Impact of a School-Based Universal Mental Health Education Intervention for Adolescents

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ABSTRACT

The primary purpose of this research study was to evaluate the efficacy of BASE, a self-paced online mental health education preventive intervention with middle school students. Two hundred ninety-five adolescent students were randomly assigned to receive BASE modules (n = 156) in a regular education classroom setting over a 5-week period or to a wait-list control (CO) group (n = 139). Change in student- and teacher-report outcome measures was investigated. Students in the BASE condition showed significant gains in mental health knowledge and teacher-reported school engagement over the intervention period whereas CO students showed declines in these areas. In addition, students who spent more time engaged in the BASE intervention modules showed significantly greater gains in BASE mental health knowledge. Because our study sample included a large percentage of Hispanic students (44%), we were able to conduct follow-up analyses to test for differential intervention effects by demographic sub-groups. Findings revealed use of the BASE modules were particularly positively impactful for Hispanic students, including positive changes in self-reported self-efficacy and school engagement as well as life skills over the intervention period compared to Hispanic students in the CO group. Discussion focuses on the potential for digital universal mental health intervention in schools. Tables and figures are appended.

Introduction

In recent years there has been a notable increase in adolescent mental health issues, including anxiety and depression (Mojtabai & Olfson, 2020). A report by The Pew Research Center found a 59% increase from 2007-2017 in the number of U.S. teenagers experiencing depression (Geiger & Davis, 2019). It's further estimated that 3.6% of 10–14-year-olds and 4.6% of 15-19-year-olds suffer from an anxiety disorder while 1.1% of 10-14-year-olds and 2.8% of 15-19-year-olds are affected by depression (World Health Organization, 2021). This suggests that the prevalence of these disorders increases as youth enter late adolescence, pointing to a need for early intervention.

Adolescents who experience depression, anxiety, and other psychological disorders perform poorer in class compared to students without these disorders (Hishinuma, Chang, McArdle, & Hamagami, 2012; Weidman, Augustine, Murayama, & Elliot, 2015). Depressed and anxious students are also more likely to be absent, take semesters off, and drop out of school. When students exit school prematurely due to social and emotional concerns, they are at significantly elevated risk for escalating mental health problems (Bond et al., 2007; Esch et al., 2014) as well as real-world negative outcomes, such as delinquency, criminality, substance abuse, and lower employment (Henry et al., 2012; Li & Lerner, 2011). While school systems cannot meet every mental health need of their students, schools are the primary mental health service setting in the United States (Rones & Hoagwood, 2000) and addressing students' mental health needs has direct positive impacts on academic achievement and learning, the primary goal of schools (Carnegie Council Task Force on Education of Young Adolescents, 1989). By promoting an environment of wellness, schools support students' success socially, emotionally, and academically (Townsend et al., 2017). Research has shown that students who receive social

emotional learning (SEL) and mental health prevention services achieve higher academic success (Tomyn, Fuller-Tyszkiewicz, Richardson, & Colla, 2016). By enhancing a culture which attends to the mental health and emotional wellness of its students, schools can significantly impact students' quality of life, retain students who might be at risk for dropping out, and decrease the likelihood of students' developing future mental health and behavioral problems (Durlak et al., 2011; Guerra & Bradshaw, 2008; Zins & Elias, 2006; Zins, Weissberg, Wang, & Walberg, 2004).

The majority of schools in the U.S. provide some level of onsite mental health services through school-based professionals (such as school counselors, social workers, and psychologists) and approximately 8% of public schools have onsite mental health service clinics (Parasuraman, 2014). However, adolescents' mental health needs are substantially greater than these resources can address (Masia-Warner, Nangle, & Hansen, 2006; Merikangas, Nakagura, & Kessler, 2009; CDC, 2018; Merikangas et al., 2011). As a result, mental health services are typically directed to those in greatest (and obvious) need, with little attention given to potentially high impact preventive interventions to address adolescent mental health needs more generally and before they become serious or long-standing.

Technology offers the potential for increasing the availability of mental health preventive resources . Furthermore, the use of digital learning tools in schools is now commonplace. For example, a pre-pandemic Gallup survey of teachers nationwide found 65% of teachers reported *daily* use of digital learning tools with their students and 85% supported increased use of technology in the classroom (Marken & Clayton, 2019). More recently, the integration of technology in the classroom has accelerated with educators finding a need for virtual classrooms such as Google Classroom which saw a jump from 40 million to 150 million

users in the beginning of the pandemic (Herold, 2022). Unfortunately, the research on use of technology-based mental health resources in schools for promoting adolescent mental health is sorely lacking. The primary purpose of this research study is to evaluate the efficacy of BASE, an online universal mental health education intervention for adolescents.

Universal Mental Health Education Intervention

The BASE mental health education intervention was created by mental health specialists to provide factual information regarding social emotional health issues commonly faced by middle and high school students. Based on more than 25 years of hands-on work with high-risk adolescents and their families, BASE Education developed a library of self-paced online learning modules designed to promote factual understanding, positive attitudes, and adaptive practices regarding more than 80 instructional topic areas including, among others: Self-Esteem, Anger Management, Restorative Practices, Healthy Communication, and Impulsive Decision-Making. In addition to teaching mental health facts, each module implements a series of self-reflection questions to help adolescents apply the concepts to their own lives, identify potential challenges they face in that area, and gain greater understanding of their own cognitive or behavioral patterns. Thus, BASE is intended as a psycho-educational resource to impart factual knowledge and to generalize that knowledge to daily life.

The BASE software is available for online access and use by schools and mental health systems to help address the mental health needs of adolescents and prevent escalation of mental health issues. School administrators and mental health interventionists can select from a library of modules, as needed, to address specific issues faced by the adolescents they serve. Each module is designed to take between 30 and 45 minutes to complete, so assigned modules can be completed within a regular education class period (e.g., health, advisory, and homeroom

classes). The software is also accessible outside of school through secure login to the online student portal, so modules can be assigned as homework or as part of an out-of-school program.

This research study constitutes the first school-based trial to evaluate the efficacy of BASE Education's online learning program for improving students' social, emotional, and behavioral functioning at school. For the purposes of this study, we selected a subset of *five generally applicable* online learning modules (see Table 1) and tested changes over time as a function of intervention delivery in the classroom setting with middle school students (grades 6 through 8). This pilot test of BASE was conducted using a universal classroom-based study design, through which homeroom and academic advisory classroom teachers administered the BASE online learning modules with their students over the course of five weeks.

Methods

Participants

School districts were recruited nationally by BASE Education through email distribution of study information. Of those districts that expressed interest, two provided a signed letter of commitment by the given deadline: one in Missouri and one in Colorado. Once IRB approval was obtained, district-established guidelines for research were followed (e.g., review by district-level personnel), including research materials compliant with district requirements. Following district-level approval, school district personnel distributed information describing the BASE Education project and requirements to eligible middle school teachers (i.e., homeroom and academic advisory teachers of 6^{th} – 8^{th} grade students).

Educator Sample. Middle school teachers in the two participating schools received detailed information via email describing the study goals and consent procedures including a link to a secure online educator consent form and demographic survey. A total of 22 educators

participated in the study (10 at School 1 and 12 at School 2). Of the participating teachers, 35% taught 6th grade, 27% taught 7th grade, 24% taught 8th grade, with 14% teaching a combined 7th/8th grade classroom. The majority of teachers (55%) had 3-5 years of teaching experience with 23% having taught only 1-2 years and 13% having taught 11 or more years. The average age of teachers was 32 years (SD = 9.69; range from 22 to 62 years of age). Participating teachers were 41% male and represented an approximate demographic spread of 27% African American or Black, 73% Caucasian or White, with 100% reported non-Hispanic ethnicity.

