

Impact of a school-based universal mental health education intervention for adolescents

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ABSTRACT

While face-to-face treatment is the gold standard, in-person intervention methods are costly and time consuming such that schools have difficulty addressing the mental health of students with high need, much less applying preventive methods more universally. The primary purpose of this research study was to evaluate the efficacy of the BASE mental health education preventive intervention with middle school students. BASE self-paced online modules were completed by a randomly selected group of 155 adolescents in a regular education classroom setting over a 5-week period. Change in student- and teacher-report outcome measures was investigated and compared to the wait-list control (CO) group (n=139). Overall analyses indicated students in the BASE condition showed significant gains in mental health knowledge and teacher-reported school engagement over the intervention period for BASE students whereas CO students showed declines in these areas. In addition, examination of the mediating influence of dosage revealed that students who spent more time engaged in the BASE intervention modules showed significantly greater gains in content knowledge as well as greater self-efficacy and future oriented attitudes. Given 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-efficacy and school engagement as well as life skills over the intervention period. Discussion focuses on the potential for digital universal mental health intervention in schools.

Keywords: Universal intervention, school-based mental health, social emotional learning, Hispanic students

INTRODUCTION

Adolescents who experience depression, anxiety, and other psychological disorders perform more poorly 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 (Tomy, Fuller-Tyszkiewicz, Richardson, & Colla, 2016). And 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, the mental health needs among adolescents 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. In part, this '*emergency mentality*' with regard to mental health service delivery in schools comes from the reality of limited resources (time, financial, staffing, training). For many schools, traditional, in-person therapeutic, SEL, or preventive interventions are simply cost prohibitive.

Technology offers the potential for substantially lowering these practical and logistical barriers, making universal delivery of mental health preventive programs (applied equally across all students) possible for schools. And use of digital learning tools in schools is now commonplace. In fact, a recent 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). Unfortunately, the research on use of technology in schools for promoting adolescent mental health is sorely lacking. The primary purpose of this research study is to build this evidence base by investigating 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 cadre 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 factual and informative portions, each module implements a series of self-reflection questions to help adolescents apply the presented content to their own lives, identify potential challenges they face in that area, and gain greater understanding of their own cognitive or behavioral patterns.

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. Implementers 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.

INSERT TABLE 1 ABOUT HERE

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 6th – 8th 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, 15 students (4%) failed to complete study activities or dropped out of the study due to transferring schools. An additional six students were deleted due to a high percentage of missingness greater than 20%. Chi-square analyses revealed no significant differences by demographic characteristics for those students who remained in the sample versus those who attrited. 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 283 middle school students who completed the research study. **Table 2** summarizes the demographic characteristics of the student sample. Across our two schools, 41% of students attended School 1 and 59% of students attended School 2. Of the participating youth, 34.6% were in 6th grade, 26.9% were in 7th grade, and 38.5% were in 8th grade with an average age of 12.63 (SD = 0.67) and ranging from 12 to 14 years of age. The youth sample was 52.7% female with an approximate racial distribution of 43.8% African American or Black, 38.2% Caucasian or White, 4.9% Asian or Pacific Islander, and 13.1% Other racial subgroup (e.g., multiracial, American Indian, unknown). Nearly half of the student sample (43.5%) reported Hispanic ethnicity.

INSERT TABLE 2 ABOUT HERE

Sample by Condition. Assignment to treatment vs. control conditions 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 153 students (54.1%) assigned to BASE and 130 students (45.9%) assigned to CO. Chi-square analyses revealed no significant gender, race, ethnicity, or school differences across the BASE and CO conditions.

