Evidence of Effectiveness
Summary Outcomes Across Eight Studies

Ripple Effects Whole Spectrum Intervention System

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Impact of Social-Emotional Learning Software on Objective School Outcomes Among Diverse Adolescents: A Summary Analyses of Six Randomized Controlled Trials

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ABSTRACT

A substantive body of evidence suggests that development of social-emotional competence can work both to address behavior problems and to promote academic achievement. However, most effective programs require extensive training and are heavily dependent on instructor expertise. This study concerns a computer-based social-emotional learning intervention called Ripple Effects. Six randomized controlled trials evaluated the impact of the intervention under diverse, real-world, school conditions. A total of 605 ethnically diverse, rural and urban adolescents with multiple risk factors participated. The intervention was self-regulated completion of 42 multimedia tutorials over a period of eight weeks. Although intended as a social-emotional intervention, data indicate the largest significant effect across studies was on academic achievement. Independent-samples t-tests resulted in mean treatment group GPA of 2.90 compared to 2.53 for the control group, p<.01. There were significant positive differences between treatment and control group students across studies for suspensions, p<.05. There were some significant differences in the number of absences and tardies between treatment and control students for individual studies. Lower discipline referral rates for treatment group students across studies was substantively meaningful, but not statistically significant. Three studies provided one-year follow-up enrollment data. At two, treatment group students were enrolled at twice the rate of control group students, a statistically significant difference. With some studies reporting only a single year's data, and most not reporting baseline data, we cannot rule out other factors being responsible for these differences.

KEY WORDS: achievement gap; social-emotional learning; computer-based training

BACKGROUND

High rates of school failure among youth with multiple risk factors is well documented, and causes for that failure have been extensively studied (Ferguson, 2002; Jencks & Phillips, 1998; McCall, Hauser, Cronin, Kingsbury, & Houser, 2006). Academic, behavioral and environmental factors all have been shown to play a role (Bennett et al., 2004; Hammond, Linton, Smink, & Drew, 2007; McEvoy & Welker 2000). A myriad of interventions have been tested, with few providing scalable solutions for real-world settings. A large funding stream has been dedicated to math and reading programs. Despite billions of dollars in public investment,

these initiatives have been largely unsuccessful in obtaining significant academic gains (Lee, 2002; McCall, 2006). Adding the use of computer-based technology as a delivery format has not produced consistent, quantifiable advantage in core academic areas (Dynarski et al., 2007).

Another approach is to focus on social-emotional instruction. A substantive body of evidence suggests that development of social-emotional competence can work both to address behavior problems and to promote academic achievement (Elias & Arnold, 2006; Zins, Weissberg, Wang & Walberg, 2004).

A growing number of social-emotional learning (SEL) interventions have been listed as promising or model programs by What Works Clearinghouse or the Substance Abuse Mental Health Services Administration (SAMHSA). Among them are *Paths* (Greenberg, Kusche, Cook, & Quamma, 1995), *Life Skills Training* (Botvin, G., Baker, Dusenbury, Botvin, E. & Diaz, 1995)*,* and *Positive Action* (Flay & Allred, 2003). All have evidence of positive impact on both behavior and academic performance. However, all require extensive training and are heavily dependent on instructor expertise. Thus none are easily scalable. Recent research has focused on the important role of implementation fidelity in achieving and replicating positive results (Dane & Schneider, 1998; Devaney, O'Brien, Resnik, Keister, & Weissberg, 2006; Fixsen, Naoom, Blase, It is counter-intuitive to think that computer technology might be advantageous for delivery of social-emotional training, when computer-based training has had mixed results in impacting academic outcomes (Dynarski, et al., 2007; Kulik, 2003; Schacter, & Fagnano, 1999). Computers are unfeeling, not self-aware, often lack nuance, miss non-verbal cues, and in most case, don't provide an environment for physical rehearsal of new skills. All are factors in implementer effectiveness of SEL programs (Devaney, et al., 2006).

Nonetheless, there is a growing body of evidence that technology-based training can be effective for some psychosocial interventions. The best evidence is for internet-delivered

cognitive behavioral therapy for anxiety disorders (Carlbring et al.; 2005; Farvolden, et al. 2005) and substance abuse treatment (Carroll, Ball, Martino, et al., 2008; Brendryen & Kraft, 2008), as well as internet-delivered cognitive behavior therapy and psycho-education for depression (Clark et al. 2005; Christensen et al., 2004). Other studies show promising positive outcomes among adults, for disorders such as uncontrollable anxiety, and eating disorders (Andersson, et al., 2005; Pull, 2006; Ybarra et al., 2005; Zabinski et al., 2003). These studies examined standardized, group level protocols among adults.

Prior the beginning of this study, little formative evaluation and very few, real-world scientific studies of effectiveness of self-directed social-emotional training for children had been conducted. One early study showed that a school-based health promotion/behavior change CD-ROM-based program (*BARN*) resulted in reductions in risk-taking behavior in adolescents (Bosworth, et al., 1994). An evaluation of a kiosk based HIV/AIDS prevention program using a game format, showed increased understanding of safety issues, and modest pre to post gains in self-efficacy scores, but the study lacked a comparison group to substantiate findings (Thomas et al., 1997). A 1999 quasi-experimental pilot study of a fifty-minute computer session to build assertiveness skills (using an excerpt from the intervention examined here, Ripple Effects) showed significant, short-term increases in assertiveness and decreases in aggression, but there was no follow-up (Ray, 1999). A three-armed RCT of the impact of a computer-based intervention comprised of 24 Ripple Effects lessons stressing empathy, impulse control and anger management over 12 weeks, showed strong trends toward increased pro-social behavior, decreased aggression, and lower rates of remedial summer school. Only the scores for subscales on anti-social behaviors related to conflict and unkindness, and more respectful behavior, were significant (Stern & Repa, 2000).

Research has demonstrated that adolescents and adults are both more comfortable seeking

help from a computer than a live interviewer, and are more honest in answering questions on the computer, especially about matters that may carry perceived social stigma (Karabenick & Knapp, 1988; Turner et al., 1998; Weisband et al., 1996).

Research that has been released during the course of the studies described here, shows that computerized delivery of science-based health information to children and adolescents can be effective in transferring accurate understanding related to substance abuse (Marsch, Bickel & Badger, 2006; Schinke, Schwinn & Ozanian, 2005). Computerized delivery of social skill training has been shown to be effective in promoting self-reported assertiveness and decision-making skills, the former at a level equal to or higher than, a widely validated, instructor- delivered program (Marsch et al., 2006). Several studies of computer-based training for children with autism have shown positive impacts on social-cognitive deficits related to autism (Bernard-Opitz et al., 2001; Whalen et al., 2006).

There is not published research that shows the impact of computerized health and behavioral interventions on school outcomes, especially academic performance. Nor is there research that has tested the efficacy of coupling standardized group training for children or adolescents, with self-directed individualized, therapeutic interventions to address personal risk and protective factors. This summary study is an effort to begin the fill that gap.

By 2002, the computer-delivered SEL intervention examined here, Ripple Effects, was in use in more than 100 school districts around the United States. It is a comprehensive, skill-building intervention that addresses a wide range of risk and protective factors related to health, school success and social behavior.

There were compelling reasons to test its effectiveness, not the least of which is that it ensures greater implementation fidelity by keeping the content expertise "in the box," thus reducing dependence on instructor expertise. It is also more affordable than instructor delivered SEL, which requires extensive training to prepare teachers to deliver the material with

fidelity. It is also designed to enable individualized interventions, across a broad range of health, social, and behavioral subject areas.

In 2002, the National Institute on Drug Abuse (NIDA) of the National Institutes of Health funded a review of the intervention by an expert panel; completion of refinements to the content, based on that review; evaluation of the feasibility of changing from a disk-based, to a web-delivered platform; and, a test of the impact of the revised intervention on risk and protective factors among adolescents.

Expert review and revision of the program based on that review proceeded as planned. During that process it became clear that bandwidth constraints and security protocols argued against the envisioned Internet delivery of this intervention. The enterprise application was delivered on disks.

In the following year (2003-04), researchers began an evaluation of the impact of the revised Ripple Effects intervention on risk and protective factors among adolescents. The original experimental design was for a single, multi-site randomized control trial (RCT) of 600 students, under real world conditions, in schools where many students had multiple risk factors. During the recruitment phase it became apparent that differences in school structure and climate, student populations, technology capacity, and potential conditions of use, along with irreconcilable differences in how discipline data is collected across schools, all made it unlikely that meaningful results could be garnered from a single study. Methods of assignment to condition also differed across sites. In addition, the design of the Ripple Effects software (which allowed for customization of a scope and sequence to fit site-specific conditions) argued for splitting the single study into six smaller, site-based ones for more meaningful analysis.

Although the change to smaller sample sizes for analysis decreased the likelihood of detecting statistically significant effects, that risk was offset by the possibility of analyzing multiple, simultaneous, controlled trials, where site-specific adaptation was built-in, under

diverse, real-world, "business as usual" conditions.

Implementation of the original school-level interventions was completed in 2004. Administrative data was received over the following two years, and analyses completed in early 2008. We have reported results of the site-specific analysis elsewhere (Author names withheld, 2008). However, conclusion drawn from analyses of these smaller samples are vulnerable to both Type I and Type II errors. A posthoc, cross-study summary analysis of results for those variables that were standardized across schools could reduce the chance of those errors, and help separate consistent trends from singular anomalies.

Purpose

This article describes the results of cross-study impact analyses of Ripple Effects computerized SEL intervention on social behavior, school engagement, and academic achievement. In separate reports we consider cross-study findings related to norms and perception about alcohol and marijuana, as well as perception of locus of control (Author names withheld, 2008).

METHODS

Research Design

The six studies were longitudinal, randomized controlled trials (RCT). All six were conducted under a variety of real world conditions, with individual students as the unit of analysis. The evaluation period extended from 2003 to 2008, including baseline data collection, training, intervention, post-intervention data collection, follow-up data collection, and analysis.

Hypotheses. (1) Under real world school conditions, if given the opportunity and access to technology, treatment students would comply with group level requirements for use of the intervention; and (2) If treatment students had three or more hours of exposure to the computerized SEL intervention, their school outcomes (GPA, attendance, tardiness, suspensions, and discipline referral rates) would improve compared with control group students.

Role of developers. In order to minimize the potential for bias of having program developers involved in the research, the role of the program developers was circumscribed. Ripple Effects staff recruited study sites, conducted a three-hour training session with facilitators at each study site, provided technical support, obtained outcome data from school and district administrators, and conducted observations and interviews with participants. They were not involved in the delivery of the intervention, nor in the statistical analysis of quantitative outcomes. An independent research firm conducted the statistical analysis of all outcome data.

Method of assignment to condition. Method of random assignment to treatment or control condition varied by study. For the five RCTs, randomization was at the level of the individual student, assigned to a group, by computer, or by odd or even date of birth. For the quasi-experimental study, in the prior spring, two groups were hand-matched to create baseline equivalence, then in the fall, the flip of a coin selected one of them to be the treatment group, with the other becoming control. In all instances, control group students had access to the intervention at the end of the intervention study period.

Conditions of use. Treatment group students worked one-on-one on the computer to complete 42 tutorials in the intervention, during advisory, academic, or computer classes, two or more times per week, for six or more weeks, in the computer lab, library, or their regular classroom. In three schools, students took time away from core academic subjects to complete the intervention. Facilitators assigned tutorials, and monitored their completion, but otherwise played no role in delivering the content of the intervention. Control group students continued with "instruction as usual." In the three cases where students were pulled from academic subjects, instruction as usual consisted of continued regular coursework in the academic subject. For the three sites that used it during advisory

period, instruction as usual included the activities deemed appropriate to advisory at each site.

Participants

Recruitment and consent. Researchers recruited widely in Northern California, presenting the research opportunity to more than 30 school districts. Ultimately, a group of alternative schools in one urban district, and two schools in a second rural district, met the criteria for inclusion (willingness to use random assignment, technology capacity, plan for implementation, and data collection) and chose to participate. The studies received IRB approval. Active consent was required from student participants, and passive (opt out) procedures were used to obtain consent from their parents.

Settings. Six public schools participated. Four schools (one continuation high school, two alternative middle schools, and one charter middle/high school) were in a low income, violence-ridden section of a major west coast city. Two schools (one elementary and one high school) were in an economically depressed,

rural area, where marijuana is a major cash crop.

Sample. A total of 605 students participated in the six studies: 267 in the treatment group and 338 in the control. All had multiple risks for school failure and/or use of alcohol or marijuana. For all students, those risks included being in communities where medical marijuana is legally distributed and marijuana is readily available. For all students in the urban studies it included low socioeconomic status and high neighborhood crime. For many it included multiple, family-level risks, including illegal immigrant status, single-parent family structures, parental addiction and mental health problems. For rural students, the geographic isolation is both an educational risk, and a risk for higher rates of alcohol abuse. For students in half of the urban studies, there were additional, group level behavioral or performance risk factors that increased students' chance of school failure. These included their having previously been retained in a grade, dropped out, been expelled, or become involved with the juvenile justice system. Key demographic characteristics are reported in Table 1.

Table 1. *Demographic Characteristics of Sample by Study and Overall*

Demographic Factor	Overall (n=605)	Study 1 (n=117)	Study 2 (n=177)	Study 3 (n=53)	Study 4 (n=107)	Study 5 (n=31)	Study 6 (n=120)
Grade(s)	6-12	8	9-12	7	8-9	8	6
Average age	13.5	13.7	16.6	11.9	13.4	14.3	10.8
Gender							
Female	43%	27%	41%	42%	54%	46%	51%
Ethnicity							
African American	31%	67%	72%	2%	2%	78%	17%
Asian/ Pacific Islander	6%	2%	10%	2%	1%	4%	0%
Hispanic	32%	29%	17%	0%	3%	18%	83%
Native American	1%	0%	0%	9%	2%	0%	0%
White	30%	2%	1%	87%	91%	0%	0%
English language learner							
Yes	30%	27%	24%	0%	0%	19%	83%
Free/Reduced Lunch							
Yes	60%	80%	61%	36%	31%	100%	94%

School principals used a variety of methods to select the twelve implementers who facilitated the intervention, from flip of a coin at School 3, to professional or non-professional status at School 6. At this site, non-professionals (janitor, cafeteria aide, secretary, volunteer) were chosen to facilitate treatment group students, in the hopes of shoring up the their performance when compared to the certified teachers overseeing control group students. At other schools implementers included a social worker, a math teacher, and an English teacher. None were experts in social-emotional learning.

Intervention

The intervention was a subset of tutorials from Ripple Effects SEL software. Ripple Effects computerized SEL training is designed to build protective factors, reduce risk factors, and solve problems in a wide range of non-academic areas correlated with school success. The tutorials are reading-independent training modules, each consisting of from 10 to 12 different learning strategies, which take about 15 minutes, on average, to complete. Content is delivered using multiple media–photos, illustrations, videos, audio, peer voices reading aloud the text, and interactive exercises, all with a hip-hop look and feel.

At the time of this study, Ripple Effects teen version had 178 multimedia tutorials (390 as of 2008). The intervention examined here was a "self-efficacy" configuration of the software. Self-efficacy is the context-specific belief in one's capacity to master what is needed to succeed (Bandura, 1997). A scope and sequence was designed to promote cognitive, social and emotional capacity-building toward those intended ends. Students were to complete 42 tutorials, or roughly 14 contact hours, by working independently directly on the computer.

Twenty-one of the tutorials addressed self-efficacy, including social-emotional competencies that are linked to successful translation of belief in one's capacity for mastery, to actual mastery. During the three-hour, pre-intervention trainings at each site, staff collaboratively chose 21 additional tutorials to address their students' needs. All 136 remaining tutorials were available for students to privately address individual interests or risks, after completing their assigned tutorials.

Learning process. Independent of specific content, the *Whole Spectrum Self-Regulated Learning System* that powers Ripple Effects software contains elements that have been linked to successful development of self-efficacy: context-specific application, guided mastery, self-regulated learning, observational learning, systematic self-reflection, transfer training, and skill rehearsal (Bandura, 1997; Pajares & Urdan, 2006). Additional elements of the system include continuous assessment of content mastery through interactive games, reading independence through peer narration and illustrations, narrative/story as teaching tool, and positive reinforcement for completion of the learning process.

Implementer role and training. The role of the adult implementer was to select the site-specific tutorials, and then introduce the intervention at the first session, assign the tutorials, and check "electronic scorecards" to monitor dosage and ensure compliance. For each site, Ripple Effects staff provided implementers with a single three-hour training session to become familiar with the software, create the site-specific scope and sequence for the "implementer's choice" tutorials, and learn how to monitor student electronic scorecards for completion. They were not trained in, did not deliver, and did not facilitate discussion of, any of the assigned content.

Measures

The analysis included multiple quantitative and qualitative, process and outcome measures.
Quantitative process measures. Quantitative process measures included enrollment attrition, study attrition, intervention attrition (compliance), dosage and self-selection of optional tutorials.

We classified as "enrollment attrition" the percentage of students for whom there was no pre- or post- intervention data, because they had been removed from school. We classified as "study attrition" the percentage of students who were physically enrolled in school, but did not comply with study protocols, withdrew consent to participate, or did not complete the self-report surveys both before and again after the intervention. We classified as "intervention attrition" the percentage of treatment group students who had consented to the study but did not have minimal exposure to the intervention. Minimal exposure was defined as completion of interactive exercises from at least 12 tutorials (equivalent to roughly three contact hours, or 30% of the total assigned content). We included in dosage analysis all students who had at least three hours exposure to the software program. Exposure to self-selected content was a yes or no event; we did not analyze that dosage.

Quantitative outcome measures The outcome measures used in the analyses included GPA as a measure of academic achievement, attendance (percentage of days missed) and tardiness as measures of school engagement, numbers of discipline referrals and suspensions as measures of behavior, and school enrollment rates at one-year follow-up, as a measure of persistence of gains. For efficacy analyses, we included all students who had at least three hours exposure to the software program.

Data Collection

Compliance, dosage and concept mastery. Ripple Effects software automatically collected data on compliance and dosage. Dosage was directly tied to completion of the interactive games that measured concept mastery. If students were awarded points for a tutorial, it signified they had successfully provided all the correct answers to the game-like quiz.

School data. School administrators provided data on GPA, absenteeism, tardies, suspensions, and discipline referrals at the end of the first semester following completion of the intervention. They also provide student demographic data. The school districts provided some prior year and follow-up data two years after the initial data collection period, however, due to high mobility rates, in only one study did the sample represent a large enough percentage of students to allow meaningful analysis.

Method of Analysis

For all data with post-Ripple Effects values only (e.g., GPA for most schools), we ran independent-samples t-tests comparing the means of the treatment and control groups. For most schools, descriptive analyses of reported number of days absent, tardies, suspensions, and behavioral referrals indicated a severe restriction of range due to the relative non-occurrence of these events (e.g., the modal value for most of these outcomes was 0). Furthermore, skewness and kurtosis values suggested that these variables did not meet the distributional assumptions of parametric tests. Severely unequal variances can lead to increased Type I or Type II error, and, with smaller sample sizes, this effect can be increased. Games-Howell corrections are used when variances and group sizes are unequal. Therefore, we used the Games-Howell test as an appropriate correction for all outcomes data except GPA. To account for the unbalanced treatment and control group sizes, we randomly sub-sampled the control group to match the treatment group size.

One study, School 5, provided sufficient administrative data with pre and post values (GPA and absenteeism), to enable use of repeated-measures of analysis of variance (ANOVA) to examine whether or not some of the differences between treatment and control remain after taking into account where students started. Two studies, Schools 1 and 2, provided enough baseline and follow-up data to enable independent-samples t-tests comparing the single-year means of the treatment and control groups. To compare long-term effects on students who may be dispersed among many schools, we conducted independent-samples t-tests comparing the means of the treatment and

control groups of school district level enrollment data, one year post-intervention.