Student Sample. Participating educators distributed parent permission materials to all students in their classrooms. Teachers sent paper packets home with students and/or emailed an online survey link to parents (as determined by school administrators) to share study details, project contact information, and parent permission forms. Parents were given 2 weeks to return the permission forms indicating whether or not they wanted their child to participate in the pilot test. Of the total pool of students across the 22 participating classrooms, parent permission for participation in the research was obtained for 368 youth (approximately 69% of the total student population across these classrooms) and, of these students with parental permission, 304 youth assented (83%) to participate in the research project.

Attrition. Over the course of the research study, 9 students (3%) transferred schools and dropped out of the study. Chi-square analyses revealed no significant differences by demographic characteristics for those students who remained in the sample versus those who dropped out. Further, a Multivariate Analysis of Variance (MANOVA) revealed no significant differences across these groups for outcome measures at baseline (pre-intervention). Therefore, the final sample included 295 middle school students who completed the research study. Table 2 summarizes the demographic characteristics of the student sample. Across our two schools, 43%

of students attended School 1 and 57% of students attended School 2. Of the participating youth, 33.2% were in 6th grade, 29.2% were in 7th grade, and 35.9% were in 8th grade with an average age of 12.63 (SD = 0.67) and ranging from 12 to 17 years of age. The youth sample was 51.2% female with an approximate racial distribution of 44.7% African American or Black, 2% Caucasian or White, 4.7% Asian or Pacific Islander, and 45.4% Other racial subgroup (e.g., multiracial, American Indian, unknown). Nearly half of the student sample (43.5%) reported Hispanic ethnicity.

Sample by Condition. Assignment to condition occurred at the classroom-level to ensure students within a participating classroom were consistently assigned to a single study condition (to minimize contamination effects within classroom). Given recruitment of classrooms occurred on a rolling basis over several weeks, classrooms were randomly assigned to the BASE intervention condition (BASE) or to the waitlist control condition (CO) as they entered into the study. In the end, 11 classrooms were assigned to each condition with a total of 156 students (59.2%) assigned to BASE and 139 students (47.1%) assigned to CO. Chi-square analyses revealed no significant gender, race, ethnicity, or school differences across the BASE and CO conditions.

Randomization at the classroom level resulted in more 8th grade students being assigned to the BASE condition (N_{8th} = 67, 43.8%) compared to 6th and 7th grade students (N_{6th} = 48, 31.4%; N_{7th} = 38, 24.8%; $X^2(2) = 7.74$, $p<.05$). This incongruence may have occurred because several classrooms in our sample included students from multiple grade level.

Procedures

Precautions were taken to ensure study ethics and protection of human subjects. The study protocol was approved by 3C Institute's institutional review board (IRB) as well as

research officials at each participating school district. Parent consent and youth assent were obtained from all participants prior to participation. All parts of the study were completed online through a secure project website.

Training. Prior to study implementation, all participating teachers attended an informational session (90-minute online webinar for each school). During this session, BASE Education staff trained teachers and other school personnel in use of the BASE Education program, including the implementation schedule and oversight procedures for the pilot study. Then, 3C Institute research staff shared information regarding data collection procedures with expected time requirements and deadlines for study tasks. Procedures for ensuring security of the collected data were also reviewed.

Data Collection. Following consenting and condition assignment, teachers and students completed a set of online surveys prior to beginning the intervention period (i.e., baseline). The baseline survey included several demographic questions (for students) and a set of outcome surveys. Participating teachers and students were given 4 weeks to complete the baseline assessment. Then, during the 4 weeks following the intervention period, teachers and students completed post-intervention surveys, using the same set of outcome measures and data collection procedures.

Intervention. Teachers and students in the BASE condition completed five online learning modules (Self Esteem, Digital Citizenship, Bullying/Cyber Bullying, Motivation, and Future Goals) as part of their regular classroom activities whereas CO teachers and students completed typical classroom activities with no access to the online learning modules. Table 1 provides a listing of the order of BASE modules completed during each week of the intervention along with specific topics covered within each module. Completion time for

students was expected to be between 30 to 45 minutes per week. Research staff emailed secure login information to teachers assigned to the BASE condition who then distributed these to each of their students so they could access and complete the program.

It is important to note that all students in the treatment classrooms completed the BASE program, but study data was collected and analyzed only for those students with parental consent and student assent to participate in the research. During the intervention period, students completed five BASE modules over a 5-week intervention period (one per week). At the start of each week, research staff emailed BASE teachers with a study timeline update and descriptions of their activities for that week. At the end of each week, research staff emailed the BASE teachers an update of their students' progress in the assigned module(s). At the end of the study period, all classrooms (BASE and CO) had open access to the online BASE modules.

Measures

Teacher Measures. Following consenting procedures, teachers completed a brief demographics questionnaire regarding their own age, gender, race, ethnicity, level of education, vocational information, and classroom grade level(s). At both baseline and post-assessment, teachers completed an online survey assessing their students' current level of school-based adjustment using a modified version of the *Engagement vs. Disaffection for Learning Scale* (EvsD; Wellborn, 1991; Skinner, Kindermann, & Furrer, 2009). The EvsD includes 20 items on which teachers rated each participating student on a 4-point scale (1=Not at All True to 4=Very True) to indicate how true that item is currently (within past 2 weeks). For this study, items were adapted to be more generally applicable to middle school teacher observations of students regarding overall school engagement. This measure includes two broadband scales of *Engagement* and *Disaffection* which are further subdivided as behavioral or emotional resulting

in four subscales (5 items each): Behavioral Engagement (e.g., '*This student works as hard as he/she can*'), Emotional Engagement (e.g., '*This student is enthusiastic*'), Behavioral Disaffection (e.g., '*This student comes unprepared to school*'), and Emotional Disaffection ('*In school, this student seems unhappy*'). Mean scores were generated for each subscale where higher scores indicated higher engagement and higher disaffection, respectively, as well as a composite score for the entire scale. The entire scale showed high internal consistency with an alpha of .97 both pre and post. Each subscale also showed high internal consistency with Cronbach alphas ranging from .80 for Emotional Disaffection to .96 for Behavioral Engagement.

Student Measures. At baseline, students reported basic demographic information, including age, grade, gender, race, and ethnicity. At both baseline and post-assessment, students completed a set of eight brief online surveys assessing their school-based and personal adjustment at school (i.e., student self-perception measures), as well as their knowledge of content covered in the assigned BASE modules. These outcome measures were chosen to reflect those attributes and skills expected to be impacted by participation in the BASE intervention. The following areas were assessed using the indicated measure(s) at pre- and post-intervention assessment periods.

School Emotional Engagement (SEE): Students were asked to complete the *School Emotional Engagement Scale* (Wang, Willett, & Eccles, 2011) to assess their feelings of interest in, enjoyment with, and value of school learning. Consisting of 5 items, rated on a 5 point Likert scale (1=Strongly Disagree to 5=Strongly Agree), higher scores indicates higher levels of emotional engagement in school (e.g., '*I feel close to people in this school*). This scale demonstrated high internal consistency at baseline and post-intervention assessments

(Cronbach's α = .81 and .87, respectively).