However, randomization at the classroom level resulted in more 8th grade students being assigned to the BASE condition ($N_{8th} = 69, 45\%$) compared to 6th and 7th grade students ($N_{6th} = 49, 32\%$; $N_{7th} = 35, 23\%$; $X^2(2) = 9.26$,

$p < .01$). 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 score were generated for each subscale where higher scores indicated higher engagement and higher disaffection, respectively. Each subscale 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 $\alpha = .80$ 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 ($\alpha = .84$ and $.88$, 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 $\alpha = .84$ 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 ($\alpha = .88$ 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.,

'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 ($\alpha = .91$ 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 $\alpha = .83$ and $.84$, respectively; Life skills $\alpha = .80$ 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 Mediator. In addition to monitoring students' completion rate and fidelity to the intervention protocol, software usage data was collected to investigate the possible mediating 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

In order to assure an accurate parameter estimation, each assumption for multivariate analysis of variance test was checked. Specifically, independent assumption and normality assumption were checked and assumed. Whereas, a violation of multivariate normality assumption was detected. Linearity assumption was also detected and met. Homogeneity of variance-covariance assumption was met based on the Box's test, $p > .001$.

Inter-correlations among Outcomes. Correlational analyses were conducted to examine the relations among the various outcome measures. First, student self-report ratings were examined at baseline (pre) and post-intervention time points. As **Table 3** displays, 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 (FA_Pre) was statistically correlated with school emotional engagement (SEE) and school social connectedness (SSC) at baseline ($r_{SEE_Pre} = .37, p < .0001$; $r_{SSC_Pre} = .17, p < .0001$), but not at post-intervention ($r_{SEE_Post} = .03$; $r_{SSC_Post} = .01$). And SSC_Pre was more strongly correlated with SEE at post-intervention ($r = .65, p < .0001$) than it was at pre-intervention ($r = .38, p < .0001$).

INSERT TABLE 3 ABOUT HERE

Interestingly, while student knowledge showed consistency over time, BASE content knowledge was not significantly related to any student self-perception measure at either time point. Thus, students' perceptions of their own school-based adjustment did not differ as a function of their level of BASE content knowledge at the same time point (i.e., no concurrent relationship).

Second, **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. 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.

INSERT TABLE 4 ABOUT HERE

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). Interestingly, in many instances, a given correlation was higher at post-intervention than at baseline. For example, teacher ratings of school engagement were not significantly related to students' academic motivation (AMS) or future aspirations/goals (FA) at baseline, but these areas were significantly related at post-intervention, $r = .16, p < .01$. It may be that teachers and students became more familiar with one another over time and therefore were more consistent in their perceptions at the second time point.

INSERT TABLE 5 ABOUT HERE

Interestingly, 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. While the reason for this pattern of findings is unknown, it may be that students who scored higher on the knowledge assessment also tend to perform higher academically in general, and that teachers' ratings of students emotional and behavioral domains may be biased to some extent by their knowledge of students' academic performance more generally. Thus, students who do well academically may tend to score higher on the knowledge test **and** to be seen by teachers as more well-adjusted at school.

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, $F(16, 542) = 2.10, p < .05, \eta^2 = .058$, but not at univariate level after adjusting Type I error and using Dunn- Bonferroni method. The same result concluded for gender variable. A significant multivariate main effect for gender $F(8, 272) = 2.25 p < .05, \eta^2 = .062$, was captured. But gender difference was not significantly present at the univariate level.

Intervention Condition Analyses

We elected to implement a Multivariate Analysis of Covariance (MANCOVA) approach to test for intervention condition differences in student outcomes over time. 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). MANCOVA adjusts each student's post-score for their baseline score before examining post-intervention mean differences across treatment conditions. For all analyses, when an effect was found to be significant at the multivariate level, univariate ANCOVAs were then investigated to determine for which outcomes the effect held. Then, post-hoc mean comparison tests were conducted to determine the direction of effects across groups. 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 (i.e., covariate).