To establish dosage, Ripple Effects software created a password-protected file for each student and tracked completion of interactive exercises for each tutorial, assigning 100 points per exercise. This data was exported from each computer, with names decoupled from identifying numbers, and then data aggregated in centralized files. Dosage was calculated from the point count of each student's total number of completed interactive exercises, which divided by an average completion rate of four per hour, resulted in per-student hours of exposure.

To see if the number of hours of exposure to Ripple Effects was associated with differences in outcomes, we performed bivariate Pearson product-moment correlations. For each set of correlations, we used the Bonferroni method to minimize the chances of making a Type I error.

RESULTS

Baseline Equivalence

There was insufficient baseline data on school outcomes for the year prior to the study to confirm that students randomly assigned to treatment and control groups were equivalent academically at baseline. Three studies (Schools 1, 2, and 5) provided some data to determine equivalence. School 5 provided sufficient data to enable a separate analysis taking into account baseline differences, reported in Table 2.

Due to high mobility and dropout rates in the district that provided some baseline data, Schools 1 and 2 represented too small a percentage of the sample to allow ANOVA from pre to post intervention. Independent-samples t-tests on prior year data at these schools revealed no significant baseline differences between treatment and control groups on GPA or attendance, with treatment group students having somewhat lower GPA, and higher absenteeism scores at baseline.

Analysis of pretest surveys across all six schools also indicated no significant baseline differences between treatment and control groups for any self-report variable (locus of control, and attitudes towards alcohol and marijuana). The equivalence on self-report measures, randomized assignment to condition, and trends on prior year data, all suggest equivalence on school outcomes, but do not demonstrate it. It is possible that starting differences between control group students and those in the intervention group may be responsible for the post-intervention differences.

Table 2. *School 5 Treatment/Control Comparisons of Baseline Scores on GPA and Absenteeism for 2002-2003 School Year*

Outcome	Treatment		Control		
	M	SD	M	SD	Difference
GPA	1.10	.36	1.78	.87	-0.68
Absenteeism	0.19	.13	.15	.15	.04

Note: The sample consists of 14 students in the treatment group and 12 students in the control group.

Process Outcomes

Enrollment attrition. Administrative data indicated that during the intervention period 5% of the treatment group and 7% of the control group moved or left the participating schools, leaving 253 in the treatment group and 314 in the control.

Study attrition. Six percent of the treatment group and 3% of the control group withdrew consent to participate, and all of these came from a single study site (School 4). The built-in electronic monitoring, coupled with reports by the facilitators, indicated that one control group student had contact with the intervention (.3%), and thus was dropped from the study (remaining TG N = 238, CG N = 305).

Intervention attrition. Intervention attrition was defined as failure to receive minimal exposure to the intervention, defined as 30% of the assigned tutorials or at least three contact hours. Of the 238 treatment group students remaining after enrollment and study attrition, 83 (35%) did not receive minimal exposure to the self-regulated intervention.

Dosage. Mean dosage for those who complied was 77% of total required topics, which equaled 31 tutorials and approximately 10 contact hours, depending on student pace.

Participation in self-selection option. Among students who had minimal exposure, 96% also chose to privately explore tutorials beyond those assigned.

School Performance Outcomes

According to Table 3, there are significant differences in GPA and suspensions between treatment and control group students. Additionally, there were some statistically significant differences in the number of absences and tardies between treatment and control students for individual studies.

GPA. Across schools, students who participated in the Ripple Effects intervention had grades that were approximately 1/3 of a letter grade higher than the control students ($p < .01$). In three of the six studies (2, 3, and 5), Ripple Effects students had better grades than the control group students, ranging from approximately 1/2 to nearly a full letter grade higher than the control group students. There were no significant differences in academic GPA between the two groups of students in Schools 4 and 6, although there were significant differences at School 6 in social and personal responsibility GPA ($p < .01$).

Attendance. In general, the rates of absences were low for both groups of students. Students in the Ripple Effects group did not have better attendance at school than did students who did not participate in the intervention. For one study (School 1), students in the control condition had a lower rate of attendance of 0.001 (0.1%) when compared to the Ripple Effects group. This difference, while small, was statistically significant ($p < .05$).

Tardiness. Treatment students were less likely to come to class late than their peers in the control group, with an average of 1 tardy per student compared to 1.3 tardies per student for the control group. Five schools had reliable data to conduct the analyses for this outcome. Of those schools, only School 5 had significantly lower tardy rates for their Ripple Effects students. Schools 1, 3, and 6 had fewer tardies for treatment students than for the control students, but these values were not significant.

Suspensions. Ripple Effects students were less likely to be suspended than their peers in the control group, with treatment group suspensions at zero compared to a mean rate of 0.14 per student for the control group ($p < .05$). Schools 1, 2, and 6 had data to conduct the analyses for this outcome. All had fewer suspensions for Ripple Effects students than for the control students, but only at School 1 was the value significant ($p < .05$).

Table 3. *Differences in Student Outcomes for Treatment and Control Students*

School	Treatment Group			Control Group			Difference	Cohen's *d*
	N	Mean	SD	N	Mean	SD		
GPA								
All Schools	155	2.90	0.73	163	2.53	1.00	0.37**	0.42
School 1	21	2.41	1.03	19	1.68	0.94	0.73*	0.76
School 2	27	2.96	0.41	27	2.46	0.98	0.50*	0..68
School 3	23	3.20	0.77	26	2.23	1.22	0.97**	0.63
School 4	22	2.88	0.82	19	3.31	0.53	-0.44	0.96
School 5	14	2.26	0.62	14	1.46	0.99	0.79*	1.01
School 6	48	3.13	0.41	58	2.97	0.46	0.16	0.37
GPA Social Responsibility (School 6 only)								
School 6	48	3.13	0.44	58	2.76	0.47	0.37**	0.82
GPA Personal Responsibility (School 6 only)								
School 6	48	3.13	0.44	58	2.72	0.49	0.40**	0.88
Absenteeism (proportion of days absent to days enrolled)								
All Schools	156	0.03	0.08	160	0.04	0.08	0.01	0.00
School 1	21	0.00	0.00	21	0.001	0.00	-0.001*	0.00
School 2	27	0.16	0.11	21	0.16	0.12	0.00	0.00
School 3	23	0.01	0.01	26	0.01	0.02	0.00	0.00
School 4	22	0.00	0.00	19	0.00	0.00	0.00	0.00
School 5	14	0.00	0.01	15	0.01	0.02	-0.01	0.70
School 6	49	0.03	0.05	58	0.05	0.06	-0.02	0.40
Tardies[a]								
All Schools	129	0.93	1.70	140	1.25	1.96	-0.32	-0.32
School 1	21	0.90	1.84	21	1.95	3.03	-1.05	-1.05
School 3	23	0.52	0.79	26	0.65	1.36	-0.13	-0.13
School 4	22	1.64	2.19	19	0.95	1.87	0.69	0.69
School 5	14	0.00	0.00	16	0.44	0.73	-0.44*	-0.44*
School 6	49	1.08	1.82	58	1.59	1.86	-0.50	-0.50
Suspensions[b]								
All Schools	96	0.00	0.00	106	0.14	0.71	-0.14*	-0.14*
School 1	21	0.00	0.00	21	0.48	1.37	-0.48	-0.48
School 2	26	0.00	0.00	27	0.11	0.58	-0.11	-0.11
School 6	49	0.00	0.00	58	0.03	0.26	-0.03	-0.03

a: No data from School 2; b: No data from School 3, School 4, and School 5
* $p < 0.05$, ** $p < 0.01$

Prior Grades and attendance. In order to make appropriate judgments about whether the treatment actually had an effect on student outcomes, it is important to compare treatment and control students taking into account their grades and attendance patterns prior to the intervention. To examine whether or not some of the differences between treatment and control remain after taking into account where students started, we conducted repeated-measures ANOVAs with School 5, where we were able to obtain prior years' data.

There were statistically significant differences between the GPA gains for the treatment and control students. The treatment students increased their GPA by over one grade point, while the control students decreased their GPA by about 1/3 of a point. With respect to attendance, there were no statistically significant differences. The rates of absences were low for both groups of students. Table 4 shows the results of these analyses.

Table 4. *Pre-Post Analysis of Grades and Attendance, School 5*

| | Treatment Group (N = 14) | | | | | Control Group (N = 12) | | | | | Difference in Gain for the Two Groups |
| | Pre Test | | Post-Test | | | Pre Test | | Post-Test | | | |
M	SD	M	SD	Change	M	SD	M	SD	Change	
GPA											
1.10	0.36	2.26	0.62	1.16	1.78	0.87	1.44	1.04	-0.34		1.5**
Absences											
0.19	0.13	0.004	0.01	-0.186	0.15	0.15	0.01	0.01	-0.14		-0.046

$* p < 0.05$, $** p < 0.01$

Discipline referrals. Overall, there were no significant differences between Ripple Effects students and their peers in the control group in frequency of discipline referrals (Table 5). At most schools, the numbers of incidents were small. The treatment group generally had fewer referrals than the control group in all categories, ranging from 20 to 100% fewer. In 7% of cases, control group students had fewer referrals. None of these differences were statistically significant. School 5 had the largest differences between treatment and control, but the school's data also tended to have standard deviations that were double the size of the means. It is therefore not surprising that with such a wide range of responses, the differences between the treatment and control means, though large, were not statistically significant.

Dosage Effects

Across all schools, there were significant, small correlations between hours of Ripple Effects and absences $r(119) = -0.34$, $p = 0.002$, and between hours and GPA $r(118) = 0.28$, $p = 0.0001$ (Table 6). Among individual schools, there were no significant correlations at the 0.002 level. There were no significant correlations between hours and tardies or suspensions across the whole sample and within individual schools. When the sample was separated into dosage groups (minimum, moderate, and maximum), there were no

significant correlations for GPA, tardies, absences and suspensions (Table 7).

Twelve-month Follow-up on School Enrollment

Attempts to test whether positive effects persisted over time were partially successful. Follow-up administrative data for the 2004-05 school year, provided by the school district, allowed us to compare school enrollment rates at three schools, one year post-intervention. At School 1, 62% of treatment group students and 60% of control group students who were enrolled at the point of post-intervention data collection were still enrolled somewhere in the school district, a non-significant difference.

At both of the other schools, the differences were both substantive and significant. At School 2, 55% of treatment group students versus 26% of control students, were still enrolled somewhere in the school district one year post-intervention. This difference was significant, p<.05. This does not include students from either group who were in 12th grade at the time of the intervention and were no longer enrolled at follow-up. We cannot state with certainty whether the 12th graders all graduated, or some dropped out. At School 5, 71% of treatment group students and 36% of control group students who were enrolled at the time of post-intervention data collection, remained enrolled at 12-month follow-up, a substantial, significant difference, p<.05.

Table 5. *Differences in Average Number of Referrals for Ripple Effects and Control Students by School*

School and Discipline Category	Treatment		Control		Difference
	Mean	SD	Mean	SD	
All Schools	N = 129		N = 142		
Fighting/starting a fight	0.02	0.12	0.03	0.17	-0.01
Defiant or disruptive	0.43	2.67	1.02	4.06	-0.59
Total number of discipline referrals	1.34	9.83	3.03	12.83	-1.69
School 1	N = 21		N = 20		
Assault	0.00	0.00	0.05	0.22	-0.05
Defiant or disruptive	0.10	0.30	0.10	0.31	0.00
Drug use	0.00	0.00	0.05	0.22	-0.05
Fighting or starting a fight	0.00	0.00	0.05	0.22	-0.05
Threaten student	0.00	0.00	0.05	0.22	-0.05
Total number of discipline referrals	0.10	0.30	0.30	0.57	-0.20
School 3	N = 23		N = 26		
Defiant or disruptive	0.52	0.85	0.73	0.87	-0.21
Fighting or starting a fight	0.04	0.21	0.04	0.20	0.01
Sexual harassment	0.00	0.00	0.12	0.43	-0.12
Swearing	0.09	0.29	0.08	0.39	0.01
Talking	0.13	0.34	0.19	0.49	-0.06
Threaten student	0.13	0.34	0.00	0.00	0.13
Total number of discipline referrals	0.91	1.12	1.15	1.57	-0.24
School 4	N = 22		N = 22		
Assault	0.00	0.00	0.05	0.21	-0.05
Cut class	0.00	0.00	0.05	0.21	-0.05
Defiant or disruptive	0.18	0.40	0.09	0.29	0.09
Tardy	0.00	0.00	0.05	0.21	-0.05
Total number of discipline referrals	0.18	0.39	0.23	0.53	-0.05
School 5	N = 14		N = 16		
Defiant or disruptive	2.14	8.02	6.94	10.46	-4.79
Fighting or starting a fight	0.07	0.27	0.06	0.25	0.01
Name calling	0.71	1.54	2.56	4.40	-1.85
Swearing	2.14	8.02	5.94	10.04	-3.79
Talking	2.29	7.99	3.50	6.78	-1.21
Threaten adult	0.00	0.00	0.13	0.34	-0.13
Threaten student	0.71	2.67	0.13	0.34	-0.59
Walk out	1.86	5.39	4.06	8.21	-2.21
Total number of discipline referrals	9.93	29.28	23.31	32.34	-13.38
School 6	N = 49		N = 58		
Defiant or disruptive	0.14	0.46	0.19	0.61	-0.05
Fighting or starting a fight	0.00	0.00	0.02	0.13	-0.02
Swearing	0.00	0.00	0.02	0.13	-0.02
Threaten student	0.00	0.00	0.05	0.22	-0.05
Total number of discipline referrals	0.14	0.46	0.28	0.74	-0.14

* $p < 0.05$, ** $p < 0.01$

Table 6. *Correlations Between Dosage, GPA, Absences, Tardies, and Suspensions Across Schools and by School*

| | GPA | | Absences | | Tardies | | Suspensions | |
School	N	r	N	r	N	r	N	r
All Schools	118	0.28**	119	-0.34**	92	0.03	118	a
School 1	21	0.26	21	a	21	0.27	21	a
School 2	27	0.21	27	-0.39	0	a	26	a
School 4	22	0.34	22	a	22	-0.34	22	a
School 6	48	0.29	49	-0.04	49	0.08	49	a

a: Value could not be computed because at least one of the variables is missing or constant
** $p < 0.002$

Table 7. *Correlations Between Dosage, GPA, Absences, Tardies, and Suspensions, by Level of Dosage*

| | GPA | | Absences | | Tardies | | Suspensions | |
Level	N	r	N	r	N	r	N	r
Minimum	39	0.30	40	-0.13	24	-0.15	36	a
Moderate	43	-0.24	43	-0.09	33	0.13	29	a
Maximum	36	0.00	36	0.23	35	0.42	31	a

a: Value could not be computed because at least one of the variables is missing or constant
** $p < 0.002$

DISCUSSION

The data from this series of real-world studies suggest: a) If you make a technology-based SEL training option available and direct students to use it, according to their own learning style, a substantial majority will comply; b) If they minimally comply with the assignment, they will proactively use it to get private, individualized guidance in areas they select; and c) This combined use of the intervention is significantly correlated with higher GPA and fewer suspensions in the short term, and higher rates of continued school enrollment in the long term.

The mean compliance rate of 65% is valid for the studies overall, but rates were somewhat bi-modal. At three of the schools, 80% or more of eligible students at least minimally complied with the intervention protocol; at the other schools, from 37% to 61% did. We hypothesize that school climate, as well as individual motivation and ease of access to the technology, may be factors in compliance, and address these issues in another paper on implementation fidelity and compliance (Author names withheld, 2008).

Among students who were minimally exposed to the intervention, the data indicate almost all (96%) took advantage of the opportunity to privately explore areas of individual interest or concern. In fact, the school with the lowest average compliance rate, School 1, had the highest rate of individual use of the intervention for self-selected topics. Essentially, student choice transformed a group-level, secondary, preventive intervention, into an individualized, intensive tertiary intervention. This is a meaningful finding because this student population with multiple risk factors frequently has high rates of family and community-related trauma, but low rates of voluntary use of school counselors, or mental health professionals.

Third, across schools, minimal exposure to the combination of teacher-assigned and self-selected skill-building tutorials resulted in positive differences in academic performance when compared to control group students. The greatest effects were among the students with the most risks. That from three to ten hours of independent use of a computerized, social-emotional learning intervention was correlated with substantively and significantly better grades among diverse adolescents with multiple

risk factors is startling. We do not currently have a way to tease out causal mechanisms, including the relative value of the self-chosen, versus teacher-assigned components.

The intervention's apparent significant positive impact on suspensions, and trends toward positive impact on attendance, tardiness, and discipline referrals, suggests that the intervention may also offer a scalable means to increase school engagement, and improve school climate. Although reductions in discipline referrals were not statistically significant, the combination of large effects sizes and reduction to zero in the treatment group of many infractions that were also low in the control group, is substantively meaningful for practitioners. More research is needed to explore these findings further.

The fact that one year post-intervention, district level enrollment data for two of the three schools that tracked it, indicated treatment group students had continued enrollment rates more than twice as high as their control group counterparts suggest that this very short term, relatively inexpensive intervention may be a valuable tool for dropout prevention among students with multiple risk factors who currently account for the largest portion of the achievement gap.

Limitations

Insufficient baseline data. Only three of the six studies had prior year school data, and even that data was insufficient to enable useful analysis, limiting the ability to interpret the impact of the intervention on outcomes. In three of the six cases, the paucity of school baseline and follow up data was a function of the extreme transience of these student populations. Many have previously dropped out, move in and out of the juvenile justice system, and/or are from undocumented families that move frequently either to find work, or/and because they get behind in their rent and have to move. It is possible that the differences in outcomes can be attributable to starting differences between students. However, none of the data we could gather suggests that is the case.

Attrition bias. Thirty-five percent of treatment group students did not have minimal exposure to the intervention, and so were excluded from analysis of efficacy. It is possible that students who were not exposed were lower performing students overall and thus raised the average performance for the remaining treatment group students.

Small sample sizes. The small sample sizes were a function of the decision to allow site-specific adaptation of content and conditions of use as a real world test of effectiveness, despite the overall available sample size and scope of the research effort. Although these conditions increase the chance of both Type I and Type II error, they also increase the probability that the implementation and study can be replicated in diverse real world settings. The small sample sizes, coupled with large variances with behavioral data, also made it difficult to detect effects of the intervention on discipline referrals. The latter is indicative of a near universal school condition in which a few students account for much of the disruptive behavior.

CONCLUSION

Given recent findings on the failures of much educational technology to positively impact outcomes in the domains of math and reading, the potential positive impacts of social-emotional learning software are particularly promising. Further research is urgently needed to replicate these studies with larger samples, and see whether the promise shown here by computerized SEL training can be further validated. If so, it offers a more widely usable and easily scalable new tool in the effort to address one of the most pressing issues facing educators today: how to improve outcomes for youth with multiple risk factors for school failure, within the real-world constraints faced by our nation's public schools.

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Impact of Social-Emotional Learning Software on Attitudes About Marijuana and Alcohol Among Urban and Rural Adolescents

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ABSTRACT

A series of six concurrent longitudinal, experimental studies involving 605 students examined the impact on adolescent attitudes towards alcohol and marijuana of Ripple Effects computerized, social-emotional learning intervention. Students were surveyed before and after the eight week intervention, using statements from the Monitoring the Future survey. The data indicate that overall, Ripple Effects intervention did not impact attitudes about marijuana. Among African American youth, exposure resulted in significantly decreased perception of harm from marijuana. On the other hand, positive trends in every study and significant differences at one suggest it has promise in positively impacting attitudes about alcohol, a larger problem than marijuana use. The data reported here suggest a neutral to negative link between perception of harm from marijuana and positive school outcomes, an unexpected finding. Media attention to legalized use of marijuana in participating communities may be a factor.