Future Aspirations (FA): Students completed the 5-item Future Aspirations/Goals subscale of the *Student Engagement Instrument* (Appleton, Christenson, Kim, & Reschly, 2006) to assess cognitive and psychological aspects of student engagement in school as it relates to their future success (e.g., '*School is important for achieving my goals*). Items were rated on a 4-point Likert scale ranging from Strongly Disagree (1) to Strongly Agree (5). This subscale showed high internal consistency at baseline and post-intervention (α = .85 and .89, respectively).

Academic Motivation (AM): Students completed the 4-item Intrinsic Motivation toward Accomplishment subscale of the *Academic Motivation Scale* (Vallerand, Pelletier, Blais, Briere, Senecal, & Vallieres, 1992). Items were rated on a 7-point scale (1=Does not correspond at all to 7=Corresponds exactly), with higher scores indicating higher levels of intrinsic academic motivation (e.g., '*In school, it makes me happy when I do better than I thought I could*'). Items were adapted to be more developmentally appropriate for middle student participants. High internal consistency for this subscale was found at baseline and post-intervention (Cronbach's α = .84 and .85, respectively).

School social connectedness (SSC): Students completed the *Loneliness and Social Dissatisfaction* measure to assess their level of social connectedness at school (Asher, Hymel, & Renshaw, 1984). To reduce participant burden, students were asked to complete the 9 negatively worded items (as recommended by Ebesutani et al., 2012) (e.g., '*I feel alone at school*'). For each item, students indicated how true that item was for them on a 5-point scale from Always True (1) to Not True at All (5). A mean score was calculated so that higher scores indicated greater school social connectedness. High internal consistency was found for this scale at

baseline and post-intervention (α = .88 and .89, respectively).

Self-Efficacy (SE): Students completed a self-report measure of their self-efficacy using the *New General Self Efficacy Scale* (NGSES; Chen, Gully, & Eden, 2001). The NGSES was developed to address the need for a general self-efficacy measure with both divergent and predictive validity. It is comprised of 8 items, each rated on a 5-point scale (1=Strongly Disagree to 5=Strongly Agree), with higher scores indicating a greater sense of self-efficacy (e.g., Adolescent mental health intervention 10 '*In general, I think that I can obtain outcomes that are important to me*'). This scale demonstrated excellent internal consistency at baseline and post-intervention (α = .90 and .92, respectively).

School-based adjustment: To assess students' behaviors and social-emotional adjustment at school, students completed two subscales of the *My Resiliency Factors* (MRF; DeRosier & Raab, 2011; DeRosier, Craig, & Leary, 2012). The MRF is a brief behavioral self-assessment tool designed to measure psychological and social factors that contribute to adolescents' ability to handle daily life stressors, such as positive attitudes and emotion regulation. Two subscales were completed by students: Cognitive Style (**CS**; 6 items; e.g., '*When bad things happen, I know things will get better*', '*I'm able to set realistic goals for myself*') and Life Skills (**LS**; 8 items; '*I'm flexible and able to adapt to changes*', '*I can control my emotions and behavior even when upset*'). Items were rated on a 4-point scale (1=Not at All/Never True About Me to 4=Very/Almost Always True About Me). Both of these subscales showed high internal consistency at baseline and post-intervention (Cognitive style: α = .82 and .84, respectively; Life skills: α = .80 and .81, respectively).

Student knowledge of BASE module content (KNOW): Research staff and BASE Education content experts created a set of 25 multiple-choice items (5 per module) to assess

student's knowledge of content areas and topics covered within the five BASE Education online learning modules: (1) Self-Esteem, (2) Digital Citizenship, (3) Bullying/Cyber Bullying, (4) Motivation, and (5) Future Goals. At each time point, the percent correct across items was calculated for each student (range of 0% to 100%).

Intervention Moderator. In addition to monitoring students' completion rate and fidelity to the intervention protocol, usage data was collected to investigate the possible moderating influence of dosage (i.e., the amount of intervention received by a student) on outcomes. Throughout the intervention period, data regarding the BASE students' use of the online learning modules was collected, including dates of login, which modules were accessed each week, the number of minutes spent completing each module, and the number of modules completed.

Results

Descriptive Analyses

All analyses were conducted using an intent-to-treat approach and did not exclude participants with low or no adherence to the program. Normality assumptions for each outcome variable were checked using Shapiro-Wilks tests which found that all of the variables violated the assumption, $p < .01$, however all of the test statistics (W) were greater than .8, with the exception of two variables which were greater than .7. This would suggest a less severe violation since larger values of W typically indicate no evidence of non-normality but the larger the sample sizes($n > 100$) the more sensitive the test is to detecting even the smallest deviations from normality (Razali & Wah, 2011). Linearity assumption was also detected and met, and the homogeneity of variance-covariance assumption was met based on the Box's test, $p > .001$.

Inter-correlations among Outcomes. We first conducted descriptive analyses to

examine means and standard deviations and the associations between variables. First, student self-report ratings were examined at baseline (pre) and post intervention time points. As seen in Table 3, student reports at the two time points were significantly correlated for all measures (i.e., within-measure across-time correlations along the diagonal). Thus, as would be expected, there was consistency over time regarding students' self-perceptions for each area assessed. At baseline, all self-perception measures were moderately correlated with one another indicating students who reported more positive self-perceptions on one measure were more likely to report positive self-perceptions on the other measures (across measure within-time correlations). This pattern of inter-correlations among self-perception outcomes was highly similar at each time point with a few exceptions. For example, student self-report regarding future aspirations and goals was statistically correlated with school emotional engagement (SEE) and school social connectedness (SSC) at baseline ($r_{SEE\_Pre} = .37$, $p < .01$; $r_{SCC\_Pre} = .15$, $p < .05$), but not at post-intervention ($r_{SEE\_Post} = .08$; $r_{SCC\_Post} = .03$). And SSC_Pre was more strongly correlated with SEE at post-intervention ($r = .65$, $p < .01$) than it was at pre-intervention ($r = .39$, $p < .01$). BASE content knowledge was not significantly related to any student self-perception measure at either time point.

Table 4 shows inter-correlations among teacher-report outcome measures at each time point. Again, there was significant consistency in ratings for each subscale at the two time points (i.e., within-measure across-time correlations along the diagonal). In other words, students who were rated highly by teachers at baseline tended to be rated highly on that subscale at the second time point as well and this held true for the composite scale as well. The pattern of correlations across subscales was very similar for the two time points and indicated strong consistency across measures. Thus, students who received high ratings on one subscale were

likely to be rated highly on the other teacher-report subscales as well. This association was particularly strong for the two engagement subscales, Behavioral Engagement (BE) and Emotional Engagement (EE). Correlation coefficients at each time points were greater than .80, which indicating these two subscales were largely redundant. Therefore, all subsequent analyses used the composite broadband scale for engagement rather than the two engagement subscales.

Third, we examined the degree to which student- and teacher-report measures were related to one another at each time point. As Table 5 shows, there tended to be low agreement between teacher and student ratings, which is consistent with the literature (Achenbach, McConaughy, & Howell, 1987; Renk & Phares, 2004; Gresham, Elliott, Cook, Vance, & Kettler, 2010).

