in this study. Behavioral and school engagement were allowed to covary within this model (.40) and were significantly related to one another.
When the contributions of behavioral engagement and school engagement to science GPA were examined (see Figure 1), only school engagement was found to contribute directly (.33). No indirect effects were detected. Among the three covariates included in the model, gender (.17) and grade (-.36) were significantly related to science GPA but race/ethnic identity was not. A similar pattern of results emerged in the model depicting math GPA (see Figure 2). The only variable that was found to contribute directly to math GPA was school engagement (.38) and no indirect effects were detected. However, none of the covariates were found to be related to math GPA. These models explained 48% of the variance in SRL, 28% of the variance in science GPA, and 17% of the variance in math GPA. This indicates that a student’s school engagement as measured by the SCQ in this study may make a direct contribution to their overall academic success in math and science. Together these results point to the importance of a school environment that fosters the growth of a student’s school engagement for their academic success.

Engagement Mediation Model

Due to the nebulous nature of the literature around these topics, it was important to explore the possible role of behavioral engagement and school engagement as mediators for the relation between SRL and academic achievement. Model fit indices suggest that both the science and math model provided an adequate fit to the observed data (see Figure 3 & 4). It should be noted that the AIC and BIC values for the engagement mediation models were found to be lower than values observed for the SRL mediation, suggesting that this model provided a superior fit to the observed data from both math and science. Standardized direct, indirect, and total effects were examined for each predictor variable and are displayed in Figures 3 and 4. The direct path from SRL to behavioral engagement (.62) and from SRL to school engagement (.52)
were both significant. Behavioral engagement and school engagement were allowed to covary within this model, however, unlike the previous model, this relation was no longer significant.

When the contributions to science GPA was examined (see Figure 3), the only variable in the model that had a significant direct effect was school engagement (.33). However, SRL was found to contribute indirectly to science GPA through school engagement (.17), indicating that school engagement mediates the relation between SRL and science GPA. A similar pattern of results emerged in the model depicting math GPA (see Figure 4). As reported above, a significant direct path was found from school engagement to math GPA (.38). Further, the indirect path from SRL to math GPA via school engagement was significant through school engagement (.20), indicating that school engagement does act as a mediator for this relation. These models were found to explain 39% of the variance in behavioral engagement, 27% of the variance in school engagement, 28% of the variance in science GPA, and 17% of the variance in math GPA.

**Discussion**

This study was conducted to address the way in which self-regulated learning worked with academic engagement, school engagement, and school connectedness to support middle school students in the areas of math and science. In recent years the importance of these variables has been identified both in research and in application. SRL is a construct that has existed since 1986 with Bandura’s work detailing how self-regulation acts as a basic human function. More recent literature has identified SRL as a key component of learning, especially now that virtual learning has become so common (Hong et al., 2021; Wong et al., 2021). Extensive research has revealed engagement to be an important factor for student’s academic achievement (Bae & Debusk Lane, 2018; Lee, 2016; Connel & Wellborn, 1991; Dennie et al.,
and to contribute to success into adulthood (Wang & Holcombe, 2010). Finally, school connectedness is a slightly newer construct that has not been as well supported as it relates to academic achievement. However, this construct has been studied as a protective factor regarding ACEs in children (McNeely & Falci, 2004; Lensch et al., 2020) and as a support for healthy behaviors in the community (CDC, 2009). These three constructs have been shown in various ways to contribute to the lives of students, but they have not been thoroughly examined with how they relate to one another.

Previous research has shown that an engaging school environment can increase self-regulated learning behaviors in students (Adams et al., 2015; Deci & Ryan, 1985; 2008, Ryan & Deci, 2000). However, no studies have assessed to see if the reversed relation is also true. To address this gap, this study examined whether self-regulated learning would mediate the relation between school connectedness and academic engagement with achievement in math and science. As an extension upon previous literature that highlights the importance of an engaging school environment as a way to support SRL and achievement, school connectedness and academic engagement were depicted as mediators of the relations between SRL and achievement in a comparison model. This comparison provided an opportunity to shed light on the structural nature of these relations, and to identify which factors have the greatest potential impact as it pertains to student achievement.