Condition effects. A MANCOVA was conducted to test whether post-intervention student outcomes differed by condition (BASE vs. CO) after controlling for baseline scores. A significant multivariate main effect for condition was found for both student measure, $F(8,267) = .98, p < .05, \eta^2 = .059$, and teacher measure, $F(3, 276) = 2.68, p < .05, \eta^2 = .028$. **Table 6** displays adjusted means, standard errors, univariate statistics, and effect sizes for all student and teacher outcomes. By using Dunn-Bonferroni adjustment, the condition main effect was statistically significant at the univariate level for both student-report BASE knowledge, $F(1, 274) = 9.11, p < .006, \eta^2 = .032$, and teacher-reported school engagement, $F(1, 278) = 7.70, p < .017, \eta^2 = .027$. Post hoc comparisons for students in the BASE condition ($M = 3.04, SE = .05$) result in **a significant improvement in BASE knowledge** over the intervention period than the control group ($M = 2.83, SE = .05$). Similarly, teachers reported students in the BASE condition ($M = 3.04, SE = .05$) showed greater school engagement at post-intervention whereas CO students ($M = 2.83, SE = .06$) showed a decline in this area, according to teachers.

INSERT TABLE 6 ABOUT HERE

Condition by demographics. In order 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. For race/ethnicity, we categorized students as Hispanic/White ($n = 104$), African-American ($n = 123$), or Other sub-group ($n = 56$; 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. There was a statistically significant main effect for **gender**, $F(7, 260) = 2.17, p < .05, \eta^2 = .06$, but not for condition at the multivariate level. The multivariate interaction between gender and condition was not significant. Univariate ANCOVA assessed the impact of each gender level on the individual dependent variables. There was not a statistically significant difference in post test scores by level of gender. However, the MANCOVA for **grade and condition** showed a statistically significant main effect for **grade**, $F(7, 259) = 2.79, p < .05, \eta^2 = .07$, but not at univariate level. Additionally, there was a significant multivariate **interaction** of condition by grade, $F(7, 259) = 2.91, p < .05, \eta^2 = .07$. By using Bonferroni method and controlling Type I error inflation, a statistically significant univariate interaction for SEE (School Emotional Engagement) was found, $F(2, 264) = 5.27, p < .007, \eta^2 = .038$. Particularly, for students in both 6th and 7th grades, BASE intervention group ($M_{6thTreat} = 2.74, SE_{6thTreat} = .06; M_{7thTreat} = 2.80, SE_{7thTreat} = .07$) significantly has more interest in school learning than those students who were in the control group ($M_{6thContr} = 2.49, SE_{6thContr} = .06; M_{7thContr} = 2.72, SE_{7thContr} = .07$) at the second time point. Whereas, for the 8th grade, students without receiving BASE intervention ($M_{8thContr} = 2.85, SE_{8thContr} = .07$) have more enjoyment in school activities than the treatment group ($M_{8thContr} = 2.71, SE_{8thContr} = .05$). This phenomenon may be occurred due to various elements. With grades and age increasing, adolescents' physical and mental gradually develop, such as students' cognitive improvement and increased learning competency (Eccles, 1999).

For teacher reports, the MANCOVA was performed with two factors: **gender and condition**. There was a statistically significant main effect for **condition**, $F(3, 274) = 2.89, p < .05, \eta^2 = .031$, but neither for gender effect nor the interaction effect. Same following steps as analyzing student reports, univariate ANCOVAs were used to detect the impact of each condition group on the individual dependent variables with controlling pretest teacher-

report scores. After adjusting the alpha level inflation, there was a statistically significant difference in school engagement by level of condition, $F(1, 276) = 8.37, p < .017, \eta^2 = .029$, with a higher level of school engagement for the BASE treatment students ($M = 3.04, SE = .05$) than those students who did not assign BASE courses ($M = 2.82, SE = .06$). Additional MANCOVA for two factors, **grade and condition**, was performed. The results showed a significant main effect for **grade**, $F(6, 548) = 2.70, p < .05, \eta^2 = .029$, as well as the **interaction of grade by condition**, $F(6, 548) = 2.31, p < .05, \eta^2 = .025$. However, neither grade effect nor interaction of grade by condition was found at the univariate level.