Finally, whereas knowledge scores showed no significant correlations with students' self-perceptions (see Table 3), correlations between teacher ratings and students' scores on the knowledge test were significant at both time points and were the highest of any teacher-student correlations.

Differences at Baseline. Prior to investigating the impact of the BASE intervention for changes in student outcomes over time, we tested whether the two conditions (BASE vs. CO) differed on outcome measures at baseline and explored possible demographic differences. For each demographic variable (school, grade, gender, race, ethnicity), we conducted a Multivariate Analysis of Variance (MANOVA) with condition and demographic main effects as well as the two-way interaction (e.g., school by condition). There were no significant differences by condition (i.e., no significant multivariate main effect) for any outcome measure at pre-intervention. There were also no significant baseline main effects by school, race, or ethnicity. In other words, these groups were found to be statistically equivalent for each outcome measure

before the BASE intervention period. However, MANOVA test results at baseline indicated a multivariate main effect for grade, $F(8, 271) = 2.70$, $p < .01$, $\eta^2 = .074$. Post hoc univariate analyses adjusting Type I error and using Dunn-Bonferroni method found that 8th graders had higher BASE knowledge at pre-test. A significant multivariate main effect for gender $F(7, 276) = 2.72$ $p < .05$, $\eta^2 = .064$, was also found. However, post-hoc univariate analysis found that the difference was not between study conditions and instead, in the control group only, girls reported lower school social connectedness than boys ($M_{Girls} = 2.57$, $SE_{Girls} = .05$; $M_{Boys} = 2.71$, $SE_{Boys} = .05$).

Intervention Condition Analyses

We used Multivariate Analysis of Covariance (MANCOVA) to test for intervention effects. Given the baseline by grade across conditions, MANCOVA was chosen rather than change scores in order to decrease the likelihood of biased effect estimates of mean differences (Fu & Holmer, 2015; Rosenberger & Lachin, 2002). Univariate ANCOVAs were then investigated, followed by post-hoc mean comparison tests to determine the direction of effects across groups. For all analyses, Dunn-Bonferroni adjustment was applied to control Type I error inflation (Enders, 2003). Given use of MANCOVA, adjusted means (M) were reported after having controlled for baseline scores as a covariate.

Main effects. An initial MANCOVA evaluating whether student outcomes differed by condition (BASE vs. CO) after controlling for baseline scores was non-significant. Subsequent univariate ANCOVAs found that the condition main effect was statistically significant for student-report BASE knowledge, $F(1, 292) = 8.06$, $p < .01$, $\eta 2 = .027$. Post hoc analyses showed that students in the BASE condition ($M = 47.76$, $SE = 1.08$) demonstrated greater improvement in BASE knowledge over the intervention period than students in the control group ($M = 43.29$,

SE = 1.15).

Another MANCOVA was conducted to determine if the two subscales of the teacher-rating scale (student engagement and student disaffection) differed by condition. A significant multivariate main effect for condition was found for the teacher subscale measure of student engagement, $F(1, 290) = 7.10$, $p < .01$, $\eta^2 = .024$. Table 6 displays adjusted means, standard errors, univariate statistics, and effect sizes for all student and teacher outcomes. Similarly, teachers reported students in the BASE condition (*M* = 3.02, *SE* = .05) showed greater school engagement at post-intervention whereas CO students (*M* = 2.83, *SE* = .06) showed a decline in this area. An additional ANCOVA was conducted using the composite Engagement and Disaffection score as the outcome and this was also significant, $F(1, 291) = 4.67$, $p < .05$, $\eta^2 = .016$. Post hoc comparisons found that teachers reported that students in the BASE condition (*M* = 3.29, *SE* = .04) showed greater school engagement and less disaffection than students in the control condition (*M* = 3.16, *SE* = .04).[1]

Moderator effects. To examine whether the impact of condition on student outcomes differed by demographic characteristics, we conducted separate MANCOVAs by gender, grade, and race/ethnicity for both student report and teacher report outcomes. For race/ethnicity, we categorized students as Hispanic/White (n = 126), African-American (n = 123), or Other sub-group (n = 42; e.g., Asian American, American Indian, Pacific Islander, White non-Hispanic, multi-racial). In each MANCOVA, we included both main effects as well as the two-way interaction between condition and the demographic variable.

For student reports, a MANCOVA was performed with two factors: gender and condition by controlling pretest scores impact. The multivariate interaction between gender and condition

[1] These main effect findings remained consistent when we confirmed them in 2-level linear mixed models with students nested within classrooms, while controlling for baseline scores and including a random intercept and slope.

was not significant. Univariate ANCOVA assessed the impact of each gender level on the individual dependent variables. There were no statistically significant differences in post test scores by level of gender. However, the MANCOVA for grade and condition showed a statistically significant main effect for grade, $F(8, 261) = 2.59$, $p < .05$, $\eta^2 = .07$, but not at univariate level, potentially due to an interdependence of the dependent variables causing them to be collectively but not individually impacted by student grade level. Additionally, there was a significant multivariate interaction of condition by grade, $F(7, 263) = 2.47$, $p < .05$, $\eta^2 = .06$ on the student outcomes. Subsequent ANCOVAs found a statistically significant univariate interaction between grade and condition on SEE (School Emotional Engagement), $F(2, 249) = 5.02$, $p < .007$, $\eta^2 = .039$. Specifically, for students in 6th grade only, the BASE intervention group ($M_{BASE} = 2.80$, $SE_{BASE} = .07$) demonstrated significantly greater interest in school emotional engagement than those students who were in the control group ($M_{CO} = 2.59$, $SE_{CO} = .07$) at the second time point (see figure 1).

Moreover, the race/ethnicity by condition interaction effect was significantly present at the multivariate level for student-report, $F(8,261) = 3.27$, $p < .001$, $\eta^2 = .09$. Univariate analysis and post hoc mean comparisons indicated a significant interaction for SEE, $F(2, 249) = 5.12$, $p < .01$, $\eta^2 = .04$; self-efficacy, $F(2, 250) = 3.77$, $p < .05$, $\eta^2 = .05$; life skills, $F(2, 282) = 7.17$, $p < .001$, $\eta^2 = .048$; and cognitive style, $F(2, 282) = 4.45$, $p < .05$, $\eta^2 = .031$. Table 7 displays adjusted means, standard errors, and effect sizes by condition for Hispanic students' self-perception outcomes. In all instances, Hispanic students in the BASE condition showed significant improvements in their self-perceptions whereas Hispanic students in the control condition showed declines in these areas over the study period (see figure 2). Therefore, the impact of the BASE intervention was particularly strong for

increasing Hispanic students' emotional engagement in school and life skills (e.g., emotion regulation, flexibility).