KEY WORDS: Substance abuse prevention, adolescents, software, NIDA, drug abuse

BACKGROUND

Adolescent substance abuse has been consistently linked to behavior problems, school disengagement and academic failure (as well as to common external risk factors, such as family discipline patterns, mental health problems, poverty and community violence) (Hawkins, Catalano, Kosterman, Abbott, & Hill, 1999). A range of school-based programs have been developed to prevent substance abuse (Tobler, 1992; Tobler & Stratton, 1997). Strategies involving components of these programs have demonstrated effectiveness in changing adolescent behavior and/or attitudes (Gottfredson, Gottfredson & Skroban, 1998). Effective prevention programs draw from these research-validated strategies to provide character education and values training (Benninga, 1991); education to correct norms and perception of harm about drugs and alcohol (Tobler, 1992), training to promote self-efficacy (Pajares, 1996); and life-skills training to directly reduce substance abuse (Botvin,1990). Effective substance abuse prevention programs also provide training in core social-emotional competencies, (Elias et

al., 1994) including assertiveness and decision-making (Botvin, G., Baker, Dusenbury, Botvin, E. & Diaz, 1995). The most effective ones do it in ways that are culturally sensitive and inclusive (Banks, 1991; Dunn, 1993). They include interactive approaches to engage the target audience effectively (Connell, Turner, & Mason, 1985; Shope, Kloska, Dielman, & Maharg, 1994; Botvin, Schinke, Epstein, & Diaz, 1994; Perry & Kelder, 1992).

While evidence-based strategies for impacting key skills related to substance use have been widely recognized for more than a decade, an economical way to ensure that those strategies are transferred to students without loss of fidelity has been more elusive (Backer, 2001; Dusenbury, Brannigan, Falco, & Hansen, 2003). Computer technology may help address the issues of affordability and fidelity, through standardization of content and training delivery.

Over the past decade, a growing body of evidence suggests that technology-based training can be effective for substance abuse prevention. One early study showed that a school-based health promotion/behavior change CD-ROM-based program (*BARN*) resulted in reductions in risk-taking behavior in adolescents (Bosworth, et al., 1994). Research that has been released during the course of the studies described here, shows that computerized delivery of science-based health information to children and adolescents can be effective in transferring accurate understanding related to substance abuse (Marsch, Bickel & Badger, 2006; Schinke, Schwinn & Ozanian, 2005). Computerized delivery of social skill training has been shown to be effective in promoting self-reported assertiveness and decision-making skills, the former at a level equal to or higher than, a widely validated, instructor- delivered program (Marsch et al., 2006). There is also recent evidence for internet-delivered substance abuse treatment for adults (Carroll, Ball, Martino, et al., 2008; Brendryen & Kraft, 2008). There is not published research that has tested the efficacy of coupling standardized group training for children or adolescents, with self-directed,

individualized, therapeutic interventions to address personal risk and protective factors. This study is an effort to begin the fill that gap.

Ripple Effects is a computerized, social-emotional learning (SEL) intervention that addresses substance abuse, school disengagement and academic failure, as well as their common external and internal risk factors, and the core social-emotional competencies that are protective against them, in a single comprehensive, modular, interactive software application. In 2002, NIDA funded a three part SBIR proposal that included qualitative analysis of content, revision of the intervention based on that analysis, and quantitative analysis of objective school outcomes, as well as subjective attitudes toward marijuana and alcohol. Expert panel review of content was completed. Two written reports were produced and provided to Ripple Effects (Drug Strategies, 2002: Repa & Associates, 2002). The intervention was then substantially modified to conform to standards suggested by the review committee. That revised software was subsequently tested in a series of six studies. Analyses of data from this series of studies indicated significant positive effects of the Ripple Effects intervention on objective school outcomes. They provided contradictory evidence about effects on locus of control. Those findings are reported elsewhere (Author names withheld, 2008).

Purpose

The purpose of this article is to present the cross-study results of quantitative analysis of the impact of the Ripple Effects intervention on norms and perception of harm about alcohol and marijuana.

METHODS

Research Design

The cross study analysis includes six longitudinal, randomized controlled trials (RCT). All six were conducted under a variety of real-world conditions, with individual students as the unit of analysis. The evaluation period

extended from 2003 to 2008, including baseline data collection, training, intervention, post-intervention data collection, follow-up data collection, and analysis.

Role of developer in research. In order to minimize the potential for bias of having program developers involved in the research, the role of the program developers was circumscribed: they recruited study sites, provided a three-hour training session, provided technical support, and obtained outcome data from school and district administrators. They were not involved in the delivery of the intervention, nor in the statistical analysis of qualitative outcomes. A third party research firm conducted the statistical analysis of all outcome data.

Hypothesis. There were three hypotheses: (1) If students had the opportunity and direction to do so they would engage in self-regulated use of the intervention; (2) If students were exposed to the intervention, their disapproval and perception of risk of marijuana and alcohol increase; and (3) Strengthened norms against substance use would correlate with improved academic and behavioral school outcomes.

Method of assignment to condition. Method of random assignment to treatment or control condition varied by study. For five studies, randomization was at the level of the individual student, assigned to a group, by computer, or by odd or even day or month of birth. For the sixth study, in the prior spring, two groups were hand-matched to create baseline equivalence, then in the fall, the flip of a coin selected one of them to be the treatment group, with the other becoming control. In all instances, control group students had access to the intervention at the end of the intervention study period. There were 267 students randomly assigned to the treatment group, and 338 to the control.

Conditions of use. Treatment group students worked one-on-one on the computer to complete 42 tutorials in the intervention, during advisory, academic, or computer classes, two or more times per week, for six or more weeks, in the computer lab, library, or their regular classroom. Facilitators assigned tutorials, and

monitored their completion, but otherwise played no role in delivering the content of the intervention. Control group students continued with "instruction-as-usual."

Participants

Recruitment and consent. We recruited widely in Northern California, presenting the research opportunity to more than 30 school districts. Ultimately, a group of alternative schools in one urban district, and two schools in a second rural district, met technology-oriented criteria for inclusion, and chose to participate. The studies received IRB approval. Students provided active consent; passive consent procedures were used to obtain parental consent.

Settings. Six public schools participated. Four schools (one continuation high school, two alternative middle schools, and one charter middle/high school) were in low income, violence-ridden sections of a major west coast city, and two schools (one elementary and one high school) in an economically depressed, rural area, where marijuana is a major cash crop.

Sample. A total of 605 students participated in the six studies (Table 1). All had multiple risks for school failure and/or use of alcohol or marijuana. For all students, those risks included being in communities where medical marijuana is legally distributed and marijuana is readily available. For all students in the urban studies it included low socioeconomic status and high neighborhood crime. For many it included family level risk, including illegal immigrant status, single-parent family structures, parental addiction and mental health problems. For rural students, the geographic isolation is both an educational risk, and a risk for higher rates of alcohol abuse. For students in half of the urban studies, there were additional, group level behavioral or performance risk that increased students' chance of school failure. These included: having previously been retained in a grade, dropped out, been expelled, or become involved with juvenile justice.

Table 1. *Demographic Characteristics of Sample by Study and Overall*

Demographic Factor	Overall (n=605)	Study 1 (n=117)	Study 2 (n=177)	Study 3 (n=53)	Study 4 (n=107)	Study 5 (n=31)	Study 6 (n=120)
Grade(s)	6-12	8	9-12	7	8-9	8	6
Average age	13.5	13.7	16.6	11.9	13.4	14.3	10.8
Gender							
Female	43%	27%	41%	42%	54%	46%	51%
Ethnicity							
African American	31%	67%	72%	2%	2%	78%	17%
Asian/ Pacific Islander	6%	2%	10%	2%	1%	4%	0%
Hispanic	32%	29%	17%	0%	3%	18%	83%
Native American	1%	0%	0%	9%	2%	0%	0%
White	30%	2%	1%	87%	91%	0%	0%
English language learner							
Yes	30%	27%	24%	0%	0%	19%	83%
Free/Reduced Lunch							
Yes	60%	80%	61%	36%	31%	100%	94%

Intervention

The intervention was 10-14 contact hours of self-regulated use of Ripple Effects software over eight weeks in the fall of the 2003-2004 school year. Students were to complete 42 tutorials by working independently directly on the computer. Ripple Effects computerized SEL training is designed to build protective factors, reduce risk factors, and solve problems in a wide range of non-academic areas correlated with school success. At the time of this study, Ripple Effects teen version had 178 multimedia tutorials (390 as of 2008). The tutorials are reading-independent training modules each consisting of from 10 to 12 different learning strategies, which take about 15 minutes, on average, to complete. Content is delivered using multiple media–photos, illustrations, videos, audio, peer voices reading aloud the text, and interactive exercises, all with a hip-hop look and feel.

The intervention examined here was a "self-efficacy" configuration of the software. Self-efficacy is the context-specific belief in one's capacity to master what is needed to succeed (Bandura, 1997). A scope and sequence was designed to promote cognitive, social and emotional capacity-building toward those intended ends. Twenty-one of the tutorials addressed "core components" of self-efficacy, including taking control, setting goals, understanding learning style, self-regulation, expectations about the future, and problem-solving. Four tutorials, translating into roughly one hour, or 10% of the intervention, were directly related to substance abuse: norms about drugs, substance abuse, marijuana, and alcohol. Those tutorials were in turn linked to further training in assertiveness and resisting peer pressure.

To supplement the core tutorials, each site chose 21 additional, site-specific tutorials to assign from the 157 still available. All 136 remaining tutorials were then available for students to privately address individual interests or risks, after completing their assigned tutorials. Facilitators assigned tutorials, and ensured compliance. They received a single, three-hour training session in preparation for this role.

Measures

The analysis included multiple, quantitative and qualitative, process and outcome measures.

Quantitative process measures. Quantitative process measures included enrollment attrition, study attrition, intervention attrition, dosage, and choice to explore self-selected content. We classified as "enrollment attrition" the percentage of students for whom there was no pre- or post-intervention data, because they were no longer enrolled in the school. We classified as "study attrition" the percentage of students who were physically enrolled in school, but did not comply with study protocols, withdrew consent to participate, or did not complete the self-report survey before and after the intervention. We classified as "intervention attrition" the percentage of treatment group students who had consented to the study but, for whatever reason, did not have minimal exposure to the intervention, defined as completion of interactive exercises from at least 12 tutorials (equivalent to roughly three contact hours, or 30% of the total assigned content). Exposure to self-selected content was a yes or no event. We did not analyze that dosage.

We included in efficacy analysis of this self-regulated intervention, all students who had minimum exposure of three hours contact with the software application and completed both the pretest and the posttest to enable measures of change in attitudes.

Quantitative outcome measures. Quantitative outcome measures included measures of concept mastery, objective school achievement measures, and two self-report measures. Scores logged by the computer for completion of "got its" (game-like, multiple-choice assessments), documented mastery of basic concepts. Objective measures were grades, tardies and absenteeism, and discipline-related data, including suspensions. At one school the discipline-related data included number of drug or alcohol related offenses.

A reading-independent, peer-narrated, computer-based survey, taken before and again two weeks after the intervention, measured longitudinal changes in student attitudes towards alcohol and marijuana for both treatment and control groups. The Norms and Perception of Harm about substance abuse scales were extracted from the full series of Monitoring the Future (MTF) surveys, a widely validated set of scales that has been used with high-schoolers since 1975, and with 8th graders since 1991, as part of an ongoing national study. The reliability coefficient for the REMTF scale on norms and perceptions about alcohol was 0.74, so norms and perceptions were analyzed together, while the coefficients for marijuana norms (0.88) and risks (0.85) were sufficiently high to enable them to be analyzed separately.

Perceived risk is measured by a question asking, "How much do you think people risk harming themselves (physically or in other ways), if they . . ." ". . . try marijuana once or twice," for example. The answer categories are "no risk," "slight risk," "moderate risk," "great risk," and "can't say, drug unfamiliar." Disapproval is measured by the question "Do YOU disapprove of people doing each of the following?." followed by "trying marijuana once or twice," for example. Answer categories are "don't disapprove," "disapprove," "strongly disapprove." The full set of questions is listed in Appendix A.

Ripple Effects adapted the delivery format of the MTF scales (REMTF) from adult-delivered and paper-based, to student-driven and computer-based. Ripple Effects adapted the design to a hip-hop look and feel, and multimedia, reading-independent, computerized delivery that is more culturally relevant for urban youth and less likely to be biased by reading level. The structure is game-like, with reinforcement built into the system, without prejudice for any answer. This allowed automatic data collection, which could later be linked to individual student outcomes, without compromising privacy.

Data Collection

Compliance, dosage and concept mastery. Ripple Effects software automatically collected data on compliance and dosage rates. Dosage

was directly tied to completion of the interactive games that measured concept mastery. If students were awarded points for a tutorial, it signified they had successfully provided all the correct answers to the quiz.

School data. School administrators provided data on GPA, absenteeism, tardies, suspensions, and discipline referrals at the end of the first semester following completion of the intervention. They also provide student demographic data. The school districts provided some prior year and follow-up data two years after the initial data collection period.

Self-report data. During the Fall of 2003, as part of their regular school activities, students completed the computer-based survey described above, before and within two weeks after the six to eight week intervention. Files containing their responses were stored on the computer, linked to individual student school IDs. Data was aggregated for analysis. At least 12 weeks elapsed from teacher training to final survey.

Method of Analysis

We ran repeated-measures ANOVAs with a between-subjects factor (study group). The set of control variables included ethnicity, gender, LEP, and free or reduced lunch status, as a measure of socioeconomic status.

To see if the number of hours of exposure to Ripple Effects was associated with differences in outcomes, we ran bivariate Pearson product-moment correlations. We ran partial correlations on the posttest data that controlled for the effect of the pretest covariate. For each set of correlations, we used the Bonferroni method to minimize the chances of making a Type I error.

Because the intervention attrition (non-compliance) rate further reduced the treatment group beyond the study attrition that impacted both treatment and control groups, the end result was unbalanced treatment and control group sizes. Thus we randomly sub-sampled the control group to match the treatment group size.

RESULTS

Baseline Equivalence

Analysis of pre-test surveys indicated no overall significant baseline differences between treatment and control groups for norms or risk related to alcohol and marijuana. Some variations based on ethnicity and gender were expected and found, and were controlled for in the analysis.

Process Outcomes

Enrollment attrition. Administrative data indicated that during the intervention period, 5% of the treatment group, and 7% of the control group, moved or left the participating schools (remaining TG N = 253, CG N = 314).

Study attrition. There were three components of study attrition: withdrawal of consent, contamination, and failure to complete the self-report surveys before and after the intervention. Six percent of the treatment group and 3% of the control group withdrew consent to participate, and all of these came from a single site (School 4). The built-in electronic monitoring, coupled with reports by the facilitators, indicated that one control group student had contact with the intervention (.3%), and thus was dropped from the study (remaining TG N = 238, CG N = 305).

After accounting for the above, roughly 30% of each group failed to provide self-report data at either pretest or posttest, or both. If they did not complete the pretest, treatment group students were still included in the intervention, since administrative data was available for them and objective school outcomes could be measured. They were not, however, included in measures of impact on attitudes towards marijuana and alcohol.

Intervention attrition. Intervention attrition was defined as lack of minimal exposure to the intervention, defined as 30% of the assigned tutorials. Of the 238 treatment group students remaining in the study after enrollment attrition, and withdrawal of consent, 35% did not meet the minimum standards for compliance of at least three hours exposure to the intervention (Remaining compliant TG N = 155).

Of the 155 treatment group students who had minimal exposure, 110 (71%) completed surveys at both pre and post. Seventy percent of control group students (214) completed both surveys. Although the rates of completion of self-report surveys were very close, having the additional requirement of completion of a minimal number of tutorials within the treatment group, resulted in that group being smaller. To equalize the groups, we randomly sub-sampled the control group. This resulted in 110 control group students being included in the analysis.

Analysis of dosage. Mean dosage for those who complied was 63% of total required topics, approximately 6.5 contact hours, depending on student pace. Analysis of dosage further indicated that treatment group students who met requirements of minimum exposure successfully completed no fewer than 12 different measures of concept mastery, with a mean of 26.

Independent exploration of additional topics. Among students who complied, 96% also chose to privately explore tutorials addressing risk and protective factors beyond those assigned. These individual explorations included a number of drug and alcohol-related topics including "alcoholic/addicted parent," "ecstasy," "crack," and "meth."

Quantitative Outcomes on Attitudes Towards Alcohol and Marijuana.

According to Table 2, there are no overall differences between the Ripple Effects students and the control group students in how they perceived norms and risks associated with alcohol and marijuana, from pre to post assessment, controlling for pre-assessment scores. There was one study site where the Ripple Effects students differed meaningfully from the control group students. At School 4, students' perceptions of alcohol norms and risks were significantly higher in the treatment group than the control. There are trends across schools, however, that may be worth exploring in future work with larger samples. All values are reported in Table 2. Higher values equal greater perception of risk or disapproval.

Trends by Study Site

Alcohol norms and risks. Across all sites, the treatment group had a greater gain in perceptions of norms and risks than did the control group. This trend was also seen in three schools: School 4, School 2, and School 6. As noted above, the difference for School 4 was significant, p = 0.013.

Marijuana norms. Pre and posttest norms about marijuana were similar for the treatment and control conditions with generally minimal difference in score gain. For two schools, School 3 and School 4, the treatment students had higher gains than the control students.

Marijuana risk. Control students generally had higher gains in risk scores than did their counterparts in the treatment group. Differences were often small, less than a point on average.

Trends by Ethnicity

Among African American students, the treatment group tended to have smaller gains in all alcohol and marijuana scores than did the control students. For marijuana risk, this gain difference was statistically significant, *p* = 0.031. Latino/a and Caucasian students generally had higher gains in the treatment condition than the control, but these differences were not significant for either ethnic group (Table 3).

Dosage Effects

We conducted partial correlations for the alcohol norms and risks, marijuana norms, and marijuana risks post test scores, controlling for the pretest scores. Across and within schools, there were no significant correlations. There were also no significant correlations with substance use norms and risks within minimum, moderate and maximum dosage levels. All values are reported in Tables 4 and 5.