Another MANCOVA for **race/ethnicity** was performed for teacher-report, which showed a significant **race/ethnicity** effect, $F(6, 546) = 6.24, p < .05, \eta^2 = .064$. Univariate ANCOVA results and post hoc mean comparisons indicated a statistically significant difference occurred in school engagement by each level of race/ethnicity, $F(2, 274) = 10.22, p < .017, \eta^2 = .069$, with the lowest interests in school engagement for African-American students ($M = 2.73, SE = .06$) than White/Hispanic students ($M = 3.05, SE = .06$) and Other sub-groups ($M = 3.15, SE = .08$) over time. Moreover,

The **race/ethnicity by condition interaction** effect was significantly present at the multivariate level for student-report, $F(14, 518) = 2.37, p < .05, \eta^2 = .06$. Univariate analysis and post hoc mean comparisons indicated a significant univariate interaction for school emotional engagement, $F(2, 264) = 6.52, p < .007, \eta^2 = .109$, and self-efficacy, $F(2, 264) = 5.83, p < .007, \eta^2 = .042$, as well as, life skill, $F(2, 264) = 8.63, p < .007, \eta^2 = .061$. Dunn-Bonferroni adjustment was used as well. Particularly, For BASE treatment group, White/Hispanic students ($M = 2.86, SE = .054$) show a higher level of social emotion engagement than African American students ($M = 2.66, SE = .053$) and Other sub-groups ($M = 2.66, SE = .076$). Moreover, White/Hispanic students ($M = 4.19, SE = .08$) show higher self-efficacy comparing with than African American students ($M = 3.88, SE = .08$) and Other sub-groups ($M = 3.95, SE = .11$). Besides, White/Hispanic students ($M = 3.44, SE = .05$) develop also the highest life skills among African American students ($M = 3.23, SE = .05$) and Other sub-groups ($M = 3.23, SE = .08$). For those who were assigned in the control group, however, African American students show a higher level in social emotion engagement and life skills than White/Hispanic students and Other sub-groups. A higher self-efficacy generated for Other sub-group comparing students race in White/Hispanic and African American. **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. 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).

INSERT TABLE 7 ABOUT HERE

Intervention Dosage Mediation 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 155 students assigned to BASE, only 12 (7%) did not complete all five of the assigned modules. On average, students engaged in the BASE intervention for a total of 208 minutes ($SD = 86$) with a range of 48 minutes to 707 minutes. For each of the five modules, on average, students spent 39 minutes ($SD = 22$) on the Self-esteem module, 56 minutes ($SD = 27$) on the Digital Citizenship module, 41 minutes ($SD = 23$) on the Bullying module, 33 minutes ($SD = 22$) on the Motivation module, and 39 minutes ($SD = 24$) 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. The ANOVA revealed no statistically significant differences in dosage by school, grade, gender, or racial/ethnic sub-group, at the alpha level .05.

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 & Glasgow, 2009), we would suppose that greater usage of the BASE online learning modules could positively correlate to student outcomes. To test this hypothesis, we examined the correlation between time spent engaging in the BASE intervention. As Pearson correlation coefficients displayed in **Table 8**, spending more time engaged in the BASE intervention modules was positively and significantly associated with gains in BASE content knowledge, as well as improvements in students' self-efficacy and their belief that school engagement is important for developing cognitive style and achieving future goals.

INSERT TABLE 8 ABOUT HERE

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 analyses 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, as would be expected 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 spend more time learning 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 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 for the BASE intervention. And 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 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: The authors declare that they have no conflict of interest.

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Appendix

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

Intervention	BASE Module	Learning Topics Covered
Week	Assignment	
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

Characteristic	Category	N	Percent of sample
School	School 1	112	41.0%
	School 2	167	59.0%
Grade	6 th grade	98	34.6%
	7 th grade	76	26.9%
	8 th grade	109	38.5%
Gender	Male	134	47.3%
	Female	149	52.7%
Race	African American/Black	124	43.8%
	White	108	38.2%
	Asian or Pacific Islander	14	4.9%
	Other	37	13.1%
Ethnicity	Hispanic	123	43.5%
	Non-Hispanic	160	56.5%