For teacher reports, the MANCOVA was also performed with two factors: gender and condition. There was a statistically significant main effect for condition, $F(2, 277) = 3.17$, $p < .05$, $\eta^2 = .022$, but not for gender effect or the gender by condition interaction. Following the same steps as analyzing student reports, univariate ANCOVAs were used to detect the impact of each condition group on the individual dependent variables controlling for pretest teacher-report scores. There was a main effect of condition on the composite Engagement vs. Disaffection score, $F(1, 279) = 4.34$, $p < .05$, $\eta^2 = .015$, with higher scores at time 2 for the students in the BASE group ($M = 3.29$, $SE = .04$) than those students who did not receive BASE courses ($M = 3.16$, $SE = .04$), as well as for life skills, $F(1, 279) = 5.88$, $p < .05$, $\eta^2 = .021$, once again with higher scores for the BASE group ($M = 3.01$, $SE = .05$) than the control group ($M = 2.83$, $SE = .06$). An additional MANCOVA for two factors, grade and condition, was performed. The results showed a significant grade by condition interaction, $F(2, 277) = 3.24$, $p < .05$, $\eta^2 = .023$. Univariate analyses found a significant interaction of grade by condition on the composite score, $F(2, 278) = 3.63$, $p < .05$, $\eta^2 = .025$, as well as the student engagement subscale $F(2, 277) = 3.25$, $p < .05$, $\eta^2 = .023$. Post hoc analyses found that 8th grade students in the BASE group ($M = 3.38$, $SE = .06$) had higher composite scores at time 2 than 8th graders in the control group ($M = 3.02$, $SE = .08$; see figure 3), and 8th graders in the BASE group ($M = 3.11$, $SE = .08$) had higher engagement ratings than 8th graders in the control group ($M = 2.67$, $SE = .010$; see figure 4).

Another MANCOVA for race/ethnicity was performed for the teacher-reported subscales, which showed a significant race/ethnicity effect, $F(2, 278) = 16.36$, $p < .001$, $\eta^2 =$

.105. Univariate ANCOVA results and post hoc mean comparisons indicated a statistically significant difference occurred only in student engagement for Hispanic/White students, $F(2, 279) = 10.10$, $p < .001$, $\eta^2 = .067$, with Hispanic/White students in the BASE condition ($M = 3.15$, $SE = .08$) having higher engagement ratings than Hispanic/White students in the control group ($M = 2.84$, $SE = .09$) at post-intervention (see figure 2). African American students and students in Other sub-groups showed no significant difference in outcomes between control and intervention groups.

Intervention Dosage Analyses

Given implementation of the BASE intervention was largely self-paced and self-directed by the students themselves, there was variation regarding the amount (or dosage) students received over the course of the 5-week intervention period. Of the 156 students assigned to BASE, only 11 (7%) did not complete all five of the assigned modules. On average, students engaged in the BASE intervention for a total of 200 minutes (SD = 89) with a range of 0 minutes to 786 minutes. For each of the five modules, on average, students spent 39 minutes (SD = 22) on the Self-esteem module, 54 minutes (SD = 29) on the Digital Citizenship module, 39 minutes (SD = 24) on the Bullying module, 31 minutes (SD = 22) on the Motivation module, and 37 minutes (SD = 25) on the Future Goals module.

Demographic differences in BASE usage. We examined whether dosage (i.e., number of minutes spent engaging in BASE modules) varied by any demographic variable. We conducted four separate Analysis of Variance (ANOVA) with school, grade, gender, and race/ethnicity as independent variables respectively in predicting BASE dosage. We found that total time spent on the modules varied based on grade, $F(2, 150) = 3.39$, $p < .05$, $\eta^2 = .043$ and gender, $F(1, 148) = 4.59$, $p < .05$, $\eta^2 = .03$. Post-hoc analyses revealed that 6th graders ($M =$

222.38, *SE* = .12.71) spent significantly more time on the modules than 7th graders (*M* = 172.63, *SE* = .14.28) and girls (*M* = 214.40, *SE* = 10.15) spent more time on them than boys (*M* = 183.43, *SE* = 10.28).

Relation between BASE dosage and student outcomes. Based on the implementation science literature (Durlak, et al., 2011; Donkin, et al, 2011; Durlak & DuPre, 2008; Berkel, et al. 2011; Ritterband, et al. 2009; Bennett & Glascow, 2009), we would suppose that greater usage of the BASE online learning modules could predict more positive student outcomes. To test this hypothesis, we conducted linear regression analyses with time spent on the modules predicting each outcome variable, controlling for baseline scores. There was a statistically significant effect of time for BASE knowledge, $\beta = .006$ (.002), $t = 3.59$, $p < .001$, $R^2 = .052$, and students who spent more time on the modules showed an increase in knowledge. There was no association between time spent on modules and any of the other outcome measures.

Discussion

This paper presents data from a randomized trial investigating the impacts of participation in the BASE Education web-based mental health education program (BASE) with 6th through 8th grade students. The BASE intervention for this study was comprised of five online learning modules (Self-Esteem, Digital Citizenship, Bullying/Cyber Bullying, Motivation, and Future Goals) which were selected as a sampling of foundational and highly relevant social emotional learning (SEL) topics for this age group, and due to their instructional alignment to empirically derived social-emotional competency frameworks, including that of the Center for Academic and Social Emotional Learning (CASEL). Students completed the online BASE intervention independently in a self-paced fashion over a 5-week period, engaging with the software for approximately 40 minutes per week on average. The intervention was

implemented universally with all students in homeroom and academic advisory classrooms. The impact of participation in BASE over time was examined using a randomized design where approximately half of students were in wait-list control classrooms and half were in treatment (BASE) classrooms.

A series of analyses were conducted to examine the impact of participation in BASE on students' school-based adjustment according to both the students themselves and their teachers. A parallel set of outcome measures was collected prior to (pre) and following (post) student participation in BASE. Student self-report measures of school-based adjustment (i.e., student self-perception measures) were administered, as well as an assessment of students' knowledge of content covered in the assigned BASE modules. Teachers completed surveys to assess their students' school engagement and behavioral and emotional school-based adjustment.

As expected, pre-post scores for each measure were significantly correlated with one another, indicating significant consistency in each area across time. This is not surprising given the short timeframe for the study of 5- weeks. In order to examine the impact of participating in BASE, above and beyond this developmental consistency in each outcome area, we conducted an analysis of covariance which examined outcomes at post-intervention, after controlling for students' pre-intervention scores.

Across the student population, there was evidence that the BASE intervention resulted in significant increase in content knowledge for students from pre- to post-intervention time points. In other words, students' social emotional health literacy increased significantly as a function of exposure to the instructional content presented in the BASE modules. Further, the more students engaged with the BASE instructional content (i.e., intervention dosage), the greater their gains in social emotional content knowledge. There was also an overall main effect

indicating that participation in BASE resulted in significantly greater school engagement. Specifically, teachers reported students who engaged with the BASE Modules showed significantly higher engagement in school at post-intervention, compared to students who were not exposed to BASE (i.e., students in control classrooms). Thus, students in BASE classrooms were seen by teachers as exhibiting behaviors indicative of greater school engagement, such as working hard and being enthusiastic at school. A moderator of the BASE intervention was grade level, such that the intervention was more impactful for 6th and 7th grade students who had greater self-reported school emotional engagement at time 2 than students who didn't receive the program, and 8th grade students who had higher teacher-rated school engagement than 8th graders in the control condition.

A unique feature of this study was the particularly large Hispanic student representation in the sample. This feature afforded the ability to investigate racial/ethnic sub-group differences as another moderator of the BASE intervention. These analyses revealed the significantly positive impact of participation in the BASE modules for Hispanic students' self-perceptions. Specifically, student self-report outcomes of their self-efficacy and social emotional and behavioral adjustment at school showed significant improvements for Hispanic students in the BASE condition whereas Hispanic students in the control condition showed declines in each of these areas over the study period. There is evidence in the literature that mental health and emotional concerns are less openly discussed within Hispanic cultures (Villatoro, Morales, & Mays, 2014; Rojas-Vilches, Negy, & Reig-Ferrer, 2011; Bermudez, Kirkpatrick, Hecker, & Torres-Robles, 2010). It may be that Hispanic students have less exposure to the social emotional content presented in the BASE modules such that the learning experience is particularly impactful for these students.