Table 2. *Differences in Perceptions of Risk by Treatment and Control Group for All Studies and By Study*

| | | Treatment Group | | | | | | Control Group | | | | | Diff. in Gain for the 2 Groups |
| | | Pre Test | | Post-Test | | | | Pre Test | | Post-Test | | | |
Study	N	Mean	SD	Mean	SD	Change	N	Mean	SD	Mean	SD	Change	Groups
Alcohol Norms and Risks (Alpha: Pre and post test = 0.71)													
All Studies	110	15.14	4.04	15.65	3.67	0.51	118	14.97	3.74	15.08	4.23	0.11	0.40
Study 1	8	15.75	2.31	16.06	2.68	0.31	10	15.30	3.37	16.60	3.92	1.30	-0.99
Study 2	16	15.94	3.60	15.94	4.12	0.00	16	15.00	4.69	17.06	5.27	2.06	-2.06
Study 3	23	14.04	3.51	14.48	2.73	0.44	26	14.31	3.39	14.54	3.99	0.23	0.21
Study 4	12	12.17	3.79	14.25	4.71	2.08	12	14.42	4.06	10.83	3.81	-3.59	5.67*
Study 5	13	17.38	3.23	14.69	2.81	-2.69	11	15.00	3.58	14.00	5.67	-1.00	-1.69
Study 6	38	15.50	4.59	16.92	3.79	1.42	43	15.43	3.74	15.77	2.73	0.34	1.08
Marijuana Norms (Alpha: Pretest = 0.87, Post test = 0.82)													
All Studies	110	6.79	2.68	6.98	2.23	0.19	118	6.77	2.46	7.06	2.56	0.29	-0.10
Study 1	8	6.75	2.82	7.13	2.64	0.38	10	7.00	2.49	7.90	2.33	0.90	-0.52
Study 2	16	5.44	2.90	6.13	2.16	0.69	16	5.63	2.96	7.31	3.42	1.68	-0.99
Study 3	23	6.43	2.15	6.87	1.89	0.44	26	7.31	2.15	6.65	2.45	-0.66	1.10
Study 4	12	4.42	2.07	5.83	3.46	1.41	12	4.75	2.09	5.00	2.17	0.25	1.16
Study 5	13	8.31	0.85	5.69	1.93	-2.62	11	6.73	2.76	6.36	2.46	-0.37	-2.25
Study 6	38	7.82	2.72	8.18	1.33	0.36	43	7.40	2.09	7.77	2.11	0.37	-0.01
Marijuana Risk (Alpha: Pretest = 0.85, Post test = 0.82)													
All Studies	110	8.75	3.30	8.77	2.95	0.02	118	8.30	3.31	8.72	3.24	0.42	-0.40
Study 1	8	9.25	2.49	8.44	2.44	-0.81	10	7.90	3.31	10.10	2.85	2.20	-3.01
Study 2	16	8.19	3.15	9.50	3.31	1.31	16	6.63	2.92	8.13	3.90	1.50	-0.19
Study 3	23	8.17	2.98	7.70	2.36	-0.47	26	9.19	2.83	8.77	2.67	-0.42	-0.05
Study 4	12	6.25	3.11	8.17	3.81	1.92	12	6.25	2.96	5.42	2.35	-0.83	2.75
Study 5	13	10.54	1.76	7.69	3.45	-2.85	11	7.36	4.03	8.27	4.52	0.91	-3.76
Study 6	38	9.39	3.70	9.71	2.43	0.32	43	9.28	3.19	9.63	2.64	0.35	-0.03

Note: * $p < 0.05$, ** $p < 0.01$

Table 3. *Differences in Norms and Perceptions of Risk by Treatment and Control Group by Ethnicity*

Ethnicity	N	Treatment Group Pre Test Mean	SD	Post-Test Mean	SD	Change	N	Control Group Pre Test Mean	SD	Post-Test Mean	SD	Change	Difference in Gain for the 2 Groups
Alcohol Norms and Risks (Alpha: Pre and post test = 0.71)													
African American	32	16.69	3.02	15.69	3.48	-1.00	35	15.57	4.72	15.06	4.65	-0.51	-0.49
Latino/a	40	15.23	4.57	16.86	3.67	1.63	47	15.16	3.02	16.23	3.55	1.07	0.56
Caucasian	32	13.41	3.76	14.34	3.54	0.93	33	14.24	3.55	13.33	4.35	-0.91	1.84
Marijuana Norms (Alpha: Pretest = 0.87, Post test = 0.82)													
African American	32	7.00	2.46	6.38	2.30	-0.62	35	5.91	2.58	6.91	2.68	1.00	-1.62
Latino/a	40	7.50	2.82	7.93	1.49	0.43	47	7.55	2.15	7.83	2.30	0.28	0.15
Caucasian	32	5.53	2.26	6.63	2.50	1.10	33	6.33	2.33	5.97	2.39	-0.36	1.46
Marijuana Risk (Alpha: Pretest = 0.85, Post test = 0.82)													
African American	32	9.53	3.14	8.50	3.30	-1.03	35	6.97	3.16	8.26	3.66	1.29	-2.32*
Latino/a	40	9.15	3.46	9.61	2.48	0.46	47	9.36	3.19	9.83	2.74	0.47	-0.01
Caucasian	32	7.41	3.20	8.06	2.78	0.65	33	8.06	3.26	7.52	3.04	-0.54	1.19

* $p < 0.05$

Table 4. *Correlations Between Dosage and Substance Use Norms and Risks, By Study and for All Studies*

	Alcohol Norms/Risks		Marijuana Norms		Marijuana Risks	
Study	N	R	N	R	N	r
All Studies	74	-0.14	74	0.21	74	0.10
Study 1	8	0.50	8	-0.67	8	0.65
Study 2	16	0.47	16	0.26	16	0.08
Study 4	12	-0.23	12	-0.002	12	0.02
Study 6	38	-0.02	38	0.33	38	0.09

Table 5. *Correlations Between Dosage Levels and Substance Use Norms and Risks Across Studies*

	Alcohol Norms/Risks		Marijuana Norms		Marijuana Risks	
Dosage Level	N	R	N	r	N	r
Minimum	23	0.14	23	0.26	23	-0.06
Moderate	27	-0.29	27	-0.01	27	-0.04
Maximum	24	0.08	24	-0.19	24	0.04

Correlation With Objective School Outcomes

As reported separately, across studies, students exposed to the Ripple Effects computerized intervention had better objective school outcomes than control group students on two school measures, GPA (p<.01), and suspensions (p<.05), and meaningfully, but not significantly fewer discipline referrals (Author names withheld, 2008). One-year follow-up data showed significantly higher continued enrollment, suggesting that positive school outcomes persisted.

Prior research has linked these positive school outcomes with higher scores on norms and perception of harm about drugs and alcohol. Yet in this series of six studies, while differences in scores on attitudes toward alcohol were in the same direction as differences in school outcomes, treatment group scores on attitudes toward marijuana trended toward the opposite direction. This runs contrary to hypothesized correlations. The two competing exceptions to neutral findings: that rural, mostly Caucasian treatment group students had significantly higher post-intervention scores for perception of harm of alcohol, and that urban, African American students had significantly lower post-intervention scores for perception of harm of marijuana, presents some intriguing questions, but fails to clarify the findings. All of this is further muddied by the fact that among the same African American population where perception of harm of marijuana was reduced, at the only study site which kept records of disciplinary offenses related to drug and alcohol use, treatment groups scores were lower than control group scores (TG M = 0, SD = 0 vs. CG M = .05, SD = .22).

DISCUSSION

Analysis of data across this series of six studies cannot confirm that Ripple Effects intervention results in greater perception of harm of marijuana and alcohol, nor in stronger norms against their use by adolescents. Trends were toward higher perception of harm and norms against alcohol, with a positive significant difference in one rural school, but lower perception of harm and norms against marijuana, with a negative significant difference in perception of harm among urban African American students. Yet the self-regulated intervention, which was configured to promote self-efficacy and reduce adolescent substance (ab)use did result in significantly higher grades, lower suspensions and meaningfully, but not significantly fewer discipline referrals. What might account for this mismatch of findings?

There are at least two potential explanations for the negative trends regarding perception of harm of marijuana. One involves the fact that these studies were carried out after a voter initiative had legalized medical use of marijuana in this state. During the period of the study, there was extensive media coverage about risks and benefits of marijuana, arising as a result of the federal government's decision to prosecute providers of medicinal marijuana within the study's catchment area during this period. This included major coverage of potential beneficial health effects of marijuana, especially in communities with high HIV rates. This category includes the urban center that was the context for four of the six studies in this series.

During the period of the study, several medical marijuana clubs chartered by the city were raided by the federal government, temporarily closed, and re-opened. A highly respected local doctor was arrested for his participation in the distribution of medical marijuana, an act that conformed with state law. A great deal of local press covered these events. The doctor who was arrested became something of a local martyr. Most editorials supported the continuation of medical marijuana clubs.

Each tutorial in the Ripple Effects intervention, includes a media analysis activity. The marijuana lesson encourages students to look critically at how marijuana use is portrayed in popular culture, and to examine how that has affected their own attitudes. This part of the program may have backfired in the context of these studies. The media analysis activity potentially heightened student awareness of news coverage about these events. The whole process may have strengthened marijuana's position as a legitimate, alternative medicine, especially among students who became attuned to this issue (i.e., students in the intervention group, as compared with the control group). Anecdotal evidence that the medical marijuana issue impacted student responses to the marijuana 'perception of harm' items was provided by one boy during a site visit who specifically inquired about medical marijuana in response to the marijuana 'perception of harm' item questions.

A second possibility is that students got the 'wrong message' from the full set of lessons about drugs and drug use. Content about marijuana is addressed directly in the marijuana tutorial and indirectly in tutorials about cocaine, methamphetamines, and other substances, which some students independently explored. Because the tutorials on methamphetamines and cocaine ascribe more harmful potential effects to those substances than the tutorial on marijuana ascribes to marijuana, it is plausible that students concluded marijuana is less harmful *relative to those other substances* and hence their perception of harm from marijuana use decreased. More study would be needed, including in population centers where medical marijuana is not allowed, to tease out these differences.

Neutral results with trends toward negative outcomes regarding norms about marijuana present more interesting questions. There are two separate meanings of "norms" implicit in the norms scale for MTF survey. The first reflects the statistical meaning of "norm." That is, it queries about perception of frequency of use by peers (never, once, occasionally, and frequently). The second refers to the value judgments placed on that frequency – the rightness or wrongness of use. It asks students to rate their disapproval of use of marijuana at various levels of frequency.

It is entirely possible, as mentioned above, that directing attention to news coverage of widespread use of marijuana in their community resulted in the treatment students' perception of greater use by their peers. As for the second meaning, the direct normative message conveyed in the tutorial on marijuana in *Ripple Effects Software* is: marijuana use is illegal and hence wrong. However, the message in the tutorial entitled "norms" is less rigid. Ripple Effects is a social-emotional learning intervention, which promotes attachment to community and appreciation for diversity. Cultivating disapproval of peers is not an objective of the training software. In this context it is possible that students would decide that using marijuana is a poor personal choice for themselves, without needing to also make a judgment about approval or disapproval of peer usage.

Further study is warranted in communities where marijuana is not a major cash crop (our rural catchment area) and where medical marijuana is not a front-burner political or health care issue (our urban catchment area).

Study Limitations

Measurement instrument. One limitation of this study was the basic premise of the measurement instrument, which uses social disapproval as a marker for actual substance use, and related outcomes. We chose this MTF measure because it was previously validated and widely used. However, future research might benefit from instruments that could separate social intolerance from other useful measures of adolescent attitudes towards marijuana use, such as awareness that it can cause short term memory loss, or result in doing things that make them look stupid.

CONCLUSION

Data from this series of six studies indicate that Ripple Effects intervention has not been effective at positively impacting attitudes about marijuana; and among African American youth, exposure to the intervention resulted in significantly diminished perception of harm from marijuana. However, when it comes to norms and perception of harm about alcohol, positive trends in every study in this series and significant differences at one, indicate it has promise in positively affecting attitudes about alcohol. Since use of alcohol is a much larger problem among both rural and urban adolescents than marijuana is, this result should not be minimized. Previously, both academic and behavioral outcomes have been linked to attitudes toward norms and harm about alcohol and marijuana. Yet the data reported here suggest a neutral to negative link between perception of harm from marijuana and positive school outcomes. We have suggested some explanatory hypotheses, including the fact that marijuana has been legalized for medical use in both the urban and rural communities in this study. There are other hypotheses to explore, including the possibility that neither fear nor social disapproval are the best motivators to reduce adolescent attraction to marijuana, nor to increase their commitment to school. The only conclusion that can be drawn here is that the Ripple Effects training software is more effective as an academic and behavioral intervention than as one to harden attitudes against marijuana use.

APPENDIX A.

Norms and Perceptions About Drugs Scale (Adapted from Monitoring the Future)

Answer choices: Don't Disapprove (1). Disapprove (2) Strongly Disapprove (3) Can't Say, Drug Unfamiliar (4)

1. Individuals differ in whether or not they disapprove of people doing certain things. Do YOU disapprove of people smoking one or more packs of cigarettes per day?
2. Do YOU disapprove of people trying one or two drinks of alcohol, like beer, wine, or liquor?
3. Do YOU disapprove of people taking one or two drinks nearly every day?
4. Do YOU disapprove of people having five or more drinks once or twice each weekend?
5. Do YOU disapprove of people trying marijuana once or twice?
6. Do YOU disapprove of people smoking marijuana occasionally?
7. Do YOU disapprove of people smoking marijuana regularly?
8. Do YOU disapprove of people trying ecstasy once or twice?
9. Do YOU disapprove of people taking ecstasy occasionally?
10. Do YOU disapprove of people taking ecstasy regularly?
11. Do YOU disapprove of people trying crack once or twice?
12. Do YOU disapprove of people using crack occasionally?
13. Do YOU disapprove of people using crack regularly?
14. Do YOU disapprove of people trying meth -- also called ice, crank, or speed -- once or twice?
15. Do YOU disapprove of people taking meth occasionally?
16. Do YOU disapprove of people taking meth regularly?
17. Do YOU disapprove of people trying hallucinogens like LSD or mushrooms, once or twice?
18. Do YOU disapprove of people taking hallucinogens occasionally?
19. Do YOU disapprove of people taking hallucinogens regularly?

[Next questions have five response categories:]

1 No risk, 2 Slight risk, 3 Moderate risk, 4 Great risk, 5 Can't Say; Drug unfamiliar

20. How much do you think people risk harming themselves (physically or in other ways), if they smoke one or more packs of cigarettes per day?
21. How much do you think people risk harming themselves if they try one or two drinks of alcohol--meaning beer, wine, or liquor?
22. If they take one or two drinks nearly every day?
23. If they have five or more drinks once or twice each weekend?
24. How much do you think people risk harming themselves if they try marijuana once or twice?
25. If they smoke marijuana occasionally?
26. If they smoke marijuana regularly?
27. How much do you think people risk harming themselves if they try ecstasy once or twice?
28. If they take ecstasy occasionally?
29. If they take ecstasy regularly?
30. How much do you think people risk harming themselves if they try crack once or twice?
31. If they use crack occasionally?
32. If they use crack regularly?
33. How much do you think people risk harming themselves if they try meth-- also called ice, crank, or speed-- once or twice?
34. If they take meth occasionally?
35. If they take meth regularly?
36. How much do you think people risk harming themselves if they try hallucinogens, like LSD or mushrooms, once or twice?
37. If they take hallucinogens occasionally?
38. If they take hallucinogens regularly?

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Computer-Based Training to Promote Adolescent Self-Efficacy: Ethnicity, Urban or Rural Status, and Impacts on Locus of Control

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ABSTRACT

A series of six experimental studies tested the impact on adolescent locus of control (LOC) of computer-based, cognitive-behavioral and social-emotional training, configured to develop self-efficacy. Post-intervention, treatment group students were significantly more likely to attribute outcomes to fate than control group students. Urban African American and Caucasian treatment group students were also more likely to attribute outcomes to self and to others. Rural treatment group students were less likely to attribute life events to self. In one study, the difference was significant. Latinos had meaningfully, but not significantly greater positive impacts on LOC than other groups. Across all groups, academic outcomes for treatment group students were significantly higher than for students in the control group, challenging the notion that LOC and school outcomes are directly correlated.

KEY WORDS: computer-based self-efficacy training; locus of control; adolescents; ethnicity; rural youth; urban youth

BACKGROUND

The concept of agency is an ancient and a simple one: the belief that individuals are makers of their own lives. Arguments over validity of that belief have endured for centuries and periodically are renewed across disciplines. Social science, a set of disciplines much younger than the argument, has reframed agency theory in terms of two key mechanisms: "locus of control" and "self efficacy." They are not mutually exclusive terms. Julian Rotter, influenced by behavioral psychology, posited that: 1) perceived patterns of reinforcement lead individuals to attribute control of life events either to self, or to external forces, loosely defined as "fate;" 2) the resultant perception of where control resides, independent of objective measures of it, strongly influences those life events, which in turn reinforce perceptions in a feedback loop (Rotter, 1966). His followers refined this theory to differentiate among external sources of control, separating attribution to fate, from attribution to other people (Wallston, B. S., Wallston, K. A., Kaplan, & Maides, 1976) and to socio-political contexts (Paulhus, 1983).

Alfred Bandura, in specifying mechanisms of agency, turned from attribution after the fact, to a forward-leaning assessment of personal capacity for competence. He popularized the term "self-efficacy" as a developmentally emerging, enabling (not merely protective) belief in one's own capacity for mastery

(Bandura, 1986, 1997). It is this belief in personal capacity that propels a person to actually master context-specific requirements to achieve intended ends. Through the resulting competence, individuals can attract, leverage and/or transcend "fortuitous events" to influence – if not control – their fate. This autonomous self-efficacy is realized in the context of community, rather than in opposition to it (Bandura, 1997). An alternate understanding of self-efficacy is a more generalized, less context-specific belief in one's personal power to affect internal and external reality, closer to Rotter's original notion of locus of control (LOC) (Schwarzer & Jerusalem, 1995).

Understandings of both self-efficacy and LOC, can be differentiated from self-esteem, which is an affective measure of worth, rather than a cognitive awareness of either control, or capacity for competence. All may be included in the global term, "self-concept," which provides a reflective impression of beliefs about self in terms of physical, social, emotional, and transpersonal elements. It answers the question "Who do I believe I am?" This often includes, but is not limited to, "What do I think I am capable of doing?" and "What value do I place on that?" This self-concept may present itself in the foreground or background of life events and the environment; that placement defines locus of control. In all of these cases, beliefs simultaneously shape the image and propel the conclusions drawn from it.

A number of proven-effective, school-based, instructor-delivered interventions, such as *Second Step* for violence prevention (Grossman, Neckerman, Koepsell, Liu, Asher, Beland, et al., 1997), *Positive Action* to promote self-confidence as a protective factor (Flay & Allred, 2003), and *Life Skills Training* for substance abuse prevention (Botvin, G., Baker, Dusenbury, Tortu, & Botvin, E., 1990), draw heavily from Bandura's social-cognitive learning theory (Bandura, 2005).

A few computer-based applications, such as for anorexia prevention, anxiety disorders, depression and addiction, draw on the same theory (Andersson, et al., 2005; Carlbring et al.;

2005; Carroll, Ball, Martino, et al., 2008; Christensen et al., 2004; Clark et al. 2005; Marsch et al., 2006; Ybarra et al., 2005; Zabinski et al., 2003). All of them have included self-efficacy training as some part of the curriculum.

Ripple Effects is a comprehensive, computerized, social-emotional learning (SEL) program that draws heavily from Bandura's social-cognitive learning theory to promote greater self-efficacy, especially in school environments. It also directly addresses issues of self-worth and locus of control. Prior to this series of studies, pilot evaluations of a version of the training software had demonstrated that it resulted in significant reductions in some behaviors related to aggression (Stern & Repa, 2001) and increases in assertiveness, an element of self efficacy (Ray, 1999).

In 2002, the National Institute on Drug Abuse (NIDA) of the National Institutes of Health funded review, revision and evaluation of the impact of the Ripple Effects intervention on objective and internal outcomes. As part of a several year process that began with the NIDA grant, a particular configuration of Ripple Effects was designed to promote context-specific self-efficacy that would lead to greater academic achievement, regulation of school-related social behavior, increased norms against and perception of harm of alcohol and marijuana, and a stronger internal LOC. What had originally been intended as a single randomized controlled trial (RCT) was divided into a series of six smaller studies that measured the impact of the training software on school outcomes, attitudes toward alcohol and marijuana and LOC.

Analyses from these studies on the impact on school outcomes indicated that, compared to the control group, treatment group students had significantly higher GPA ($M=2.9$ vs. 2.5, $p<.01$), significantly fewer suspensions ($p<.05$) and substantively, but not statistically, fewer absences and discipline referrals, post-intervention. Cross-study pre-to-post data indicated there were not significant differences in how much treatment versus control group students perceived norms and risks associated

with alcohol and marijuana, after controlling for pre-assessment scores, although in one rural study perceptions of alcohol norms and risks were significantly higher in the treatment group than the control. Detailed findings from these analyses have been reported elsewhere (Author names withheld, 2008).