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

Measure	SEE		KNO														KNOW
	Pre	Post	FA_Pre	FA_Post	AM_Pre	AM_Post	SE_Pre	SE_Post	SSC_Pre	SSC_Post	LS_Pre	LS_Post	CS_Pre	CS_Post	W_Pre	W_Post	
SEE_Pre	1	.22**	.37**	.17**	.53**	.34**	.47**	.27**	.38**	.25**	.42**	.32**	.34**	.29**	.01	-.09	
SEE_Post	.22**	1	.04	.09	.20**	.25**	.13*	.25**	.65**	.95**	.16**	.22**	.22**	.26**	-.02	-.02	
FA_Pre	.37**	.04	1	.40**	.45**	.27**	.51**	.26**	.17**	.03	.34**	.26**	.37**	.32**	-.02	.03	
FA_Post	.17**	.09	.40**	1	.25**	.42**	.21**	.49**	.03	.09	.19**	.32**	.26**	.32**	.08	.12	
AM_Pre	.53**	.20**	.45**	.25**	1	.53**	.49**	.38**	.32**	.22**	.54**	.39**	.55**	.46**	.03	-.02	
AM_Post	.34**	.25**	.27**	.42**	.53**	1	.29**	.54**	.27**	.26**	.35**	.51**	.37**	.53**	.11	.11	
SE_Pre	.47**	.13*	.51**	.21**	.49**	.30**	1	.50**	.22**	.15*	.58**	.38**	.60**	.47**	-.02	-.04	
SE_Post	.27**	.25**	.25**	.49**	.38**	.54**	.50**	1	.28**	.27**	.44**	.56**	.48**	.60**	.11	.07	
SSC_Pre	.38**	.65**	.17**	.03	.32**	.27**	.22**	.28**	1	.66**	.30**	.27**	.36**	.34**	-.08	-.09	
SSC_Post	.25**	.95**	.03	.09	.22**	.26**	.15*	.27**	.60**	1	.17*	.25**	.25**	.31**	-.03	-.03	
LS_Pre	.42**	.16**	.34**	.19**	.54**	.35**	.58**	.44**	.30**	.17*	1	.53**	.79**	.57**	.11	.04	
LS_Post	.32**	.22**	.26**	.32**	.39**	.51**	.38**	.56**	.27**	.25**	.53**	1	.42**	.77**	.05	.01	
CS_Pre	.34**	.22**	.37**	.26**	.55**	.37**	.60**	.48**	.36**	.25**	.79**	.42**	1	.58**	.05	-.001	
CS_Post	.29**	.26**	.31**	.32**	.46**	.53**	.47**	.60**	.34**	.31**	.57**	.77**	.58**	1	.10	.09	
KNOW_Pre	.01	-.02	-.02	.08	.03	.11	-.02	.11	-.08	-.03	.11	.05	.05	.10	1	.64**	
KNOW_Post	-.09	-.02	.03	.12	-.02	.11	-.04	.07	-.08	.03	.04	.01	-.001	.09	.64**	1	

Note. *p<.001; **p<.0001; within-measure across-time correlations are presented in bold along the diagonal; SEE=School Emotional Engagement, FA=Future Aspirations/Goals, AMS=Academic Motivation, SE=Self-efficacy, SSC=School Social Connectedness, LS=Life Skills, CS=Cognitive Style, and KNOW=Knowledge of BASE content.

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

	BE_Pre	BE_Post	EE_Pre	EE_Post	BD_Pre	BD_Post	ED_Pre	ED_Post
BE_Pre	1	.68**	.86**	.61**	.78**	.58**	.59**	.42**
BE_Post	.68**	1	.57**	.85**	.47**	.79**	.45**	.59**
EE_Pre	.86**	.57**	1	.60**	.70**	.50**	.59**	.41**
EE_Post	.61**	.85**	.60**	1	.40**	.70**	.44**	.64**
BD_Pre	.78**	.47**	.70**	.40**	1	.58**	.74**	.42**
BD_Post	.58**	.79**	.50**	.70**	.58**	1	.54**	.73**
ED_Pre	.59**	.45**	.59**	.44**	.74**	.54**	1	.54**
ED_Post	.42**	.59**	.41**	.64**	.43**	.73**	.54**	1

Note. *p<.001; **p<.0001; within-measure across-time correlations are presented in **bold** along the diagonal.