Overall, this study adds to the evidence-based regarding use of digital platforms for universal social, emotional, and behavioral health intervention with adolescents. The goal of BASE is to provide schools and mental health clinics with a feasible preventive intervention that can be applied universally to enhance adolescents' social, emotional, and behavioral health, in school and more generally in life. BASE is disseminated via online self-paced modules in an effort to offer an affordable and accessible alternative to in-person lessons and therapeutic methods, and thereby increase the reach of mental health education intervention and broaden the potential positive impact. Further, a digital platform may lower barriers (e.g., stigma, discomfort with face-to-face discussion) for students, creating a safe, private place to explore sensitive topics and increase knowledge and skills in social, emotional, and behavioral health. Given the ubiquitous presence of technology in adolescents' lives today, use of a screen may increase students' engagement and comfort level for participation in mental health education. The low attrition rate for this study, as well as the fact that students engaged with the software for considerable time despite low to zero oversight by teachers, speak to the potential of using digital platforms to engage students in universal preventive intervention at school.

Limitations and Future Directions. Logistical restrictions within our participating schools limited the possible length of the intervention period to five weeks. This brief intervention period and limited exposure to BASE instructional content likely resulted in only two outcomes showing significant change for the overall sample. Consistent with other studies that have shown intervention exposure to be significantly related to outcomes (e.g., Durlak, et al., 2011), there was evidence from this study that greater exposure to the BASE instructional content over the intervention period (i.e., more minutes of engagement in the modules) resulted in greater gains in self-efficacy and positive future aspirations and goals for participating

students, in addition to greater content knowledge. An important next step would be to assess whether greater exposure to BASE modules result in greater benefits for students, and likely emergence of additional significant outcome changes. Further, for this initial study, we selected five foundational BASE modules out of the available library of 80 social emotional health topics. It may also be useful to examine whether allowing students to select modules of particular interest from this larger library (i.e., for more personalized learning) increases the impact of the intervention for student outcomes.

The intervention's relatively greater positive impact for Hispanic students was unexpected. A valuable avenue for future research would be to examine the efficacy of BASE where comparison across demographic sub-groups is deliberately included in the research design. Such research would assist with understanding the elements of BASE that were particularly impactful for students of Hispanic/Latino descent, which in turn, would assist with development of culturally responsive interventions more generally.

Ethical approval: All procedures performed involving human participants were in accordance with the ethical standards of the 3C Institute Institutional Review Board (IRB; IRB00002238) and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent: Informed consent was obtained from all individual participants included in the study.

Conflict of Interest: Drs. Raoul and McKown are employed by the parent company of BASE Education and could benefit from the results of this study.

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APPENDIX

Table 1. *Intervention schedule of BASE online module completion with learning topics.*

Intervention Week	BASE Module Assignment	Learning Topics Covered
Week 1	Self-Esteem	Defines self-esteem, outlines categories of self-esteem, discusses how to develop a stronger sense of self, explores possible barriers to success, and provides tools to overcome challenges and reviews a plan for the future.
Week 2	Digital Citizenship	Discusses safety in the use of technology and outlines appropriate behavior in the digital world, including cell phone use, texting, social media, and all facets of cyber behavior.
Week 3	Bullying/Cyberbullying	Discusses different forms of bullying and explores ways to keep safe and avoid bullying.
Week 4	Motivation	Defines motivation, outlines the various types, explores barriers to success, provides tools to overcome challenges, and discusses ways to improve motivation and plan for the future.
Week 5	Future Goals	Defines what it means to have goals, highlights the benefit of being focused, helps the student create a vision for one's self, discusses strategies to stay on task, explores barriers to success, and provides tools to overcome challenges.

Table 2. *Student Sample Demographic Distributions.*

Demographic	Category	Total N	Percent of sample	BASE	Control
School	School 1	128	43.4%	56	72
	School 2	167	56.6%	100	67
Grade	6th grade	98	33.2%	48	50
	7th grade	86	29.2%	38	48
	8th grade	106	35.9%	67	39
Gender	Male	138	46.8%	74	64
	Female	151	51.2%	76	75
Race	African American/Black	132	44.7%	63	69
	White	6	2.0%	3	3
	Asian or Pacific Islander	14	4.7%	6	8
	American Indian	1	0.3%	1	0
	Mixed	18	6.1%	9	9
	Other	110	37.3%	63	47
	Unknown	5	1.7%	5	0
	Prefer not to answer	9	3.1%	6	3
Ethnicity	Hispanic	128	43.5%	72	54
	Non-Hispanic	160	56.5%	63	65

Table 3. *Pearson correlation matrix among student-report outcomes at pre- and post-intervention.*

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Pre SEE	--														
2. Post SEE	.22**	--													
3. Pre FA	.37**	0.03	--												
4. Post FA	.18**	0.08	.40**	--											
5. Pre AM	.52**	.20**	.45**	.25**	--										
6. Post AM	.33**	.25**	.27**	.42**	.52**	--									
7. Pre SE	.46**	.13*	.50**	.21**	.50**	.29**	--								
8. Post SE	.27**	.25**	.26**	.49**	.38**	.54**	.50**	--							
9. Pre SSC	.39**	.65**	.15*	0.02	.32**	.25**	.23**	.28**	--						
10. Post SSC	.25**	.95**	0.03	0.10	.22**	.25**	.15*	.27**	.65**	--					
11. Pre LS	.42**	.17**	.33**	.19**	.53**	.34**	.57**	.44**	.30**	.18**	--				
12. Post LS	.31**	.22**	.25**	.32**	.38**	.50**	.37**	.56**	.25**	.25**	.53**	--			
13. Pre CS	.35**	.23**	.35**	.25**	.54**	.36**	.59**	.46**	.37**	.26**	.78**	.41**	--		
14. Post CS	.29**	.25**	.29**	.30**	.45**	.50**	.45**	.58**	.34**	.28**	.56**	.76**	.56**	--	
15. Pre BASE Knowledge	.01	-.02	-.03	.06	.02	.10	-.03	.10	-.07	-.03	.10	.05	.05	.11	--
16. Post BASE Knowledge	-.09	-.01	.03	.11	-.01	.11	-.04	.07	-.07	-.03	.03	-.00	.00	.08	.63**
Mean	3.42	2.71	3.59	3.62	5.62	5.78	3.90	4.01	2.66	2.71	3.30	3.37	10.26	11.41	3.42
Standard Deviation	0.79	0.43	0.48	0.51	1.16	1.07	0.72	0.70	0.39	0.38	0.49	0.49	3.84	4.38	0.79

Note. *p<.05; **p<.01; SEE = School Emotional Engagement, FA = Future Aspirations, AM = Academic Motivation, SE = Self-Efficacy, SSC = School Social Connectedness, LS = Lifestyle Skills, CS = Cognitive Style.