The correlations among the variables of interest in this study were predominantly weak and insignificant. In fact, of the three main variables (SRL, academic engagement, and school connectedness), only SRL correlated with both areas of achievement, and only did so weakly (See Table 2). Additionally, the subscales within the school connectedness measure did not correlate as expected. The school connectedness subscales were weakly correlated with one
another, indicating that in this study they may not have measured their intended constructs appropriately. These subscales were found to correlate more highly with other subscales within the MSES measure of engagement than with each other. The SCQ, as it was used in this study, has only been used in a handful of other studies, with a lengthier version of the measure being used more broadly. Studies that have utilized the SCQ, including its initial validation study, have not reported correlations among the subscales (Marsh, 2020; Marsh & Randolph, 2020). While this measure was selected for this study due to adequate reliability and consistency scores as well as the benefit of being a brief measure, results from this study indicate that it may not be a broadly valid measure of the construct of school connectedness. As such, it was necessary to determine what, if any, scales seemed appropriate to include in these models based off these results as well as prior literature.

The measures of these constructs have proven to be murky at best when it comes to accurately assessing aspects of engagement and connectedness (Li et al., 2010; Furlong et al., 2003; Jimerson et al., 2003). Significant conceptual overlap has been identified as a potential issue with using the four-factor model of engagement. In fact, previous studies often conceptualized engagement using the three factors of behavioral, emotional, and cognitive engagement (Bae & Debusk Lane, 2018; Lei et al., 2018; Skinner et al., 2009; Wang et al., 2010), with behavioral and emotional engagement being studied most commonly in middle school students (Bae & Debusk Lane, 2018; Lee, 2016). The multidimensional model of engagement is a relatively new concept, with the four-factor model becoming more common in the literature within the last decade. Consensus does not yet exist in the literature regarding what structure carries the best evidence base. Based on the correlations found in this study, as well as the prior literature indicating that a multi-factor representation of engagement may not be the
most salient, it was decided that the subscale of behavioral engagement would be used to represent the construct of academic engagement in this study.

Unfortunately, the correlational data did not support the use of the full SCS score. The three subscales comprising the SCS total score were weakly associated with one another, and although the total score correlated weakly with math it was not correlated significantly with science. Among the three subscales, only school engagement was found to correlate with both science and math (see Table 2). The initial validation of the SCQ emphasized the importance of school engagement as a component of overall school connectedness because it was conceptualized as an application of behaviors that are consistent with a student’s overall commitment to their school (Marsh & Randolph, 2020). Essentially, the subscale of school engagement for the SCQ was used as support of a student’s level of school connectedness. It was suggested that feeling secure, supported, and connected in their school would promote students’ engagement. However, as an individual measure it does not appear to reflect the main concepts associated with a student’s connectedness (i.e., feeling as though teachers and students care about their well-being). As such, it would be inaccurate to use this subscale as a general measure of a student’s level of connectedness. Instead, this subscale should be conceptualized as a separate measure of engagement which assesses for more general engagement behaviors.

A careful review of the items revealed that the school engagement subscale maps on closely to similar concepts of engagement while still evaluating separate behaviors from the behavioral engagement subscale. In essence, the behavioral engagement items from the MSES addressed specific activities or behaviors that show they are engaged such as contributing in class, asking questions, putting forth best effort, and getting involved with school activities. On the other hand, the school engagement subscale of the SCQ included more general items related
to engagement such as school attendance and completing homework and classwork. It was determined that the items for these subscales addressed unique aspects of engagement. For example, if a student comes to school every day (measured by school engagement) that does not necessarily mean that they will always try their best (measured by behavioral engagement). Similarly, if a student is involved with school activities (measured by behavioral engagement), that does not mean that they will do their homework (measured by school engagement). It was determined based on correlations from this study, the extant literature, and the review of the items, that both subscales could play an important role in academics and assessed unique aspects of the overall concept of engagement and were therefore included in the models. In line with this decision, SRL correlated positively with the school engagement and behavioral engagement subscales, which is consistent with prior literature supporting the importance of both SRL and aspects of engagement (Cleary et al., 2020; Garrels & Palmer, 2019; Boekarts, 1997; Cleary & Zimmerman, 2004; Connel & Wellborn, 1991; Dennie et al., 2019).

Two path analysis models were used to examine how the variables of interest work together to support a student’s achievement across math and science. In the first model, SRL was examined as a mediator in the relation between the two engagement variables and academic outcomes. A comparison model depicting behavioral and school engagement as mediators between SRL and the academic outcomes was also assessed. In the SRL mediation model, both behavioral engagement and school engagement contributed directly to self-regulated learning. Essentially, this indicates that the skills associated with school engagement and behavioral engagement help to facilitate the student’s self-regulated learning skills. The reciprocal relations were also found to be relevant. When the models were reversed and the two engagement variables were used as mediators, both factors were found to directly contribute to self-regulated
learning. This indicates that these three factors work together and contribute to one another in a way that benefits students in the classroom. These results are consistent with the current literature which indicates the benefits of supporting an engaged environment to foster students’ self-regulated learning skills (Deci & Ryan, 1985, 2008; Ryan & Deci, 2000). To support a student’s success, it may be beneficial to provide ample opportunities for both school and behavioral engagement and to provide students with an environment in which they can be engaged and build up their self-regulation skills. Across both models, school engagement and behavioral engagement were allowed to covary; however, this relation was only significant within the SRL mediation model. After taking into account the contributions of SRL in the engagement mediation model, the positive association between the two engagement variables dissipated. To my knowledge, this is the first study that has evaluated the relation between these two engagement variables, however prior literature has indicated the association between SRL and engagement more broadly (Adams et al., 2015).