Purpose

The purpose of this paper is to examine the impact of self-regulated use of the computerized SEL training, as configured to promote self-efficacy, on LOC, and the role of ethnicity and rural/urban identification in that impact.

METHOD

Research Design

The six studies were longitudinal, randomized controlled trials (RCT). All six were conducted under a variety of real-world conditions, with individual students as the unit of analysis. The evaluation period extended from 2003 to 2008, including baseline data collection, training, intervention, post-intervention data collection, follow-up data collection, and analysis.

Role of program developers. In order to minimize the potential for bias of having program developers involved in the research, the role of the program developers was circumscribed: they recruited study sites, provided a three-hour training session, provided technical support, and obtained outcome data from school and district administrators. They were not involved in the delivery of the intervention, nor in the statistical analysis of quantitative outcomes. A third party research firm conducted the statistical analysis of all outcome data.

Logic model. The logic model is that self-efficacy (belief in capacity for mastery), especially belief in one's capacity to master learning itself, is the mediator that leads to investment in mastery of specific abilities, including social-emotional abilities that aid in learning. Context-specific applications of these social-emotional abilities in turn are the mediators of positive outcomes. Those positive outcomes are the reinforcement that lead to a generalized sense of increased personal power (LOC), which further confirms self-efficacy.
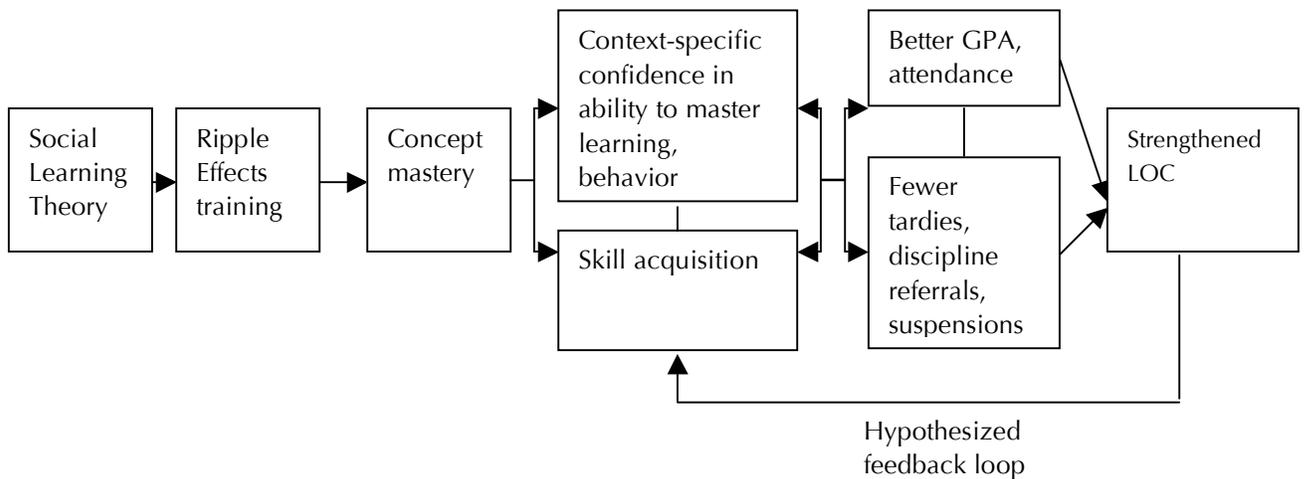

Figure 1. Diagram of Logic Model

Hypothesis. There were four hypotheses: (1) If students had the opportunity and direction to do so they would engage in self-regulated use of the intervention; (2) If students were exposed to the intervention, they would master key abilities related to self-efficacy in a school context; (3) Those improved abilities would result in improved academic and behavior school outcomes; and (4) Feedback from improved school outcomes would confirm self-efficacy and result in increased internal locus of control and decreased attribution to external forces.

Method of assignment to condition. Method of random assignment to treatment or control condition varied by study. For five studies, randomization was at the level of the individual student, assigned to a group, by computer, or by odd or even day or month of birth. In one of those studies, insufficient technology forced the administrator to cut the original groups in half. For the sixth study, in the prior spring, two groups were hand-matched to create baseline equivalence, then in the fall, the flip of a coin selected one of them to be the treatment group, with the other becoming control. In all instances, control group students had access to the intervention at the end of the intervention study period. There were 267 students in the treatment group, and 338 in the control group.

Conditions of use. Treatment group students were assigned completion of 42 tutorials, working one-on-one on the computer, during advisory, academic, or computer classes, two or more times per week, over seven weeks, in the computer lab, library, or their regular classroom. Facilitators assigned tutorials, and monitored their completion, but otherwise played no role in delivering the content of the intervention. Control group students continued with "instruction as usual."

Participants

Recruitment and consent. Program developers recruited widely in Northern California, presenting the research opportunity to more than 30 school districts. Ultimately, a group of alternative schools in one urban district, and two schools in a second rural district, met all criteria for inclusion, and chose to participate. The studies received IRB approval. Students provided active consent, and passive consent procedures were used to obtain parental consent.

Settings. Six public schools participated. Four schools (one continuation high school, two alternative middle schools, and one charter middle/high school) were in low income, violence-ridden sections of a major west coast city. Two schools (one elementary and one high school) were in an economically depressed, rural area, where marijuana is a major cash crop.

Sample. A total of 605 students participated in the six studies (Table 1). All had multiple risks for school failure and/or use of alcohol or marijuana. For all students, those risks included being in communities where medical marijuana is legally distributed and marijuana is readily available. For all students in the urban studies it included low socioeconomic status and high neighborhood crime. For many it included multiple family-level risks, including illegal immigrant status, single-parent family structures, parental addiction, and mental health problems. For rural students, the geographic isolation is both an educational risk, and a risk for higher rates of alcohol abuse. For students in half of the urban studies, there were additional, group level behavioral or performance risk that increased students' chance of school failure. These included: having previously been retained in a grade, dropped out, been expelled, or become involved with juvenile justice.

Table 1. *Demographic Characteristics of Sample by Study and Overall*

Demographic Factor	Overall (n=605)	Study 1 (n=117)	Study 2 (n=177)	Study 3 (n=53)	Study 4 (n=107)	Study 5 (n=31)	Study 6 (n=120)
Grade(s)	6-12	8	9-12	7	8-9	8	6
Average age	13.5	13.7	16.6	11.9	13.4	14.3	10.8
Gender							
Female	43%	27%	41%	42%	54%	46%	51%
Ethnicity							
African American	31%	67%	72%	2%	2%	78%	17%
Asian/Pac. Islander	6%	2%	10%	2%	1%	4%	0%
Hispanic	32%	29%	17%	0%	3%	18%	83%
Native American	1%	0%	0%	9%	2%	0%	0%
White	30%	2%	1%	87%	91%	0%	0%
English language learner							
Yes	30%	27%	24%	0%	0%	19%	83%
Free/Reduced Lunch							
Yes	60%	80%	61%	36%	31%	100%	94%

Intervention

The intervention was 12-14 contact hours of self-regulated use of a self-efficacy configuration of Ripple Effects software over seven to nine weeks in the fall of the 2003-2004 school year.

Principles of social-cognitive learning and self-efficacy training are embedded in the structure of the *Whole Spectrum Learning System* that underpins the software. Six of the 12 modes of learning offered for every tutorial are ones that Bandura has identified as important to the development of self-efficacy (Bandura, 1997; Pajares & Urdan, 2006). Two of the most important are guided mastery (through an expert system integrated into the software), and self-regulated learning (both content and process). Observational learning (through specific tutorials, assigned transfer training exercises, and video peer-modeling), systematic self-reflection (through journal writing, interactive self-profiles, and a set of tutorials on "knowing yourself"), off-line transfer training (to friends, family and sports contexts) and skill rehearsal (either in private or with a partner) are also included. All are in context-specific applications, introduced with a case study scenario, and extended in games, illustrations, and narrative, including first person video true stories. Interactive games use the process of assessment, without the threat of failure, as one of the means toward mastery. Playful, non-judging feedback guides toward mastery; a video-game style point system provides positive reinforcement for completion of the learning process.

Two areas in which the Ripple Effects approach diverges from Bandura's classic model are that, although Ripple Effects directs students toward rehearsal and role plays, those processes do not occur in a group; and all modeling is done through video by peers, rather than by adults.

The library of content to which these processes were applied at the time of the study included 178 peer-narrated, context-specific, multimedia tutorials (since expanded to 390), which address Bandura's triad of thoughts, behavior and environment. What the hundreds of context-specific applications have in common is that they are challenges that have an impact during the course of adolescent development, and are linked to objective

health, behavioral and academic outcomes. Content is organized both in an alphabetical index, and thematically into strengths, problems, and reasons. The "strengths" nomenclature is consistent with positive psychology and Bandura's framing of self-efficacy as an enabling, not "sheltering" process (Bandura, 1997; Seligman, 1990). The "problems" category recognizes that, while experts may champion a strength-based approach, many users of the program will be coming from a point of pain or need. The "reasons" category (divided into inside me and outside me), address individual risk factors that exist in psychological, family, peer, school, community and societal domains.

For every study in this series, all treatment group students were assigned 21 tutorials (5.5 contact hours) related to self-efficacy. They began with the "learning styles" tutorial, which includes an interactive self-profile designed to promote students' sense of self-efficacy about the single most important capacity in a school-environment, the capacity to learn. Other core content shared across sites in these studies included the general tutorial on "strengths" and skill and trait elements that are linked to the successful translation of belief in one's capacity for mastery, to actual mastery: goal setting; self-regulation of thoughts, emotional reactions and behavior; expectations about the future; assertiveness; problem-solving; and resilience, which included two traits linked to self-efficacy – optimism and managing change.

All of this was framed in the context of participating in a community. Two of the required tutorials promoted affective capacity (identifying with others and expressing solidarity), which balanced the intended stronger sense of self, with training toward a deeper felt awareness of others and expression of that awareness in caring respectful behavior. Core content also included two topics directly related to locus of control: "luck" (fate) and "control" (empowerment), as well as a tutorial on risk and protective factors that included an interactive self-profile. Four topics related to substance abuse included norms, and science-

based information about alcohol and marijuana.

In addition to the core tutorials, each site chose 21 additional, site-specific tutorials to assign from the 157 available. Sites varied widely in their self-selected topics, with no topic common to all six sites, and just one, "disputes," selected by five of the six sites. Four sites had four tutorials in common: "disrespectful," "peer pressure," "showing care," and "teacher conflict." Tutorials on self-efficacy traits of "motivation," "effort," "perseverance," "reflecting on performance," "predicting consequences," "standing up for beliefs," "helping others," "choosing friends," and "getting help" were chosen by at least one site. Two sites added the tutorial on "success-phobia," which addresses self-efficacy issues directly.

Facilitators assigned tutorials, and ensured compliance. They received a single, three-hour training session in preparation for this role.

Measures

The analysis included multiple, quantitative and qualitative, process and outcome measures.

Quantitative process measures. Quantitative process measures included enrollment attrition, study attrition, intervention attrition, dosage, and choice to explore self-selected content. We classified as "enrollment attrition" the percentage of students for whom there was no pre- or post- intervention data, because they were no longer enrolled in the school. We classified as "study attrition" the percentage of students who were physically enrolled in school, but did not comply with study protocols, withdrew consent to participate, or did not complete the self-report survey both before and again after the intervention. We classified as "intervention attrition" the percentage of treatment group students who had consented to the study but, for whatever reason, did not have minimal exposure to the intervention, defined as completion of interactive exercises from at least 12 tutorials (equivalent to roughly three contact hours, or 30% of the total assigned content).

Exposure to self-selected content was a yes or no event. We did not analyze that dosage.

We included in efficacy analysis of objective outcomes all students who had minimal exposure to the software application (at least three hours; 30% of assigned content). We included in efficacy analysis of subjective outcomes, including LOC, those students who both had minimal exposure and completed self-report surveys both pre and post intervention.

Quantitative outcome measures. Quantitative outcome measures included measures of concept mastery, objective school achievement measures, and two self-report measures. Scores logged by the computer for completion of "got its" (game-like, multiple-choice assessments), documented mastery of basic concepts. Self-efficacy-related questions were integrated into a number of different tutorials. Examples are listed in Table 2.

Table 2. *Sample Questions From Multiple-Choice Assessments Of Concept Mastery*

Tutorial	Sample statement and answer choices
Self-determination 1	Self-determination means you:
	choose your life
	are selfish
	don't care about others
Self-determination 2	If you want to gain control, a good first step is to control:
	your thoughts
	other people
	the weather
Learning styles 1	Learning styles are about:
	how you learn
	what you learn
	how dumb you are
Learning styles 2	People who learn by facts and figures are called:
	thinkers
	doers
	watchers
Resilience 1	A person who is flexible:
	handles change
	does yoga
	doesn't bend
Resilience 2	When it comes to being resilient, either you are or you aren't:
	false – you can learn to be
	true – you're born that way

Objective measures were grades, tardies and absenteeism, and discipline-related data, including suspensions. The self-report measures were two computer-based surveys on (1) attitudes toward alcohol, marijuana and (2) perceived locus of control (LOC). The LOC measure is addressed here.

Rotter developed the first widely used LOC scales to measure attribution of life events to internal or external cause (1966). Originally the external control scale was uni-dimensional. Levenson contributed the concept of separating fate from powerful others (Levenson IPC scale, 1973). Wallston built on both to develop the Multi-dimensional Health Locus of Control scales (MHLC) that are in the public domain (1976). Paulhus further refined the measure of external attribution to include socio-economic influences (1983). MHLC have been used in over a thousand studies and have been cited in the literature hundreds of times over the past 20+ years (Wallston, 1995).

Ripple Effects Locus of Control (RELC) scales were adapted from MHLC. RELC measures Internal Locus of Control (INTERNAL), External Locus of Control Due to Luck or Fate (FATE), and External Locus of Control Due to Powerful Others (People and/or Powerful Social Forces). RELC scales have adapted specific content and a scoring structure from the Multi-dimensional Health Locus of Control scales. However, RELC include educational and social, as well as health contexts. RELC scales are like the MHLC scales (and unlike Rotter's original scale) in that they use a Likert scoring method, instead of forced choice. This allows for the fact that students may experience BOTH a strong/weak sense of internal control AND a strong/weak sense of external controls. Students rate their agreement on a rating scale from 1 (Strongly agree) to 4 (Strongly disagree). Lower numbers indicate a stronger affiliation with that scale. Higher values indicate that a person or group disagrees with the attributions in the items (i.e., that consequences are attributable to self, fate, other structures or other people). This even number prevents them from taking a completely neutral position.

RELC scales have a very different delivery format from the other LOC scales. Ripple Effects adapted the design to a hip-hop look and feel, and multimedia, reading-independent, computerized delivery that is more culturally relevant for diverse youth and less likely to be biased by reading level. The structure is adapted for a game-like delivery, with reinforcement built into the system, without prejudice for any answer. This allowed automatic data collection, which could later be linked to individual student outcomes, without compromising privacy.

The RELC is divided into three scales: Self, Fate, and Others. We intended to further divide the Other scale into people and identifiable *structures and processes* – such as racial or gender discrimination – as a possible source of external control, separate from chance. We conducted pre-post comparisons between treatment and control students on two scales, Self and Fate. Both of these scales had pre and posttest alpha values of 0.70 or above, and therefore met or exceeded the minimum reliability needed to consider a group of items an internally consistent scale. The alpha values for the Other-Structures and Other-People scales ranged from 0.37 to 0.62 and did not meet the criteria for scaling. We then re-combined the Other items into a single scale, which produced alpha values of 0.59 for the pretest and 0.71 for the posttest. Since the pretest still did not meet the 0.70 criterion, we made the decision to analyze the posttest data alone with independent samples t-tests. If we had analyzed the pre and posttest data together, we would not have been certain that the two instruments measured the same construct.

Qualitative measures included pre to post teacher reports, and posttest student reports, as well as reports from on-site observation.

Data Collection

Intervention attrition, compliance, dosage and concept mastery. Ripple Effects software automatically collected data on compliance and dosage rates. Dosage was directly tied to completion of the interactive games that measured concept mastery. If students were

awarded points for a tutorial, it signified they had successfully provided all the correct answers to the quiz.

School data. School administrators provided data on GPA, absenteeism, tardies, suspensions, and discipline referrals at the end of the first semester following completion of the intervention. They also provide student demographic data. The school districts provided some prior year and follow-up data two years after the initial data collection period.

Self-report data. During the Fall of 2003, as part of their regular school activities, students completed the two computer-based surveys described above, before and within two weeks after the intervention. Files containing their responses were stored on the computer, linked to individual student school IDs. Data were aggregated for analysis.

Method of Analysis

For the LOC data with pre and post values, we ran repeated-measures ANOVAs with a between-subjects factor (study group). For the Other RELC scale, since the pre-test did not meet the 0.70 criterion, we analyzed that post-test data alone with independent samples t-tests. The set of control variables included ethnicity, gender, LEP, and free or reduced lunch status, as a measure of socioeconomic status.

To see if the number of hours of exposure to Ripple Effects was associated with differences in outcomes, we ran bivariate Pearson product-moment correlations for the sample as a whole and for individual study sites. In cases where there was pretest data (the Self and Fate scales), we ran partial correlations on the posttest data that controlled for the effect of the pretest covariate. We ran the correlations in multiple ways, looking first at all participants who at least met a minimum threshold of exposure of around three hours, and then by grouping students into three groups based on exposure level. For each set of correlations, we used the Bonferroni method to minimize the chances of making a Type I error.

RESULTS

Baseline Equivalence

Analysis of pre-test surveys indicated no overall significant baseline differences between treatment and control groups for any self-report variable (i.e., locus of control, or norms or risk related to alcohol and marijuana). Variations based on ethnicity and gender were expected and found, and were controlled for in the analysis.

Process Outcomes

Enrollment attrition. Administrative data indicated that during the intervention period, 5% of the treatment group, and 7% of the control group, moved or left the participating schools (remaining TG N = 253, CG N = 314).

Study attrition. There were three components of study attrition: withdrawal of consent, contamination, and failure to complete the self-report surveys before and after the intervention. Six percent of the treatment group and 3% of the control group withdrew consent to participate, and all of these came from a single site (School 4). The built-in electronic monitoring, coupled with reports by the facilitators, indicated that one control group student had contact with the intervention (.3%), and thus was dropped from the study (remaining TG N = 238, CG N = 305).

After accounting for the above, roughly 30% of each group failed to provide self-report data at either pretest or posttest, or both. If they did not complete the pretest, treatment group students were still included in the intervention, since administrative data was available for them, but they were not included in measures of impact on LOC.

Intervention attrition. Intervention attrition was defined as failure to receive minimal exposure to the intervention, defined as 30% of the assigned tutorials or at least three hours exposure to the intervention. Of the 238 treatment group students remaining in the study after enrollment attrition, and withdrawal of consent, 35% did not meet the minimum

standards for compliance (Remaining compliant TG N = 155).

Of the 155 treatment group students who had minimal exposure, 116 (75%) completed surveys at both pre and post. Seventy percent of control group students (214) completed both surveys. Although the rates of completion of self-report surveys were close, having the additional barrier of completion of a minimal number of tutorials within the treatment group, resulted in that group being smaller. To equalize the groups, we randomly sub-sampled the control group. This resulted in 123 control group students being included in the analysis.

Analysis of dosage. Mean dosage for those who complied was 63% of total required topics, approximately 6.5 contact hours, depending on student pace. Analysis of dosage further indicated that treatment group students who met requirements of minimum exposure successfully completed no fewer than 12 different measures of concept mastery, and an average of 26.