Table 4. *Pearson correlation matrix among teacher-report outcomes at pre- and post-intervention.*

	1	2	3	4	5
1. Pre Composite	--				
2. Post Composite	.66**	--			
3. Pre Engagement	.96**	.66**	--		
4. Post Engagement	.63**	.97**	.67**	--	
5. Pre Disaffection	.90**	.55**	.74**	.48**	--
6. Post Disaffection	.60**	.90**	.54**	.77**	.60**
Mean	3.16	3.23	2.86	2.93	3.46
Standard Deviation	0.70	0.68	0.89	0.88	0.61

Note. **p<.01.

Table 5*. Correlations between student self-report and teacher-report outcome measures at pre- and post-intervention.*

Student Self-Report Measures	**Teacher-report Measures**		
	Composite Score (Pre/Post)	Engagement (Pre/Post)	Disaffection (Pre/Post)
School Emo. Engagement	.14*/.00	.14*/-.01	.10/.03
Future Aspirations/Goals	.12/.15*	.10/.15*	.12*/.13*
Academic Motivation	.10/.16**	.09/.16**	.12/.14**
Self-Efficacy	.11/.13*	.11/.14*	.09/.13*
School Social Connectedness	.001/.05	-.01/.03	.02/.07
Life Skills	.14/.14*	.14*/.12*	.10/.16**
Cognitive Style	.09/.13*	.10/.11	.08/.15*
BASE Content Knowledge	.26**/.35**	.25**/.36**	.23**/.29**

Note. *p<.05; **p<.01.

Table 6. *Adjusted means (M), standard errors (SE), ANCOVA F-statistics, and effect sizes by condition for student and teacher outcomes.*

Student Self-Report	**BASE Condition M (SE)**	**Control Condition M (SE)**	**F**	**η2**
School Emo. Engagement	2.74 (0.03)	2.68 (0.04)	1.918	.007
Future Aspirations/Goals	3.63 (0.04)	3.63 (0.04)	.000	.000
Academic Motivation	5.79 (0.07)	5.78 (0.08)	.014	.000
Self-Efficacy	4.00 (0.05)	4.02 (0.05)	.068	.000
School Social Connectedness	2.73 (0.02)	2.69 (0.03)	1.386	.005
Life Skills	3.31 (0.03)	3.28 (0.04)	.421	.001
Cognitive Skills	3.49 (0.03)	3.49 (0.04)	.009	.000
BASE Content Knowledge	11.94 (.27)	10.82 (0.29)	8.055**	.027
Teacher-Report	**BASE Condition M (SE)**	**Control Condition FM (SE)**	**F**	**η2**
Composite Engagement vs. Disaffection Scale	3.29 (0.04)	3.16 (0.04)	4.301*	.015
School Engagement	3.02 (0.05)	2.83 (0.06)	5.965*	.020
School Disaffection	3.57 (0.04)	3.51 (0.04)	1.239	.004

Note. * p<.05; ** p<.01

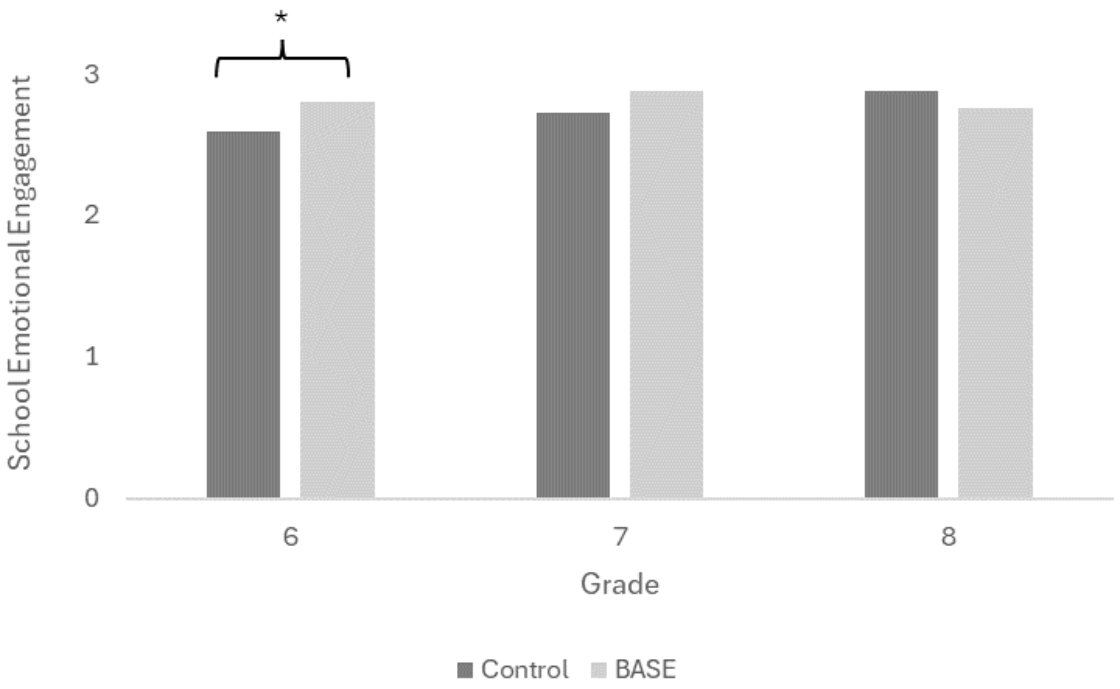
Table 7*. Adjusted means (M), standard errors (SE), ANCOVA F-statistics, and effect sizes by condition for Hispanic students' self-perception outcomes.*

Student Self-Report	**F**	**η^2**
School Emo. Engagement	5.320**	.037
Self-Efficacy	4.567*	.031
Life Skills	7.167***	.048
Cognitive Skills	4.446**	.031

	BASE Condition M (SE)	**Control Condition M (SE)**	**η^2**
School Emo. Engagement	2.88 (.05)	2.62 (.06)	**.03**
Future Aspirations/Goals	3.72 (.06)	3.57 (.06)	.01
Academic Motivation	5.89 (.11)	5.71 (.12)	.01
Self-Efficacy	3.92 (.08)	3.69 (.09)	**.03**
School Social Connectedness	2.78 (.04)	2.67 (.04)	.01
Life Skills	3.41 (.05)	3.18 (.06)	**.03**
Cognitive Skills	3.55 (.05)	3.89 (.06)	**.03**
BASE Knowledge	12.05 (.40)	11.41 (.46)	.004

Note. * p<.05; ** p<.01; *** p<.001

Figure 1. *Univariate interaction between intervention condition and grade on school emotional engagement.*