When evaluating the math and science outcomes across both models, the only variable that made a significant, direct contribution to GPA was school engagement. Within each model that was examined, it is important to note that the trends were consistent across math and science. The only apparent difference was that a larger percentage of the variance was explained by these models for science than math (i.e., 28% and 17%, respectively). Previous literature has supported the importance of engagement as it relates to achievement (Connel & Wellborn, 1991; Dennie et al., 2019). This study sought to expand on current literature and hypothesized that SRL would play a mediation role for both school and behavioral engagement, however the data did not support this relation. SRL was not identified as a mediator and did not play a direct role in promoting achievement for either math or science. This directly contradicts much of the current
literature on the role of SRL and achievement (Hong et al., 2021; Wong et al., 2021; Cleary et al., 2020; Garrels & Palmer, 2019; Boekarts, 1997; Cleary & Zimmerman, 2004). This contradiction may be due to the time at which data was collected. Initial survey data was collected at the end of the first semester (December) after returning to in person instruction following a year and a half of virtual learning due to covid, while the GPA data was collected at the end of the year (May). Although this data collection method allowed this study to establish temporal precedence and make some causational inferences regarding this data, it may indicate that the effects of SRL may not apply across a more longitudinal time frame. Previous studies that have found a connection between SRL and achievement have generally examined concurrent relations. This study had approximately a six-month period between survey data and GPA scores, and this time lapse could explain the lack of relation between SRL and GPA. Future studies should collect data at multiple time points as a way to assess the importance of time when relating to these factors.

Although both models were found to have adequate fit, the engagement mediation model demonstrated superior fit based on the AIC and BIC indices and may carry more weight. In this model, it is notable that SRL was found to contribute indirectly to science and math GPA through its influence on school engagement. This is consistent with other findings within the engagement literature (Adams et al., 2015) and indicates the importance of supporting student’s engagement and providing opportunities for them to become more engaged with their school in addition to supporting their skills in self-regulated learning. Although there was no direct contribution from SRL to achievement, the indirect relation indicates that SRL has a part to play as it relates to achievement. Specifically, the mechanism of SRL may be most beneficial when paired with school engagement skills.
In contrast, behavioral engagement was not found to have a direct or indirect effect on science or math GPA and did not act as a mediator for any of the models. This finding was surprising given that the literature has generally indicated behavioral engagement as correlated with academic outcomes (Li et al., 2010). It is possible that these results are due to the proximity of the data collection (3 months) to students return to in-person schooling following the Covid pandemic-required virtual instruction. Students may not have had enough time to reacclimate to the school environment and to recover from various pandemic-related stressors, which could have impacted aspects of engagement (i.e., contributing in class, asking questions). Given more time, it is possible that a relation may have emerged. It should be noted that behavioral and school engagement should be viewed as aspects of engagement, with school engagement referring to somewhat less advanced aspects of engaged behaviors. The aspects of engagement that are encompassed by school engagement in this measure address basic behaviors such as completing work and coming to school, while behavioral engagement includes behaviors that are more complex such as being involved in school activities and asking questions in class. These findings may indicate that a more basic level of engagement plays more of a role in a person’s achievement as opposed to more complex or nuanced behaviors.

**Practical and Theoretical Implications**

This study resulted in important implications for practices within the school setting. As stated previously, engagement, connectedness, and SRL have been identified as important components of a student’s education (Cockerill, 2019; Bond et al., 2007; Ryan & Patrick, 2001; Farrington et al., 2012; Shin & Ryan, 2012; Wang et al., 2018; Wang et al., 2019; Cleary et al., 2020; Garrels & Palmer, 1997; Cleary & Zimmerman, 2004). This study shed light on how these factors overlap and work together to support a student’s academic
achievement across subject areas. School engagement was found to be a primary factor in success in both math and science, indicating the importance of school attendance and completion of schoolwork in building up academic skills. In general, this study indicates the importance of supporting and building these factors within the classroom. Specifically, building an environment in which students can practice these basic skills of school engagement by having an opportunity to participate in class, ask questions, etc. will help students attain greater success in the subject areas of math and science as well as help develop skills related to self-regulated learning.