Independent exploration of additional topics. Among students who complied, 96% also chose to privately explore tutorials addressing risk and protective factors beyond those assigned.

Locus of Control Outcomes

Measures of concept mastery. Scores logged by the computer for completion of "Got its" documented mean successful completion of 26 tests of concept mastery. Each test included one or more questions related to self-efficacy, as previously noted in Table 2.

Self-report scores. Scores for locus of control were mixed across schools and ethnic groups, with mostly small differences in gain for the treatment and control groups and only one significant difference for the group as a whole. For all schools on the Fate scale, the treatment students decreased their mean score from pre to post, while the control students increased their mean score. This change in scores was

significant, $p = 0.049$. The lower the score, the greater the agreement with the scale. Therefore, students in the treatment group were more likely to attribute outcomes to Fate on the posttest than were the control students. While most differences were not statistically significant, there are several trends worth noting for future study. The easiest way to understand and interpret score differences is to view them in the context of the mean scores in Tables 3-6.

Trends by school and urban/rural status. On the Self scale, the direction of differences between the treatment and control conditions varied widely across schools. For the sample as a whole, the control students had a higher, but not significant, pre-post gain than the treatment students, a point that is easiest to see by looking at Table 3. Because higher scores indicate greater <u>dis</u>agreement with a scale, the treatment-control difference means that the treatment students were more likely to attribute outcomes to themselves than were the control students. This same trend was found at all four urban schools. In contrast, the two rural schools, the control students were more strongly aligned with the Self scale than the treatment. At one rural school, School 4, this difference was significant, $p = 0.02$.

On the Fate scale, the sample as a whole saw the greatest gain for the control students, meaning that treatment group was more likely than the control group to agree that their lives were controlled by Fate (see values in Table 3). However, one rural and one urban school had results in the opposite directions.

On the Other scale, score differences varied widely on the posttest across schools (Table 4). For the entire sample, the treatment students were slightly more likely than the control students to agree with items attributing consequences to Other structures and people. Students at four schools mirrored this trend; two did not. These did not break into rural–urban groupings.

Table 3. *Differences in Perceptions of Locus of Control by Treatment and Control Group by School*

| | | Treatment Group | | | | | | Control Group | | | | | Differ-ence in Gain for the 2 Groups |
| | | Pre Test | | Post-Test | | | | Pre Test | | Post-Test | | | |
School	N	Mean	SD	Mean	SD	Change	N	Mean	SD	Mean	SD	Change	
Self scale (Alpha: Pretest = 0.72, Post test = 0.79)													
All	115	25.28	5.02	25.34	5.76	0.06	123	26.01	6.05	26.76	6.23	0.75	-0.69
School 1	10	26.20	6.65	26.25	11.20	0.05	10	25.70	7.07	27.70	9.56	2.00	-1.95
School 2	17	25.00	6.25	24.24	6.06	-0.76	18	24.94	9.47	28.44	9.76	3.50	-4.26
School 3	22	25.14	4.43	25.02	5.50	-0.12	26	24.73	3.78	24.23	3.13	-0.50	0.39
School 4	12	25.33	3.87	26.75	4.39	1.42	12	30.42	5.16	28.92	5.88	-1.50	2.92*
School 5	13	25.46	4.39	24.85	3.74	-0.61	11	25.27	4.90	26.00	4.75	0.73	-1.34
School 6	41	25.17	5.08	25.49	4.98	0.32	46	26.24	5.35	26.96	5.05	0.72	-0.40
Fate scale (Alpha: Pretest = 0.76, Post test = 0.78)													
All	115	37.30	6.53	36.57	7.21	-0.73	122	36.5	7.66	37.87	6.71	1.37	-2.1*
School 1	10	34.30	6.18	33.50	11.29	-0.80	10	36.60	9.42	37.50	7.35	-0.90	0.10
School 2	17	38.59	5.68	36.76	5.64	-1.83	18	34.22	10.65	36.39	8.28	2.17	4.00
School 3	22	39.18	7.01	39.64	6.77	0.46	26	41.38	3.99	42.08	4.38	0.70	-0.24
School 4	12	36.58	3.92	33.50	5.95	-3.08	12	37.67	5.02	35.08	7.63	-2.59	-0.49
School 5	13	37.15	4.14	36.38	4.17	-0.77	11	36.45	5.07	36.27	4.65	-0.18	-0.59
School 6	41	36.76	7.70	36.54	7.58	-0.22	46	34.33	7.52	37.26	6.44	2.93	-3.15

Table 4. *Differences in Locus of Control-Other for Treatment and Control Group by School*

| School | Treatment Group | | | Control Group | | | Difference |
	N	Mean	SD	N	Mean	SD	
All Schools	121	33.62	6.62	127	34.47	6.08	-0.85
School 1	13	29.54	9.61	10	36.50	8.20	-6.96
School 2	19	33.68	6.27	18	33.61	7.93	0.07
School 3	22	35.00	6.39	26	35.54	4.90	-0.54
School 4	12	32.08	5.18	12	34.08	4.17	-2.00
School 5	13	32.77	6.42	11	33.36	2.58	-0.59
School 6	42	34.85	5.90	50	34.16	6.43	0.69

Trends by ethnicity. There were no statistically significant scores based on ethnicity. Trends discussed here are reported in Table 5. On the Self scale, African American and Caucasian students in the treatment group had a greater increase in scores than their control group counterparts. This means the treatment students were less likely than the control students to attribute consequences to an individual's decisions. The Latino/a treatment students saw a slight decrease in their Self scores from pre to post, while the control students' scores increased. The Latino treatment students were therefore more likely than the control students to attribute consequences to themselves post intervention

On the Fate scale, there was a negative difference in gain scores between the treatment and control groups, for all ethnic groups. The

values in Table 5 show that the treatment groups tend to decrease or minimally increase their mean score from pre to post, while the control groups all increase or minimally decrease their scores. This suggests that the treatment students are more likely to attribute consequences to Fate after exposure to the program.

On the Other scale, reported in Table 6, African American and Caucasian students had lower mean scores in the treatment condition than the control condition. In other words, the treatment group was more likely than the control group to attribute consequences to Other structures and people. This was reversed for the Latino/a students. In these cases, the treatment students were less likely than the

control group to associate outcomes with structures and people.

Relationship with impact on objective school outcomes. As reported elsewhere, across studies, Ripple Effects students had better school outcomes on two measures, GPA (p<.01), and suspensions (p<.05), when compared with control group students (Author names withheld, 2008). Treatment group students' school outcomes improved, despite mixed findings on internal LOC, and a statistically significant increase in attribution to Fate. One-year follow-up data showed significantly higher continued enrollment, suggesting that positive school outcomes persisted. This runs contrary to hypothesized correlations.

Table 5. *Differences in Perceptions of Locus of Control by Treatment and Control Group by Ethnicity*

| Ethnicity | N | Treatment Group | | | | | N | Control Group | | | | | Difference in Gain for the 2 Groups |
| | | Pre Test | | Post-Test | | | | Pre Test | | Post-Test | | | |
		Mean	SD	Mean	SD	Change		Mean	SD	Mean	SD	Change	
Self scale (Alpha: Pretest = 0.72, Post test = 0.79)													
African Am.	34	24.50	5.11	24.97	6.59	0.47	37	25.32	7.25	26.08	6.14	0.76	-0.29
Latino/a	44	25.75	5.60	25.33	5.71	-0.42	50	26.22	5.78	28.08	7.08	1.86	-2.28
Caucasian	30	24.93	4.28	25.37	4.98	0.44	33	26.30	5.27	25.42	4.80	-0.88	-1.32
Fate scale (Alpha: Pretest = 0.76, Post test = 0.78)													
African Am.	34	38.97	5.41	37.03	6.48	-1.94	37	36.68	9.00	37.79	6.59	1.11	-3.05
Latino/a	44	35.48	7.36	35.52	8.09	0.04	50	33.74	7.33	36.82	6.84	3.08	-3.04
Caucasian	30	38.60	6.15	37.70	7.32	-0.90	33	40.27	4.76	40.09	6.63	-0.18	-0.72

* p < 0.05, ** p < 0.01

Table 6. *Differences in Locus of Control-Other by Treatment and Control Group by Ethnicity*

| Ethnicity | Treatment Group | | | Control Group | | | Difference |
	N	Mean	SD	N	Mean	SD	
African American	38	33.11	6.28	38	34.53	4.97	-1.42
Latino/a	46	34.08	7.37	53	34.02	7.52	0.06
Caucasian	30	33.73	6.32	33	34.91	4.81	-1.18

* p < 0.05, ** p < 0.01

Dosage correlations. We conducted partial correlations for the Self and Fate post test scores, controlling for the pretest scores. We ran bivariate correlations for the Other scale, because the pretest scale did not have an adequate reliability to be used as a covariate. Across and within schools, there were no significant correlations. Breaking the sample into groups uncovered one significant correlation between maximum dosage and the self scale $r(26) = 0.61$, $p = 0.001$. This means that the greater the exposure, the more likely students were to disagree that consequences were attributable to personal actions.

Qualitative Data

Qualitative data from interviews with both staff and students indicated a strengthened sense of personal power, contradicting some of the quantitative data on students' sense of personal power as measured by the RELC instrument. Implementers cited the process of students' privately addressing individual risk factors, as potentially as important as the systematic skill training, in accounting for observed behavioral and attitudinal changes. Interviews with a sample of students also suggested a sense of increased empowerment associated with capacity for mastery. Both students and teachers specifically mentioned inclusion of the learning styles interactive profile as contributing to student's enhanced sense of capacity to master what is needed to succeed academically.

Table 7. *Correlations Between Dosage and Locus of Control by School*

	Self Subscale		Fate Subscale		Other people and structures Subscale	
School	N	R	N	r	N	r
All Studies	80	-0.09	80	0.03	86	0.02
Study 1	10	-0.45	10	-0.35	13	0.12
Study 2	17	-0.29	17	-0.04	19	-0.14
Study 4	12	-0.22	12	0.01	12	0.10
Study 6	41	-0.07	41	0.06	42	-0.09

** $p < 0.002$

Table 8. *Correlations Between Dosage and Locus of Control by Level of Dosage*

	Self Subscale		Fate Subscale		Other People and Structures Subscale	
School	N	R	N	r	N	r
Minimum	26	0.08	26	0.12	28	-0.04
Moderate	28	-0.15	28	-0.12	31	0.08
Maximum	26	0.61**	26	0.06	27	0.29

** $p < 0.002$

DISCUSSION

Implications of Results

The data indicate that LOC results trended in the opposite direction from what our logic model predicted. We had predicted training in self-efficacy and social-emotional learning would lead to reduced attribution to Fate. From pre to post overall, students in the treatment group were significantly *more* likely to attribute outcomes to Fate than were the control students, p=.049. At first glance this is a decidedly negative result. The somewhat higher scores on attribution to Self in tandem with the higher attribution to Fate among the urban students who came from dangerous and uncertain environments, although not significant, is a meaningful finding.

It may be that students from undocumented families who can be rounded up without warning and deported, and students who live in an environment of high levels of both random and systematic gang violence, can increase belief in their ability to master required skills, master those skills, see the results in improved school-related outcomes, and in that process, become even more aware that many forces, outside their own capacity for mastery, are not under their control. Indeed, one of the exercises they engaged in was completing an interactive profile of their own internal and external risk factors, which may have heightened this distinction. The hallmark of resilience is not the belief that one can control fate, but the assurance that one can find ways to survive adversity and perhaps become stronger because if it. So this is not necessarily a negative finding.

In the two rural studies with mostly Caucasian students, at posttest, treatment students were also less likely to attribute life events to Self. At one the difference was significant. In the context of a community that is characterized as "ruggedly individualistic" it is possible that these results could indicates a reduced sense of *isolated* self, and potentially stronger sense of connectedness to others, rather than a diminished sense of personal power. A much larger study would be needed to examine these relationships more closely.

Overall, the attribution of control to Others (people or structures) was inconsistent and does not allow us to draw any conclusions.

The impact of the program on Latino students was stronger and more positive than on other students. Post treatment they were relatively, but not significantly, more likely to attribute life events to Self than other ethnic groups, and less likely to attribute events to Others, even while their sense of Fate also increased significantly.

Study Limitations

LOC instrument. One limitation of this study was the marginal internal reliability of the Other measure. Although originally designed as a single scale, we had hoped it would allow us to tease out attribution to Other People from attribution to Social Influences such as racism and class differences. It did not systematically allow that distinction, but the marginal internal reliability suggested that indeed, it may have been measuring more than one construct.

Treatment group rate of survey completion. One hundred and sixteen treatment group students both complied with minimal exposure to the intervention and completed both the pre and post test surveys. The differences between 75% of compliant treatment group students and 70% of all control group students who completed both surveys is not meaningful; 25-30% is considered low attrition by the model programs initiative of the Substance Abuse and Mental Health Services Administration. However, because of the additional screen of minimal exposure to the intervention, the overall attrition rate for the treatment group was 49%, a cause for concern that may have biased findings.

These real-world studies required staff to oversee the pre and post survey administration. Unlike with the intervention itself, in which students who had been absent could make up the work, there was a very narrow window of time for students to complete the staff administered self-report surveys. Most students could not make it up if they were absent. Thus sample size was diminished, and that smaller

size may or may not have been appreciably affected by deliberate student decision.

Risk-weighted sample. This series of studies focused on student populations with multiple external risk factors that may independently correlate with LOC. The conclusions about impact on LOC cannot validly be extended to students in economically and physically secure environments, where the force of law is neither arbitrary nor disproportionately applied, and where discipline is consistent within intact family systems.

Conclusion

Previously, both academic and behavioral outcomes have been linked to self-efficacy (Bandura, Barbaranelli, Caprara, & Pastorelli, 1996). As we have reported elsewhere, the computerized self-efficacy intervention described here resulted in improved academic and behavioral outcomes (Author names withheld, 2008).

Yet the data reported here indicated that across studies, the combination of context-specific self-efficacy training and any reinforcement from positive school-related outcomes slightly, but not significantly increased internal LOC among urban students, while it significantly decreased internal LOC among one group of rural students. It significantly increased, rather than reduced, attribution of life events to Fate among all students, and resulted in mixed results on attribution to Others. There were some ethnic differences in impact. Positive trends with Latin students were stronger than with other groups.

These combined results are consistent with the hypotheses that self-efficacy and LOC are indeed different constructs; and that, among students who have multiple external risk factors, generalized LOC is less important in predicting positive school outcomes, than is context-specific training in self-efficacy. They suggest ethnicity and rural/urban identification may influence the impact of this training on LOC.

This analysis does not answer the question of whether the computerized training actually confers self-efficacy, or simply results in

outcomes that prior evidence has demonstrated are linked to it. With validated tools for assessing self-efficacy now available, it would be important to make self-efficacy itself the proximal measure in future studies, and to include, at the least, a control group of more "entitled" students for comparisons, if measuring locus of control.

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Unexpected Findings

On The Impact Of Computerized Social-Emotional Learning
Implications For Research And Practice

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Unexpected Findings On The Impact Of Computerized Social-Emotional Learning Implications For Research and Practice

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Paper presented at the annual meeting of American Educational Research Association

March 27, 2008

Abstract: Over a period of ten years, a series of randomized, controlled trials (RCTs) and quasi-experimental studies have examined the effectiveness of Ripple Effects computerized Social-Emotional Learning program on school success. Nine papers have reported effects on grades, behavior, attitudes and internal assets. This paper focuses on unexpected findings from some of those studies. The findings are all related to specific conditions of use in four well-designed RCTs, with equal sized control groups, very low attrition rates and third party collection and analysis of data.

The unexpected findings:

- In a pilot study, trends were that students who used the computerized program <u>without</u> supplemental, adult-facilitated sessions had better behavioral outcomes than students with adult supplement.
- In a later study, students with <u>non-professionals</u> for advisory period, plus self-directed use of the computer program, got better grades for personal and social responsibility than students with professional teachers, without the software (p<.01), and data indicated trends toward higher academic grades and lower discipline referrals as well.
- Students who had the self-directed, computerized SEL training <u>in lieu of academic instruction</u>, for two hours per week, <u>got better grades</u> than control students who had instruction in math and language arts during the same periods (p<.01).
- Students who used the program had higher empathy scores (p=.02), but <u>control group peers in the same classrooms</u> had higher scores on connectedness (p=.04).
- Various content scopes and sequences resulted in similar outcomes

This paper discusses the contexts for these unexpected findings, hypotheses to explain them, and potential implications for practice in schools and a broader social context.

Background

Over the past 20 years, a substantial body of research has accumulated about the correlation between Social-Emotional Learning (SEL) and school and life success (Benard, 2004; Elias & Arnold, 2006; Durlak & Weissberg, 2007; Hawkins, Van Horn & Arthur, 2004; Osher et. al, 2007). Little of that research has studied the effects of computer-based delivery of SEL. In the last decade, a small group of randomized, controlled trials (RCTs), and quasi-experimental studies in urban, suburban, and rural settings, have examined the effectiveness of a self-regulated, computer-based training program for SEL called Ripple Effects. Those studies have examined impacts on academic performance (grades and summer school referrals), absenteeism, social behavior, discipline referrals, suspensions, attitudes toward drugs and alcohol, locus of control, and core social emotional abilities, including assertiveness, and resiliency assets, such as social competence (empathy and connectedness), problem solving, and autonomy (De Long-Cotty, 2007; Bass, Perry, Ray, & Berg, 2008; Repa & Stern, 2001; Ray, 1999). Data has been analyzed by individual site/study and across multiple sites. In each case, some findings have been as hypothesized, and some not. However, in some studies, there were also significant findings that were not only inconsistent with hypotheses, but also inconsistent with previously published

research, and initially counter-intuitive as well. Several of these findings are related to specific conditions of use, in various settings.

This paper discusses those unexpected findings, hypotheses to explain them, and potential implications for further research and real world practice. The report draws from four well-designed, randomized, controlled studies, where dosage was consistent, sample and control groups equal in size, attrition low, and data collection and analysis conducted by third party researchers.

Methods
Goals

The goal of this report is to identify and comment upon unexpected findings from a series of studies that evaluated the impact of Ripple Effects computer-based training on objective, school-related outcomes and/or internal assets.

Research Design:
Real World, Randomized Controlled Trials

The four RCTs described below were all longitudinal studies conducted under real world conditions, without any direct involvement of program developers in delivery of the intervention. All included random assignment down to the individual level, with approximately equal-sized control groups and low attrition rates. Methods of random assignment to condition differed by study and are described below. No special education students were excluded.

Control conditions

Control group students participated in "business as usual" as separately defined in each study and described below. Some aspects of experimental versus control group conditions were site specific. These factors, such as level of expertise of implementers, supplemental adult instruction or not, and school context for implementation (academic or not), were dependent variables in their respective studies, and became the basis for some of the unexpected findings reported here.

Settings

The four studies referenced here were all conducted in public school settings, including regular, alternative, and charter schools. Conditions varied by study including location (urban or suburban), school size and type, ethnicity and social-economic status (SES) of student participants, certification level of adult facilitators, physical setting of the program, technology platforms, and length or dosage of the program, as described below.