<i>Table 5. Correlations between student self-report and teacher-report outcome measures at pre- and post-intervention</i>			
	Teacher-report Measure		
Student Self-report Measure	School Engagement (Pre/Post)	Behavioral Disaffection (Pre/Post)	Emotional Disaffection (Pre/Post)
School Emo. Engagement (Pre/Post)	.15* / -.02	.09 / -.01	.11 / .08
Future Aspirations/Goals (Pre/Post)	.10 / .16**	.13* / .13	.09 / .12*
Academic Motivation (Pre/Post)	.09 / .16**	.12* / .12*	.08 / .15*
Self-Efficacy (Pre/Post)	.12 / .14*	.08 / .11	.06 / .15*
School Social Connectedness (Pre/Post)	-.007 / .03	.001 / .02	.05 / .12*
Life Skills (Pre/Post)	.14* / .12*	.09 / .12*	.08 / .18**
Cognitive Style (Pre/Post)	.10 / .12*	.06 / .10	.09 / .18**
BASE Content Knowledge (Pre/Post)	.25** / .35**	.22** / .31**	.21** / .22**
<i>Note.</i> *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

	BASE Condition	Control Condition			
Student Self-report	M (SE)	M (SE)	F	p	η^2
School Emo. Engagement	2.74 (.04)	2.68 (.04)	1.69	.20	.006
Future Aspirations/Goals	3.60 (.04)	3.64 (.04)	.44	.51	.002
Academic Motivation	5.79 (.07)	5.76 (.08)	.09	.77	.000
Self-Efficacy	4.01 (.05)	4.01 (.06)	.00	.95	.000
School Social Connectedness	2.74 (.03)	2.67 (.03)	2.31	.13	.008
Life Skills	3.32 (.03)	3.28 (.04)	.59	.44	.002
Cognitive Style	3.48 (.03)	3.49 (.04)	.03	.86	.000
BASE Content Knowledge	12.27 (.36)	10.70 (.38)	9.11**	.003	.032
Teacher-report	M (SE)	FM (SE)	F	p	η^2
School Engagement	3.04 (.05)	2.83 (.06)	7.70*	.006	.027
Behavioral Disaffection	3.47 (.05)	3.35 (.05)	3.17	.08	.011
Emotional Disaffection	3.69 (.03)	3.64 (.04)	.86	.36	.003

Note. * $p < .017$; ** $p < .006$; significantly different conditions are signified in **bold**

<i>Table 7. Adjusted means (M), standard errors (SE), ANCOVA F-statistics, and effect sizes by condition for Hispanic students' self-perception outcomes</i>			
Student Self-report	F	p	η^2
School Emo. Engagement	6.52**	.002	.047
Self-Efficacy	5.83**	.003	.042
Life Skills	8.63**	< .001	.061
Student Self-report	BASE Condition M (SE)	Control Condition M (SE)	η^2
School Emo. Engagement	2.86 (.05)	2.60 (.06)	.11
Future Aspirations/Goals	3.75 (.06)	3.55 (.07)	.04
Academic Motivation	6.02 (.12)	5.69 (.14)	.03
Self-Efficacy	4.19 (.08)	3.86 (.09)	.07
School Social Connectedness	2.85 (.05)	2.63 (.06)	.08
Life Skills	3.44 (.05)	3.14 (.06)	.11
Cognitive Skills	3.59 (.05)	3.42 (.06)	.07
<i>Note.</i> ** p<.006; significantly different conditions are signified in bold			

<i>Table 8. Correlations between BASE intervention dosage and student outcomes</i>	
Student Self-report	Correlation (r)
School Emo. Engagement	-.10
Future Aspirations/Goals	.22**
Academic Motivation	.14
Self-Efficacy	.22**
School Social Connectedness	-.07
Life Skills	.11
Cognitive Style	.17*
BASE Content Knowledge	.28**
Teacher-report	Correlation (r)
School Engagement	-.04
Behavioral Disaffection	.02
Emotional Disaffection	.05
<i>Note.</i> *p<.05; **p<.01; significant correlations are bolded .	