The (short-term) longitudinal design of this study makes it unique in the SRL literature. While most studies in this field collect self-report data concurrently with academic outcomes, this study collected surveys in December of 2021 and end of year outcomes in May of 2022. This allows us to make some assumptions regarding the predictive nature of these results. The current study found that a student’s level of school engagement at the end of the fall semester played both a direct and indirect role in their achievement in both math and science. This points to the importance of fostering an engaging environment throughout the school year to encourage strong academic outcomes at the end of the year.

In addition to examining the importance of SRL, school engagement, and behavioral engagement, this study also identified important gaps in the theoretical conceptualization of these factors. Although the multifactor model of engagement has been used frequently in the current literature (Bae & Debusk Lane, 2018; Lei et al., 2018; Skinner et al., 2008; Wang et al., 2010; Linnenbrink-Garcia et al., 2011; Wang et al., 2010; Wang et al., 2019), this study identified ways in which this model may be problematic. Within this study, behavioral engagement was the only dimension measured by MSES that correlated with an academic
outcome (science). This was consistent with other literature supporting the importance of behavioral engagement (Li et al., 2010); however, it also indicated conceptual issues surrounding this definition of engagement. The multifaceted model of engagement may not accurately represent the overall construct of engagement. The conceptual overlap between factors of engagement as well as other constructs such as school connectedness, and the current lack of consensus in the literature on what model of engagement may be most accurate resulted in a construct that is very difficult to measure. As it pertains to this study, although the behavioral engagement subscale was deemed to be an adequate measure of engagement, the fact that full scale scores could not be used may mean that some of the importance of engagement was missed due to issues with the measures.

There is a lack of well-studied and validated measures related to school connectedness (Marsh & Randolph, 2020), and based on the results of this study it seems as though the SCQ may have significant issues with its definition of school connectedness. There may be significant conceptual flaws with the definition of school connectedness, not only within this measure but across measures. In fact, many studies citing the importance of school connectedness did not use a validated measure, instead piecing their own unique measures together using various surveys or pieces of validated measures (McNeely & Falci, 2004; Lensch et al., 2020; Moritz Rudasill et al., 2013). Although the definition of school connectedness seems largely universal (to what extent a student believes that the adults in a school care about their learning as well as them as individuals [CDC, 2009]), the tools to measure it have varied significantly. This lack of consistent measurement can create significant challenges in trying to determine the role of school connectedness and may prevent high quality research from being conducted. In order to really
understand the role of school connectedness, it will be vitally important to determine an appropriate and accurate measure of the construct.

**Limitations & Future Directions**

Results from this study must be considered in light of several limitations. Although an initial sample size of 149 was collected, due to outliers and improper ID coding the final sample was 128. This sample size was found to be acceptable for the current project, but to increase confidence in these results and increase generalizability further studies should prepare to collect data on a broader scale. The available sample size prevented this study from assessing potential factors such as race, gender, and grade, which served instead as covariates. Gender and grade were found to have a significant relation to science GPA and should be considered in future studies. Additionally, due to the lack of SES data available within this data set, we were unable to assess the role that financial status may have played within this sample. This is an important area of research and should be considered in future studies. The importance of school connectedness and the role that it plays in achievement deserves far more attention than it has received both in this study and in prior literature. Specifically, the measure used in this study may not have been a valid measure of the construct of school connectedness. As such, important implications of school connectedness may have been missed due to the selection of an inappropriate measure. Further validation studies of short measures of school connectedness are necessary as well as more studies evaluating the role of school connectedness as related to academics. Moving forward, a potential avenue for further research would be to conduct a factor analysis using the items from these measures to determine construct overlap. The impact of the temporal proximity to the Covid pandemic on these results is not known. Survey data was collected in December of 2021, meaning that it was collected at the end of the first semester back
in person for these students. Students had been participating in virtual learning since March of 2020 and therefore there may not have been adequate time for the students to adjust to in-person instruction. So, while this study provides insight into the ways these variables worked together during this very unique and important point in history, its generalizability is limited due to this potential confound.
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Table 1

Descriptive Statistics

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<th>Standard Deviation</th>
<th>Skewness</th>
<th>Kurtosis</th>
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<td>0.52</td>
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<td>1-6</td>
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<td>0.56</td>
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Table 2

Correlations among the Variables

Note. *p < .01 ** p < .001

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<td>.19*</td>
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<td>.62**</td>
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<td>.72**</td>
<td>.66**</td>
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<td>12. School Connectedness</td>
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Figure 1

SRL Mediator Model: Science

Note. Fit indices for this model are as follows: $\chi^2 (9, N = 128) = 8.50, p = .48$, RMSEA (90% CI) = .00 (.00–.10), SRMR = .05, CFI = 1.00, TLI = 1.01, AIC = 800.50, BIC = 848.99. Dashed lines indicate indirect effects, while solid lines indicate direct effects.