Participants

A total of 362 sixth, seventh and eight graders participated in the studies, including African American, Caucasian, Asian/Pacific Islander, and Latino students. (Native American students participated in another study of the impact of Ripple Effects program.) Almost exactly half of the study participants were very low SES and eligible for free lunch. 52% were male. Demographic patterns at each school were often skewed toward one ethnic group. However, taken as a whole, this group of students was well balanced, with somewhat fewer Caucasian members and more Latinos than current US Census figures for the population. The sample is weighted in the direction of population shifts that are forecast for the United States, and includes strong representation of those students most at risk for school failure.
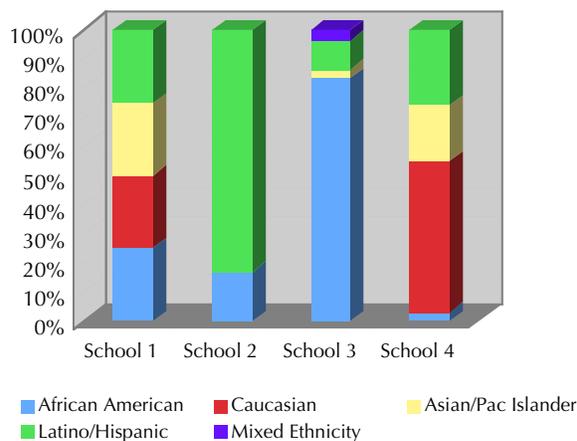
Intervention
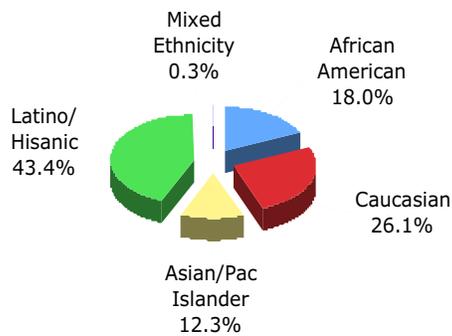

Figure 1. Breakdown of demographics by school

Figure 2. Breakdown of demographics across schools

Background: Ripple Effects social-emotional learning software, teens version, is a self-regulated, computer-based training program intended to develop core social-emotional competencies and positively impact academic performance, engagement with school and discipline-related behavior, especially among students at-risk for school failure. The program has been purchased by more than 500 school districts in 49 states for use in advisory, remedial, special education, alternative, discipline and health settings, mostly with students who have multiple risk factors that threaten school and life success. The cost is approximately $10,000 for a school-wide license and staff training for the first year, with a 10% optional annual maintenance agreement. Ripple Effects software programs for children, teens and staff have received 30 major awards from the education, software, health and communications industries.

Library of evidence-based multimedia content

In each study, intervention content was comprised of a subset of 390 multimedia tutorials designed to build strengths (individual protective factors), reduce risk factors, and solve problems in non-academic areas correlated with school success. All tutorials had been previously reviewed by an expert panel for consistency with science-based theory and practices that have been shown to be efficacious in live instruction settings.

Implementation: Students in the experimental groups were exposed to self-regulated learning through the Ripple Effects computer-based, SEL training program. Adult implementers did not deliver any core content, but were mandated to check the computer to monitor student compliance, and in one study, provided supplemental discussion and facilitated role plays.

In three of the studies, once students had completed the required tutorials, they could follow the links to go deeper into those topics that interested them. This included exploring individual, peer, family, and neighborhood or societal risk factors such as depression, domestic violence, abuse, bullying, teacher conflict, learning disorders, substance abuse, or discrimination.

Scopes and Sequences

In this set of studies, configurations of the program varied by site and included three elements:

- Standard components assigned by Ripple Effects
- Additional tutorials for each school group, chosen by school staff
- Individual tutorials privately chosen by individual student participants.

In each study, only the interactive screens of each tutorial in the preset scope and sequence were defined as core components of the program. Completion of these interactive components was automatically logged by the computer and became the basis for defining dosage.

Whole Spectrum Learning System®

Tutorials were delivered via the proprietary *Whole Spectrum Learning System*. This content, learning and data management system includes reading-independent training modules, comprised of: photos, illustrations, videos, peer narration with parallel text, interactive, assisted-writing exercises, games and interactive self-profiles.

All are all designed to present evidence-based strategies (cognitive, behavioral, interpersonal, social skill and attention strategies) that have been shown to be effective in live instruction settings (Lipsey, 1995; Lipsey, Wilson, & Noser, 2007).

Learning is self-paced and self-directed. Students who are absent for a particular session can make it up. The system also includes a video-game-style point structure to measure progress and a data management system to track compliance.
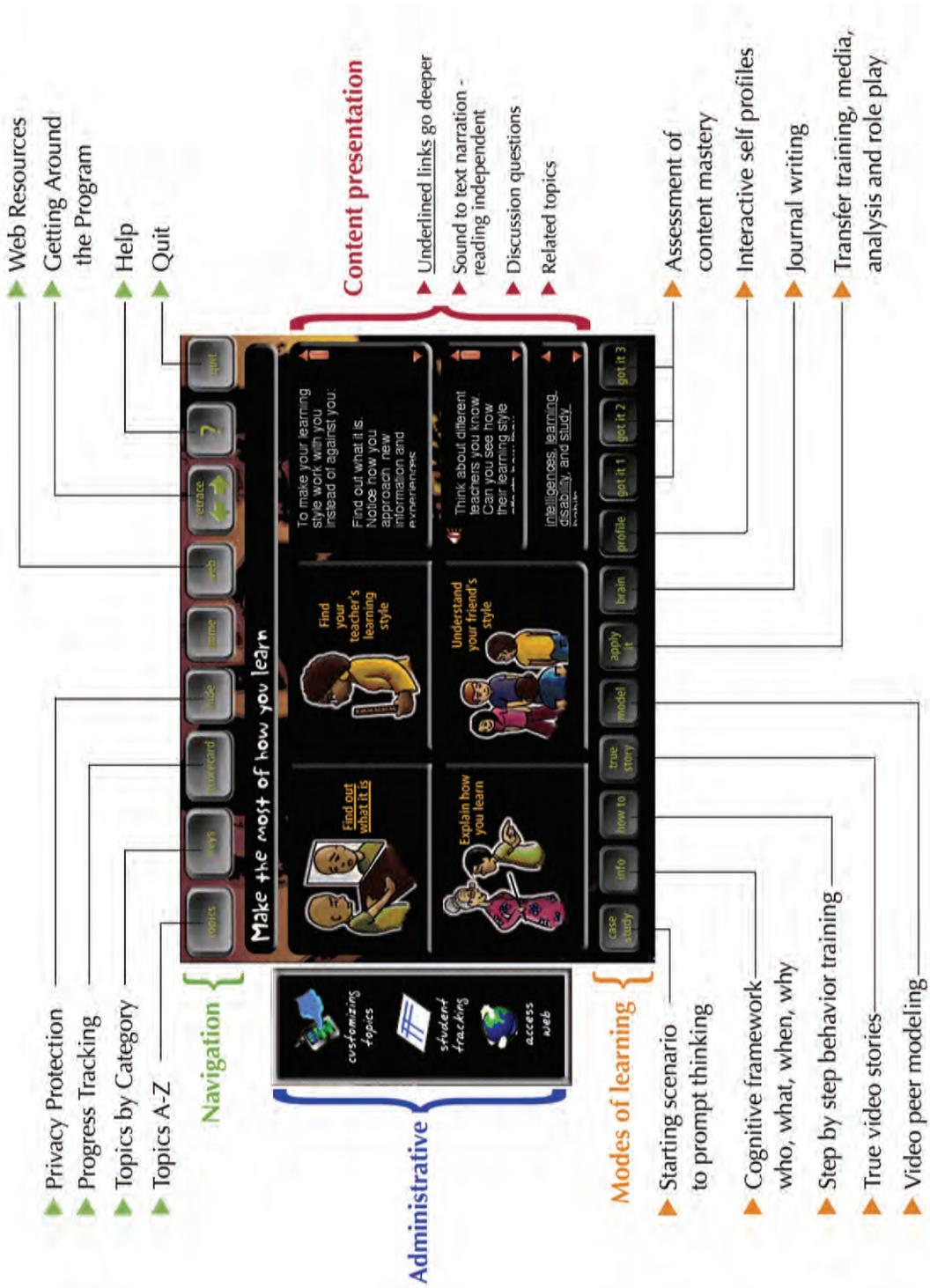
Navigation
- Web Resources
- Getting Around the Program
- Help
- Quit

Content presentation
- Underlined links go deeper
- Sound to text narration - reading independent
- Discussion questions
- Related topics
- Assessment of content mastery
- Interactive self profiles
- Journal writing
- Transfer training, media, analysis and role play

Navigation
- Privacy Protection
- Progress Tracking
- Topics by Category
- Topics A-Z

Administrative

Modes of learning
- Starting scenario to prompt thinking
- Cognitive framework who, what, when, why
- Step by step behavior training
- True video stories
- Video peer modeling

Figure 3. Diagram of Whole Spectrum Learning System

Outcome measures

The measures used in the original analyses include: GPA, attendance (percentage of days missed), tardies, number of detentions, suspensions, and discipline referrals; attitudes toward alcohol and marijuana, (both risk and disapproval); locus of control; and measures of core social-emotional competencies, including empathy, assertiveness, problem solving and connection to community. Not every measure was used in every study.

Administrative records: Objective outcome data for grades, attendance and tardy rates were provided by school or district administrators. Data on discipline referrals and suspension were collected by each school, according to categories that differed by site.

Behavioral observation: In one study, discrete classroom behaviors were observed in five-minute increments by trained graduate students who were blind to whether students were in experimental or control groups. In other studies, staff observations of on-campus behavior were the basis for discipline referrals.

Self-report: The scales used in student surveys of attitudes and social-emotional abilities were computerized adaptations of previously validated instruments and are described under the relevant studies. All of them were peer-narrated, thus accessible to English Language Learners and students with low reading ability, without cultural mediation by an adult, and without compromising privacy of participants. The peer voices were gender balanced and ethnically diverse. Completion of all surveys was self-regulated. Each student could move at his or her own pace. A game structure provided a reward for responding to all questions.

Student, staff and administrator interviews: Post intervention interviews were conducted with staff participants and a sample of students at three of the four sites.

Data collection

Study attrition, measured using school administrative data, was low: 4.7% overall. Compliance was separately defined as exposure to a minimum dosage level of three hours, or 12 tutorials. The mean compliance level was 92%. Dosage levels were computed as a percent of that minimum requirement. The process for measuring student dosage, and by proxy, implementation rates, was automated. The software program created a password-protected file for each student and tracked completion of interactive exercises, the core components of each tutorial. This data was exported from each computer with names decoupled from identifying numbers, and then data aggregated in centralized files.

Methods of analysis

SPSS and STATA/SE 9.2. were the programs used to run the original analyses. Study-specific methods of analysis are outlined in the descriptions of respective studies.

Results

Findings consistent with hypotheses

The data indicate that various configurations of the Ripple Effects program were effective in reducing risk factors and strengthening protective factors among adolescents from diverse ethnic, social and economic backgrounds. Specifically, one or more configurations, in one or more studies, has had significant, positive effects on grades, social behavior, tardies, and suspensions (Bass et al, 2008), and core social emotional competencies of assertiveness (Ray, 1999), and empathy, problem solving and connection to community (De Long-Cotty, 2007). Baseline adjusted effect sizes ranged from <.05 to <.01. Exposure to the program was generally not effective in increasing perception of harm of marijuana. It increased perception of harm of alcohol in some studies, but not others. It had mixed effects on locus of control (Bass et al, 2008). These findings are described in greater detail in the reports cited.

Unexpected findings

For almost every study, in addition to the hypothesized findings, there were unexpected findings that challenge conventional wisdom. The setting, sample group, and implementation mode that yielded each unexpected result is described for each study, in chronological order.

1. S*tudent behavior changes more <u>without</u> adult mediation*
2. Role plays did not add value
Year: 2000. Setting: New York City public middle school. N=57 seventh graders, randomly assigned to one of two experimental groups of 17 students each, and one control group of 23 students, over a 12 week period. 54% male, 25% each African American, Latino, Asian, Caucasian.

Goal: Examine the impact of Ripple Effects training software on pro-social and anti-social behavior and remedial summer school referrals, under two conditions of use.

Conditions of use: One experimental group, used the computer program with self-regulated learning to complete 24 assigned tutorials (six contact hours) as a stand-alone intervention during free time at one of four computers in the back of classroom (Treatment A). The other had the same self-regulated, computer-based intervention, *plus* a supplemental, weekly counselor-facilitated session with role plays and discussion (Treatment B). The control group had neither.

Hypothesis: Independent, self-regulated use of the program might show slight effects, but adult mediation and role plays were necessary to ensure clinically meaningful change.

Measures: Social Behavior Observation Scale. Face validity was established by mapping to training modules from the software program, which in turn had been mapped to evidence-based strategies that had been proven effective in live instruction settings. Discrete behaviors during academic classes at times when social interaction was expected (i.e. social studies project) were logged in five minute increments. "Blind" observers were graduate students, with an inter-rater reliability rate of .93. School administrators provided data on summer school referrals.

Method of Analysis: The SPSS analysis of variance (ANOVA) program was used to compare the average mean observation scores among the three groups (.05 level of significance.) The SPSS chi square analysis program was used to compare the percentages referred to remedial summer school.

Unexpected outcome: The data indicated that the intervention group without adult mediated extra support (Treatment A) had significantly more (p<. 01) pro-social behaviors than the other two groups on one category: the "respect" subscale (items such as student gives feedback in a constructive manner). In addition, overall, trends were toward students who used the program *without* supplemental counselor-facilitated weekly sessions, exhibiting more pro-social and less anti-social behavior than students from either the adult supplemented group (Treatment B), or the control group. While not reaching the level of significance, the effect sizes were clinically meaningful.
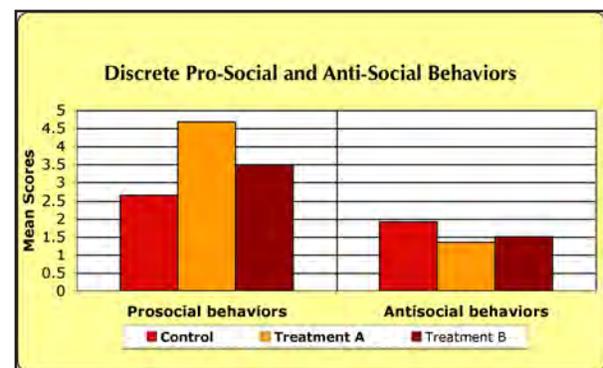

Figure 4. Difference in Mean Behavioral Scores for Treatment A, Treatment B, and Control Students

Data showed 42% fewer summer school referrals for the computer only group, and 61% fewer for the computer plus adult-facilitated treatment group, both compared to the control group. This was not statistically significant but had practical significance to administrators.
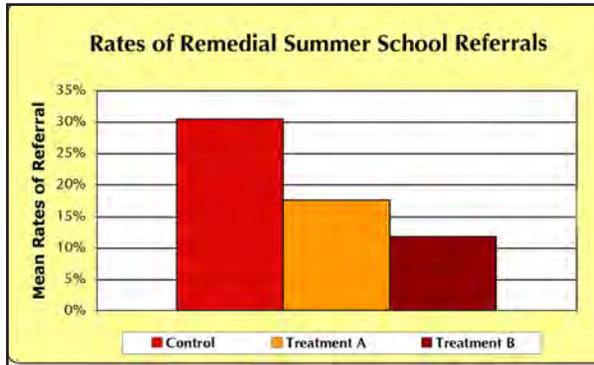
Figure 5. Difference in Mean Rates for Remedial Summer School Referrals

Due to the small sample size, both Type 1 and Type 2 errors were possible. Because the potential implications of these trends, if confirmed, were so wide, a replication study with a larger sample size was undertaken the following year. The scheduled collection of final outcome data coincided with the week of the terrorist attack on America (9/11). Thus attempts to replicate the study had to be abandoned.

The next series of studies were all tests of the impact of Ripple Effects self-regulated, computer-based learning, without adult mediation, under a variety of conditions.

In 2003, NIH/NIDA funded an expert panel review, program revisions, and a series of studies of the effectiveness of the revised version of the Ripple Effects program. These studies were designed only to assess self-regulated use, without supplemental adult facilitation. They examined academic as well as behavioral and attitudinal outcomes. Originally intended as a single, multi-site study, irreconcilable school-based differences in systems of data collection, as well as differences in anticipated conditions of use, required the study to be split into six smaller ones. This enabled examination of conditions of use as dependent variables in two of the studies, described next.

3. *Non-professionals + software results in student outcomes ≥ those from* credentialed teachers

Year: 2003. Setting: Oakland, CA, urban charter school. N =107 sixth graders, the overwhelming majority of them Latino students who were English language learners (ELL). 49% male.

Randomization to condition: All students were randomly assigned to one of eight gender-based advisory classes. Half of the classes had credentialed teachers for advisory period; the other half had non-professionals (janitor, volunteer, school secretary, cafeteria worker) for advisory period.

Conditions of use: The classes advised by non-professionals were the intervention group. They were assigned 42 tutorials (roughly 10.5 contact hours) over 7 weeks, to be completed in a computer lab, or laptops. The classes advised by teachers were the control group. They received live, classroom instruction from credentialed teachers on social emotional issues related to school success.

Goal: Examine the impact of Ripple Effects on grades, attendance, behavior, locus of control, and attitudes toward drugs and alcohol, when the program was used in advisory periods monitored by non-professionals.

The hypothesis was that use of the Ripple Effects program by students in advisories staffed by non-professionals might negate the presumed advantage of students with certified teachers for advisors, and result in no significance differences in outcomes between the intervention group and control group students who had credentialed teachers.

Measures: Computer adaptation of previously validated Monitoring the Future survey and Locus of Control Scale, plus school administrative data.

Method of analysis: SPSS was used for all original analyses. For data with post-intervention values only (e.g., GPA), independent-samples tests were used to compare the means of the treatment and control groups. Games-Howell post hoc corrections were used when standard deviations were very large, such as with discipline referrals and absenteeism. Analysis of covariance was used to control for student factors, and allowed statistical analysis of variance in means between groups with identifiable baseline unequivalence. Dosage effects were measured with Bonferroni correction applied to reduce the chance of Type 1 error.

Unexpected Finding: The data indicate that students with non-professional facilitators for
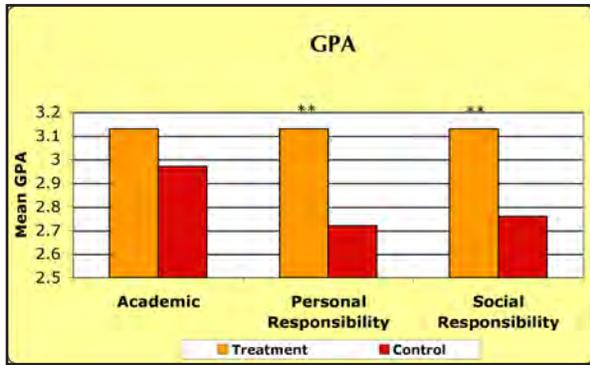
Figure 6. Difference in Mean GPA for Treatment and Control Students on Academic, Personal, and Social Grades (p < .01)

advisory, when supplemented with the Ripple Effects computerized training, had significantly higher grades for personal and social responsibility, than their peers in the control group p<.01. Treatment group discipline referrals were half those of the control group, a clinically important outcome, but not a statistically significant one (due to large variance). Smaller differences in academic GPA (3.13 treatment vs. 2.97 control) reflected the same positive trend, but differences were not statistically significant. Differences in absenteeism followed the same trend, with treatment group scores on average 2% lower than control group scores, a 40% difference, but not a statistically significant one. In this case, the lack of significance differences in some outcomes, as well as positive differences in others, disproved the null hypothesis.

4. *Computerized SEL instead of academic instruction = higher grades*

Year: 2003. Setting: Oakland, CA. A small, alternative middle school in a violence ridden urban neighborhood. N=31 eighth graders, 83% African American, 10% Latino, 100% eligible for free or reduced lunch, 52% male.

Randomization to condition: Staff assigned all consenting eight grade students to treatment or control group based on odd or even months of birth, without reference to any other variable. 15 were randomly assigned to the treatment condition, and 16 to the control condition.