Note. * p<.05

Figure 2. *Significant univariate outcomes for Hispanic Students.*

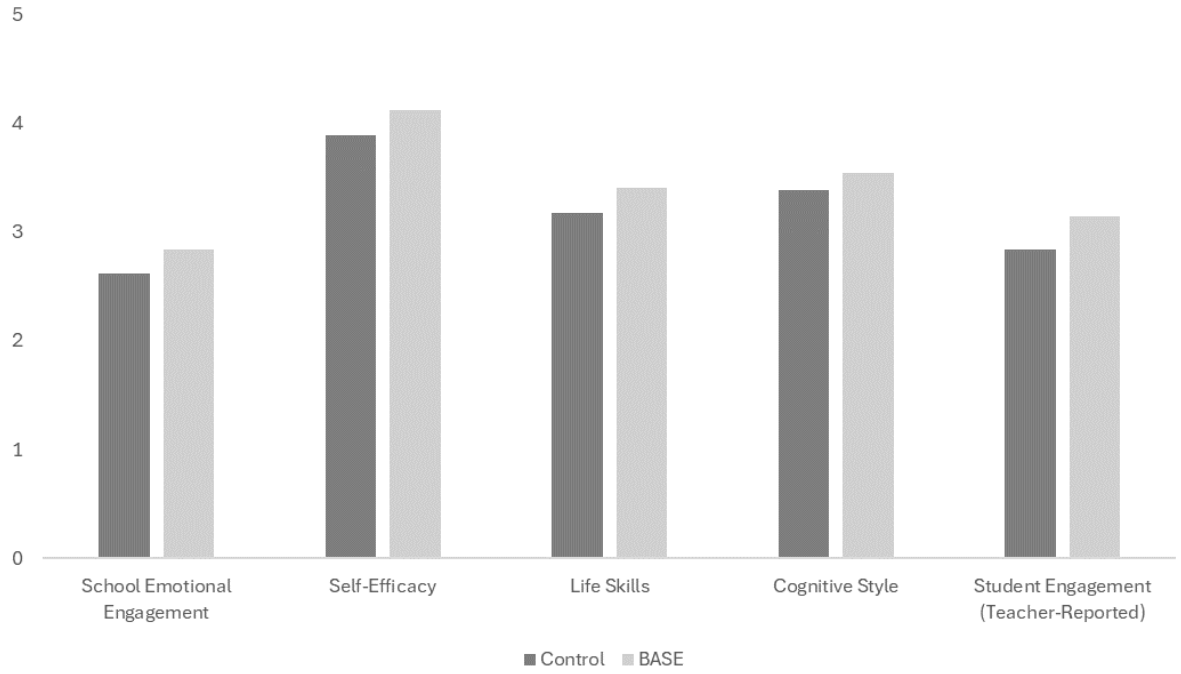
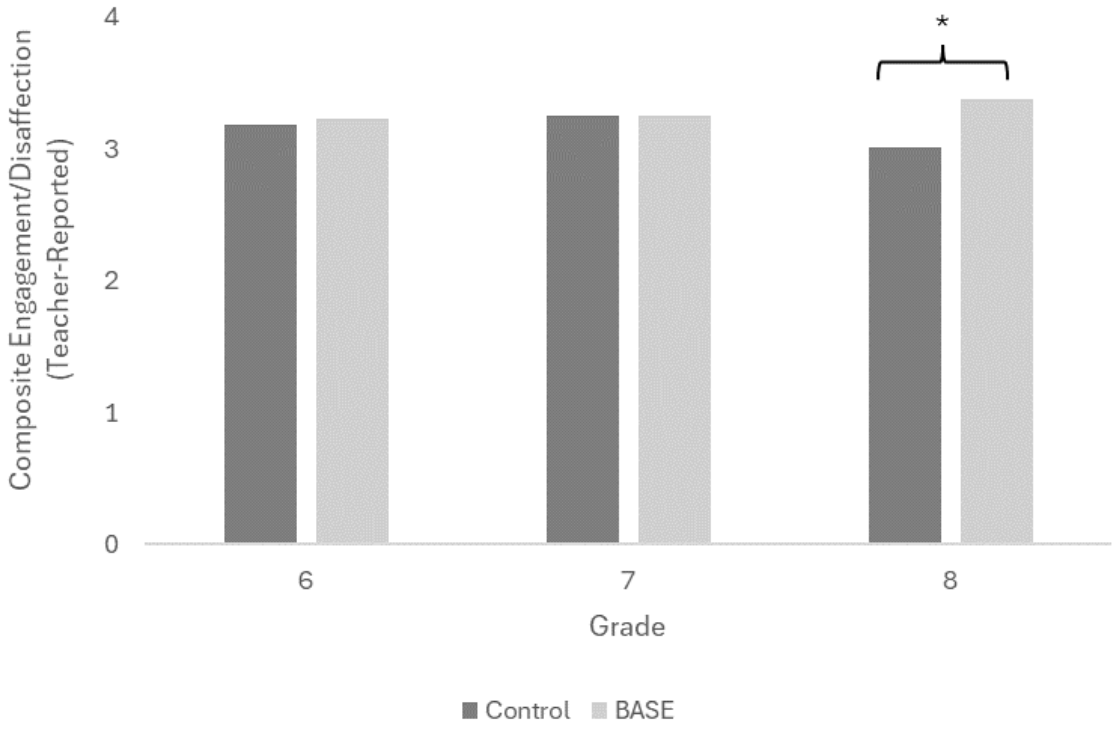
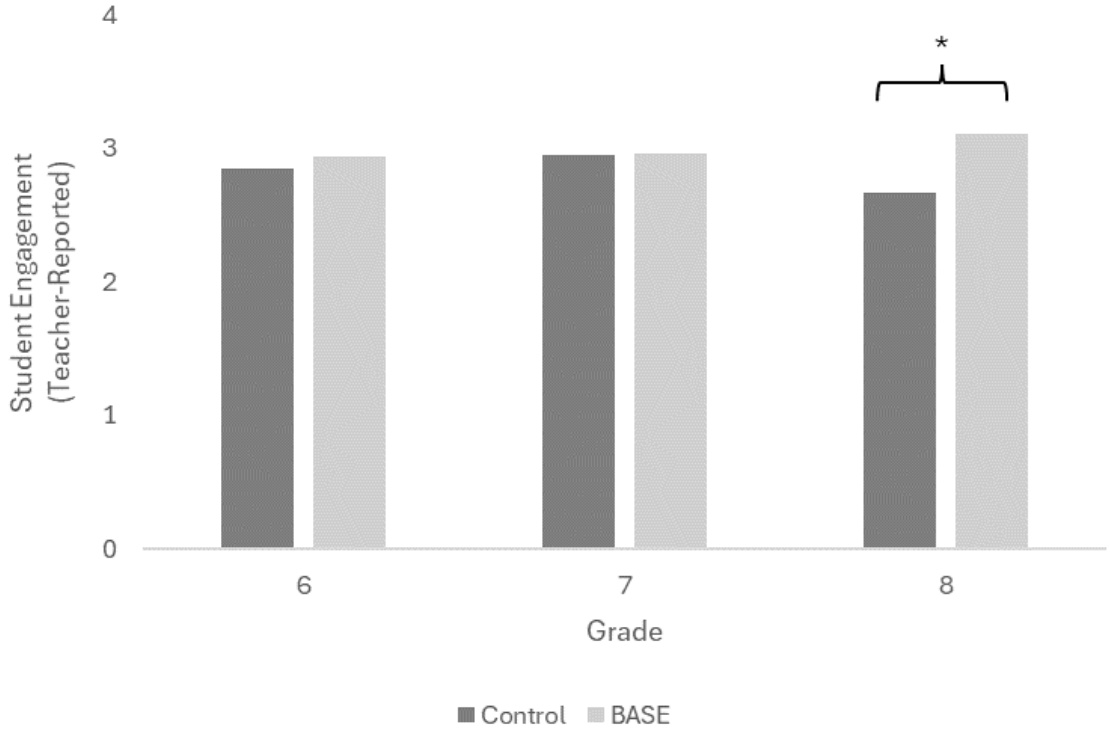


Figure 3. *Univariate interaction between intervention condition and grade on the composite engagement vs. disaffection teacher-reported score.*



Note. * p<.05

Figure 4. *Univariate interaction between intervention condition and grade on teach-reported student engagement.*



Note. * p<.05