*p < .05
Figure 2
SRL Mediator Model: Math
Note. Fit indices for this model are as follows: $\chi^2 (9, N = 128) = 8.50$, $p = .48$, RMSEA (90% CI) = .00 (.00–.10), SRMR = .05, CFI = 1.00, TLI = 1.01, AIC = 777.400, BIC = 825.88. Dashed lines indicate indirect effects, while solid lines indicate direct effects.
*p < .05
Figure 3
Engagement Mediator Model: Science
Note. Fit indices for this model are as follows: $\chi^2 (6, N = 128) = 8.35, p = .21$, RMSEA (90% CI) = .06 (.00–.14), SRMR = .04, CLI = .98, TLI = .96, AIC = 476.64, BIC = 519.42. Dashed lines indicate indirect effects, while solid lines indicate direct effects.
**Figure 4**

*Engagement Mediator Model: Math*

*Note.* Fit indices for this model are as follows: $\chi^2 (6, N = 128) = 8.35, p = .21$, RMSEA (90% CI) = .06 (.00–.14), SRMR = .05, CLI = .98, TLI = .95, AIC = 453.54, BIC = 496.32. Dashed lines indicate indirect effects, while solid lines indicate direct effects.

*p < .05*
Appendix

The Self-Efficacy for Self-Regulated Learning Scale (Usher & Pajares, 2008)

Please respond to the following items by reading each statement and then selecting on the response that best describes you on a Likert Scale (i.e., 1= Not well at all; 2 = Typically not well 3 = Somewhat not well; 4 = Somewhat well; 5 = Typically well; 6= Very Well ). There are no right or wrong answers, so please be honest.

1) How well can you finish your homework on time?
2) How well can you study when there are other interesting things to do?
3) How well can you concentrate on your school work?
4) How well can you remember information presented in class and in your school books?
5) How well can you arrange a place to study at home where you won’t get distracted?
6) How well can you motivate yourself to do schoolwork?
7) How well can you participate in class discussions?

Multidimensional School Engagement Scale (Wang et al., 2019)

Please respond to the following items by reading each statement and then selecting on the response that best describes you on a scale of 1= Not at All like me and 5= Very Much Like Me. There are no right or wrong answers, so please be honest.

1) I always try my best in school (Beh)
2) I contribute to what we are doing in class (Beh)
3) I asked questions when I don’t understand. (Beh)
4) I get involved in school activities (e.g., clubs, sports, school events). (Beh)
5) I plan out how to finish my schoolwork. (Cog)
6) I look over my schoolwork and make sure it is done well. (Cog)
7) I keep trying even when I get stuck on my schoolwork. (Cog)
8) I work hard in the face of challenges/difficulties at school. (Cog)
9) I figure out what I did wrong when I make mistakes on my schoolwork. (Cog)
10) Doing well in school is important to my future. (Emo)
11) I have fun at school. (Emo)
12) I am happy at school. (Emo)
13) I am proud of my school. (Emo)
14) I am interested in what we are learning at school. (Emo)
15) I help my peers when they are struggling. (Soc)
16) I enjoy working with peers at school. (Soc)
17) I work with other students and we learn from each other. (Soc)
18) I am open to making new friends at school. (Soc)
19) I enjoy spending time with peers at school. (Soc)

School Connectedness Questionnaire (SCQ; Marsh & Randolph, 2020)
Please respond to the following items by reading each statement and then selecting on the response that best describes you on a Likert Scale (i.e., 1= True, 2=Somewhat True, 3=Not True at All). There are no right or wrong answers, so please be honest.

1) People are happy when I come to school (Peer)
2) I have a friend at school (Peer)
3) I have more than one friend at school (Peer)
4) My friends are happy when I’m at school (Peer)
5) I like my teachers (Teach)
6) My teacher helps me (Teach)
7) If I have a problem, my teacher helps me (Teach)
8) I do my classwork (Engage)
9) I do my homework (Engage)
10) I come to school every day (Engage)