Condition of use: Students from the treatment group were pulled out of academic classes (Language Arts or Math) and sent to the computer lab at a set time for 45 minutes, three times a week, for seven weeks. They were assigned 42 tutorials (roughly 14 contact hours) to complete during that time. Control group students received regular instruction in Language Arts and Math.

Measures: same as study above.

Methods of analysis: same as above.

Unexpected Finding: The data indicates that treatment group students who had the SEL computer program instead of academic instruction for two hours a week had higher academic grades, by a full point and one-half, than control group students who received the two hours of instruction in Math or Language Arts. This was after adjusting for baseline unequivalence. The treatment group's GPA increased from 1.10 to 2.26 from pre-to-post, while the control group's declined from 1.78 to 1.44, at a high level of significance (p<.01). Discipline referral scores were also lower, but didn't reach the .05 level of significance.
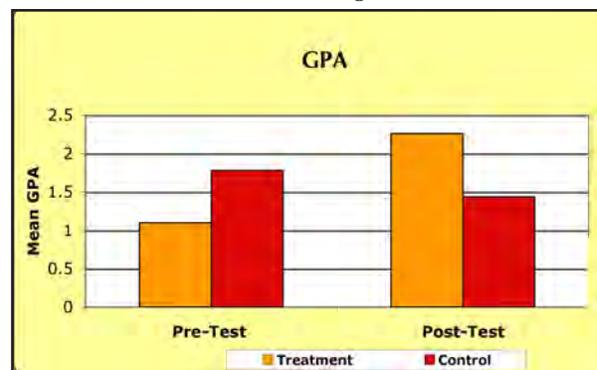

Figure 7. Difference in Mean GPA for Treatment and Control Students from Pre-Test to Post-Test

5. *More empathy in experimental group, but more connectedness in control group.*

Year: 2005-2006. Setting: Two regular middle schools in a suburb of San Francisco. N= 154 sixth graders. 51% male. 52% Caucasian, 26% Hispanic, and 19% Asian/Pacific Islander; with 37% coming from non-English-speaking homes.

Goal: Examine impact of self-regulated Ripple Effects computer-based training on resiliency assets and school success.

Intervention: 44 tutorials were assigned over 10 weeks. 42 were assigned by staff, two were student selected. Students in the treatment group went to the library computer lab to complete the program, while control students stayed in their classes.

Assignment to condition: Randomization of assignment to condition was at the level of the individual student within each school, not at the level of the school, using a random number generator to assign students to conditions.

Control condition: Control group students participated in business as usual during their life skills or computer classes.

Hypothesis: Students exposed to the computer-based training would show gains in resiliency assets, and those gains would be greater than any in the control group.

Measure: Previously validated California Healthy Kids Survey measures of internal resiliency assets: social competence (empathy and connectedness), problem solving and autonomy, adapted for peer-narrated, computer delivery. A video game structure embedded in the software rewarded each answer (any answer) with forward movement in the game.

Method of analysis: Data analysis was conducted using STATA/SE 9.2. Descriptive statistics included mean scores on study measures at baseline, post-, and follow-up test. Baseline comparisons of scores within/between groups for treatment vs. control were computed using t-tests. Changes between pre-post, post-follow-up, and pre-follow-up were measured using Analysis of Covariance (ANCOVA) controlling for baseline or posttest scores, gender, and ethnicity.

Unexpected finding: As hypothesized, but not generally expected, the data indicates the treatment group showed significantly higher mean score changes than the control group from pre- to post-test on empathy (p<.02). (The treatment group also showed significantly higher mean score changes than the control group from pre- to post-test on problem-solving, p<.03, consistent with some prior studies on technology and cognitive abilities.) However, the control group had significantly higher

mean score changes than the treatment group from pre- to post-test on connectedness (p<.04). Teacher and principal interviews indicated the entire sample of students showed improved behavior toward spring, a reversal of the normal trend of more behavior problems as the year progresses. There was no objective prior years' data to measure the accuracy of this perception.
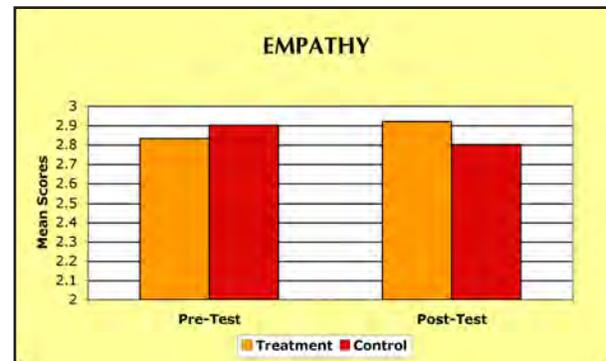

Figure 8. Difference in Mean Score Changes for Treatment and Control Students from Pre-Test to Post-Test for EMPATHY (Difference = 0.146*; p= .02)

6. *Various content configurations yielded positive results*

At each site for each study, there was an explicit scope and sequence. However, scope and sequences of content were differently configured in each study, and between treatment groups within one study. In addition, there were differences in content exposure within groups, as students followed links in a self-directed process.

Of 103 tutorials used across the set of studies, only a single tutorial,"empathy" was common to all four of these studies. One or more of five tutorials related to "feelings" were used in every study (identifying, understanding, predicting, communicating, managing); but the exact tutorials differed across studies and sites. 18 tutorials were core components in three out of four studies, but not all for the same three studies. Those 18 tutorials all promoted core, social-emotional competencies of awareness and skills related to self and others. Different configurations could not be directly correlated with different outcomes (i.e., academic

Common content across three sites

	Awareness	Skills	
Self	**Self-understanding** Learning style Strengths Risk and protection Resilience Physical sensations	**Self-regulation** Controlling impulses	**Self-efficacy** Taking control Setting goals Assertiveness Luck Future
Other	**Empathy** Identifying with others	**Connecting with others** Perspective taking Expressing solidarity Getting help	**Problem-solving** Fighting Teacher conflict

Figure 9. The 18 tutorials which were part of the content in three of four studies.

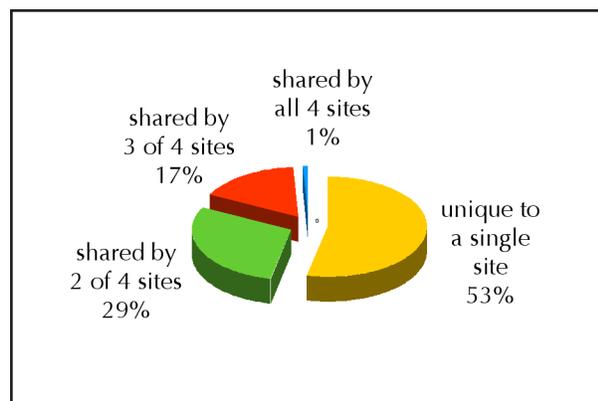outcomes versus behavioral outcomes versus internal resiliency assets).

Figure 10. Pie chart of content differences

Discussion: Implications for Research and Practice

Change in role of adult facilitators
Each of these studies separately, and all of them together, confirm the counter-intuitive claim that *self-regulated use of a computer program, without any adult mediation of content, can be an effective method* of promoting social-emotional learning among adolescents and can positively impact school outcomes in the process. This suggests that a change in the role of adult facilitator from "sage on the stage" to guide on the side" could - and possibly should - occur.

Diminished importance of public rehearsal
The greater gains of New York students who used the program on their own, over those who also had an adult-facilitated session involving discussion with role plays, are counter to widely documented evidence that live role plays are an effective, and potentially necessary means of rehearsing social behavior to make it "stick." (Bandura, 1977, 1986). While not statistically significant, the effect sizes were clinically important, and led to retesting the condition of self-regulated, unmediated use -without role plays - in several subsequent studies, with positive effects discussed earlier.

Although unexpected at the time, the results are consistent with newer research on the role of video modeling, which the Ripple Effects program does provide. Studies since 2000 have found that video modeling is more effective than live modeling in teaching social skills to children, and that children generalized skills across settings better after video modeling (Charlop-Christy, Le, &

Freeman, 2000; Sherer et al., 2001; Charlop-Christy & Daneshvar, 2003). Computerized delivery of video modeling could potentially further enhance this effect, since a user can watch them as many times as desired.

We hypothesize that the private and non-judging nature of a computer may also foster a greater trust in the computer-based training than in live alternatives. Indeed, there is a growing body of research that shows people are more likely to be honest with a computer than with a live interviewer (Turner et al, 1998). In addition, adolescents look to their peers rather than adult authority for guidance on personal matters, and the program was peer-narrated. Students' ability to approach the training according to their preferred learning style might also have contributed to the positive effect.

Finally, we should not assume that because the treatment group students did not engage in public role plays, that they did not rehearse the behavior. Indeed, every tutorial advised practice of key skills, provided *suggested* role plays, and presented opportunities for transfer training to friends and family, and sports setting. It is entirely possible that students rehearsed the skills privately, or in non-classroom social settings.

Use of non-professionals as program implementers

The finding that students with non-professional advisors supplemented by Ripple Effects computer-based training had significantly higher personal and social responsibility grades, and at least equal (with trends toward better) academic grades, as well as strong trends toward lower absenteeism and lower discipline referrals, than control group students with credentialed teachers – but not the software – is startling. Instructor competence has been repeatedly shown to be a major factor in student outcomes. The lack of credentialed teachers has been identified as a significant risk factor for poorer academic and behavioral outcomes (Wayne & Youngs, 2003).

This unexpected finding suggest that a much wider range of people than previously had been thought potentially could facilitate programs to address risk and protective factors, as long as the

expertise is "in the box." Providing these computerized resources may be a way to offset some of the disadvantages students face when they are in schools with less experienced, or less expert, teachers.

Use of academic time for SEL training

The academic effect of attending to non-academic risk factors was literally the difference between failure (1.11 GPA) and success (2.21 GPA) among one of the highest risk groups for dropping out of school and early entrance into the criminal justice system: African American adolescents, the majority male, from a very low income, violence-prone neighborhood. This effect was gained by reducing rather than increasing the time spent on core academic subjects by more than two hours per week, with students instead pursuing self-regulated learning to develop social-emotional competency, and privately seeking guidance on personal matters that concerned them. This sharply challenges conventional theory, often cited in NCLB, that academic failure of students with multiple risks, can best be addressed by more academic training and practice. It suggests providing students with time and resources to develop social-emotional strengths and address personal risk factors can pay off in academic gains. It further suggests that in some cases, adolescents may be better judges of their own needs than are the adults who supervise them.

Use of computer to promote affective abilities

Empathy is considered by many researchers to be the cornerstone of social emotional abilities (Goleman, 1995, 2006). It has cognitive, behavioral and affective components. The efficacy of computer-based training to develop cognitive abilities is well established (Schacter & Fagnano, 1999; Underwood & Underwood, 1990). The potential of Ripple Effects computerized training to change observable social behavior, by including empathy training, has also been established through prior studies, though on a more limited scale (Bass et al, 2008). But the potential for self-directed, computer-based training to directly

impact an affective characteristic - the ability to identify with the felt experience of others - had never been demonstrated prior to the 2005 study. It is counter-intuitive that a machine – a computer – can teach an adolescent to feel. But the data indicates that the Ripple Effects computerized program has done that, without any mediation of content by adults.

This suggests new possibilities for fortifying and strengthening universal positive youth development programs. The Ripple Effects program offers many of the same empathy training strategies as in clinically validated, live instruction programs like *Paths, Second Step,* and *Social Decision Making/Social Problem Solving.* It can (but need not) be systematically sequenced in similar ways. Sample scopes and sequences for universal promotion are include in supplemental materials. While we are not recommending Ripple Effects as a replacement for evidence-based programs that are already incorporated into a school's policy and culture, the software-based training could potentially be a valuable supplement to them. It could allow students who miss a key lesson to make up the work, and students who show signs of needing more training, to get it without holding back the whole class. More studies are be needed to test these hypotheses. (Disclosure: the author originated both the *Second Step* curriculum and Ripple Effects computer-based training).

This finding also suggests there may be new, more accessible and affordable individual treatment options for students with anti-social behavior linked to lack of empathy, from bias crimes, to cliquish behavior, to sexual assault. The most common use of the Ripple Effects program around the country, is as a therapeutic sanction in discipline and counseling settings, or as supportive supplemental services for special needs students with behavior related disorders.

We can hypothesize why this is so. The program addresses a wide range of risk factors in multiple domains, as well as normal developmental challenges. The computer program is completely non-judgmental, while even the best therapist can only try to be. The program bypasses the need for

adult mediation, which can be a barrier to access during adolescence. The program can accommodate different processing speeds and language ability, as well as diverse learning styles, and is culturally relevant across groups.

Targeting mainstream students in order to reach alienated students.

The unexpected finding that teaching the treatment group skills for caring had the effect of the the control group feeling more connected, also has implications for prevention. To date, efforts have focused on "fixing" alienated, at-risk students, reinforcing the notion that they are the problem. These new findings suggest that another approach is to target some critical mass of mainstream students with training in skills to include, with the goal that whomever they come in contact with will feel more connected. In the case of this study, it was a randomly chosen 50% of all students in the class. More study would be needed to better understand what, if any, is the minimal critical mass needed to effect this kind of change.

Personalization versus standardization

Inclusion of a comprehensive body of evidence-based content and processes in one program diminishes the importance of standardization in scope and sequencing and/or instructional methods. Weisberg and Durlak have identified a strong correlation between explicit content sequencing and positive outcomes for effective social emotional learning programs (2007). Yet in the studies described herein only a small amount of core content was shared across sites; that shared content was differently sequenced at each site; and additional "idiosyncratic" content choices were made at both the site and individual levels. To some degree, students built their own scope and sequence as they intuitively moved through the program, in the same way that children create their own cars or houses from a single set of lego blocks. To continue the analogy, outcomes were positive whether they built a car or a house.

Similarly, while some core learning *processes* were shared across sites (i.e. students were required

to complete all the interactive games and journaling), more were not. Beyond the two interactive learning modes, students could access - or not - any of at least seven other modes of learning, in any order, at any pace.

By definition, the process of self-regulated learning is individualized, not standardized. A truly effective teacher needs to employ the whole range of instructional methods that can appeal to diverse learners and learning styles in a single classroom. By contrast, a student can effectively learn by focusing only on those modes of instruction which best match his or her personal learning style and preferences.

A good body of theory would support the hypothesis that outcomes may have been better, because both students and their schools were able to match their goals with strategies that could be effective in achieving them. Lipsey has conceptually linked adolescents' most important risk factors with the most effective strategies for positively impacting them (2007). In the Ripple Effects programs these elements are electronically linked as well.

Financial implications

These finding have immediate financial as well as educational implications, on two levels. They suggest that there may be a way to provide some professional level services, without incurring the formidable expense of adding professional level staff. This does not discount the need for trained counselors, nurses and psychologists, but may help enable those professionals leverage their services more efficiently.

Limitations of these findings
1. Regarding outcomes

Results of these studies were based on tests of a single, multi-award winning computer program, with a strong theoretical base and culturally competent, systematic, multimedia learning system. (Ray, 2008). These results cannot be extended to other programs simply because they use similar technology.

The studies each used site-specific configurations of the Ripple Effects program, which were designed to increase the chance of affecting specific outcomes. There is no evidence that random configuration of any tutorials in the comprehensive program would have the same effect.

Private exploration of individual risk factors was a component of the intervention in two studies. These studies did not isolate that variable and were too small too draw any conclusions about correlations between that individualized use and specific outcomes.

Participants in these studies were all adolescents. Most were younger than 15. Findings about the role of self-direction versus adult mediation in the use of Ripple Effects program cannot be validly extended to younger students.

In these studies a distinction has been made between adult <u>mediation of content</u> and adult <u>monitoring of the process</u> of student self-directed study. The former is not required, the latter is. There is no evidence that students will voluntarily initiate use of the program, or choose the scope of training modules best designed to elicit specific academic, behavior, social and emotional effects, if they are not mandated to do so and their progress actively monitored by responsible adults.

2. Regarding research methodology
A. Randomization Because the intervention studied was self-directed, it was possible to have true randomization down to the level of the individual, and to accurately measure dosage for each student. The strength of this approach is that it greatly reduces, if not eliminates, the teacher effect in an intervention, and it enables objective analysis of individual, dosage-related effects.

Nonetheless, while long considered the "gold standard" for medical trials, simple logic would argue against RCTs at the level of the individual, as the best research design for evaluating SEL programs. These interventions, by definition, involve social interaction, thus social contagion. "Contamination" of results is almost inevitable, and as noted, may actually be a beneficial side effect.

Since, with computerized delivery of SEL

training, the teacher effect is greatly reduced, a case can be made for power analysis at the level of the student, but randomization at the level of the classroom.

B. Impossibility of componential analysis

The studies described here demonstrate *that* this program can be effective under a variety of conditions. They don't answer the questions of *how* or *why* it works under any of those conditions. With the Ripple Effects modular program, instead of a single logic model, there are multiple logic models operating concurrently. It involves an expert system in which both process and content variables change in real time, in response to user input (Ray, 2008). Such a complex logic model complicates evaluation studies enormously. There is no easy way to tease out the relative importance of required core content, versus individualized content choices, versus the process of self regulated learning, versus specific choices among multiple, multi-sensory modes of learning. If sequencing is considered, true componential analysis is nearly impossible. With 390 tutorials to choose from, there are literally an infinite number of possibilities for content topical configurations alone. $(n-1)! = 389! = \infty$. Just the 18 topics shared across the three later studies have 3.55687E+14 potential configurations. (1.0E+9 = 1 billion). While the possible combinations of available modes of learning are not numberless, at 5040 options they too defy analysis within the size constraints of any educational study to date.

This is a case where the whole is quite literally much more than the sum of the parts. It offers the possibility of a more calibrated matching of individual risk factors with specific strategies proven to be effective in addressing them. It accommodates differences in learning style, processing speed and reading ability. Together this offers the possibility of providing personalized, evidence-based training in social-emotional learning to a much wider range of people than ever before.

However, it also makes componential factor analysis a practical impossibility. In this light, the recent trend in educational research to move "beyond" outcome descriptions to quantifying the effect of specific mediators, may end up being a turn backward, rather than movement forward. The reduction of program options to a level that enables researchers to find the answers they seek, would have to come at the expense of providing children the personalized interventions they need and deserve, and for which this program was designed.

Conclusion

These unexpected findings are intriguing and worthy of much further study. They can help inform a continuing evolution of the meaning of "best practices" for prevention and positive youth development programs in an increasingly technology driven and diverse society. In particular, they hold the possibility of greatly widening our understanding of how, when, under whose supervision, and at what financial cost, students can receive evidence-based training in strategies to promote social-emotional learning.

Due to the settings in which the original studies were conducted, these findings have particular relevance for those schools and districts that have persistent, disproportionate representation of African American and Latino students in disciplinary actions, and/or persistent gaps in academic achievement between these students and their Anglo and Asian American counterparts, and/or inexperienced or inexpert teachers, who often add an additional risk factor to the very students who are already most at-risk for failure.

Much work still needs to be done to tease out the relative mediating effects of self-regulating learning, learning modes and platforms, standardized content, and individualized content. In pursuit of that task, researchers may be forced to acknowledge that in this instance, good enough must be good enough. The perfect study would be not just the enemy of the good, but its annihilation.

Author's note

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As the creator of the Ripple Effects program, I am an interested party in this research and analysis. For that reason I have been involved in research design and interpretation of results, but have *not* been directly involved in implementation of the intervention, data collection, or data analysis for any studies referenced here.

I have used these unexpected findings to inform further development of the teen and younger children's computer-based SEL training program, as well as professional development training software and supplemental print and web-based resources for staff, parents and administrators.

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