



# 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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**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 without supplemental, adult-facilitated sessions had better behavioral outcomes than students with adult supplement.
- In a later study, students with non-professionals 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 ( $p=.001$ ), and data indicated trends toward higher academic grades and lower discipline referrals as well.
- Students who had the self-directed, computerized SEL training in lieu of academic instruction, for two hours per week, got better grades than control students who had instruction in math and language arts during the same periods ( $p=.001$ ).
- Students who used the program had higher empathy scores ( $p=.02$ ), but control group peers in the same classrooms 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 eighth 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

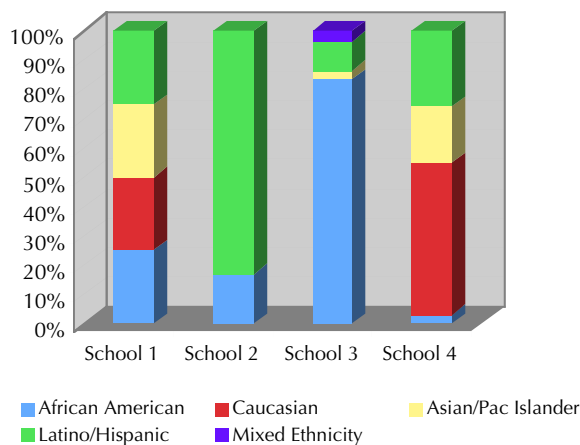


Figure 1. Breakdown of demographics by school

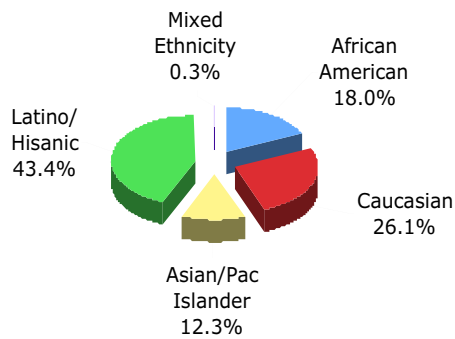


Figure 2. Breakdown of demographics across schools

*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.

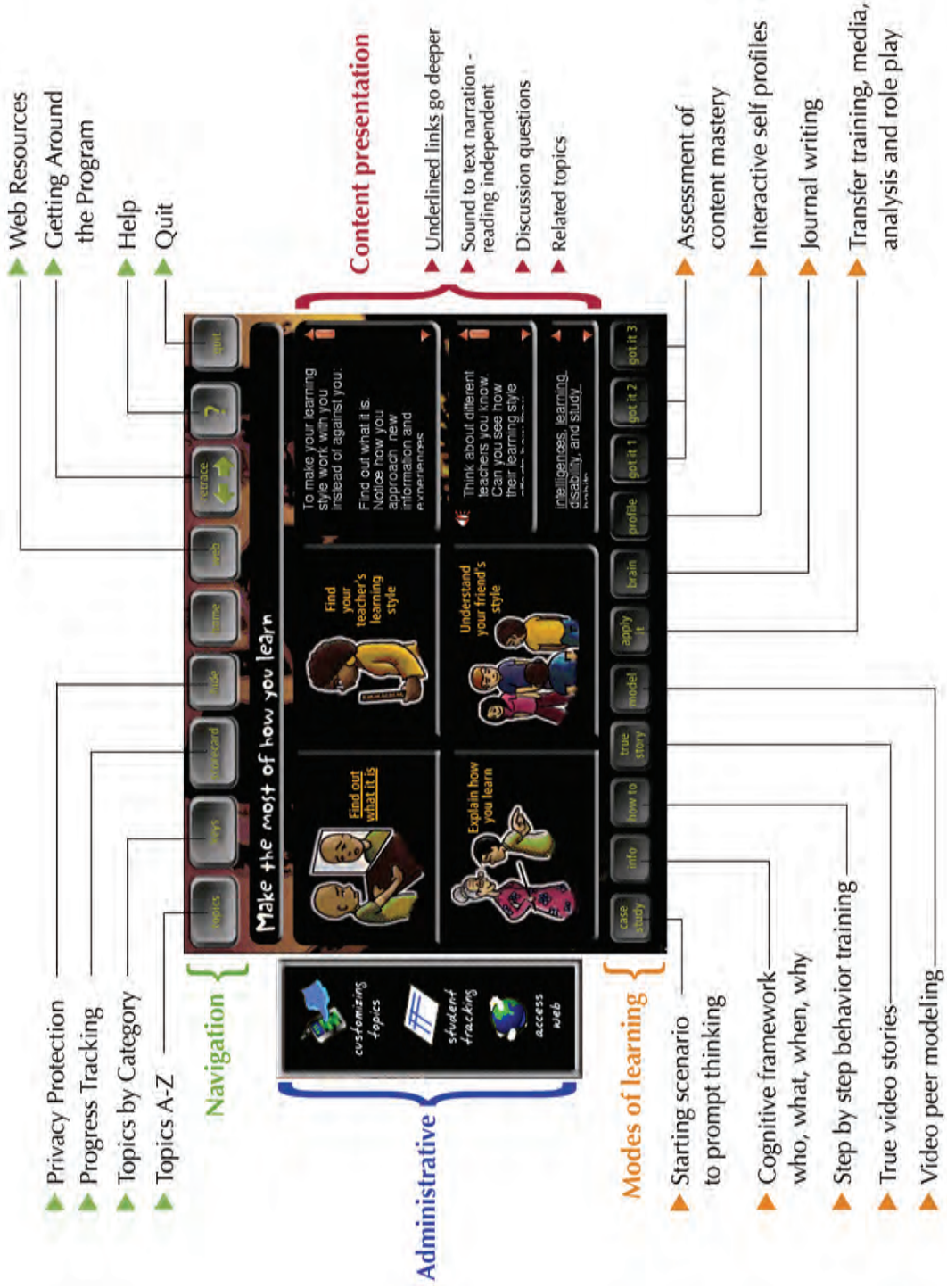


Figure 3. Diagram of Whole Spectrum Learning System

### *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 <.001. 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. Student behavior changes more *without* 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.

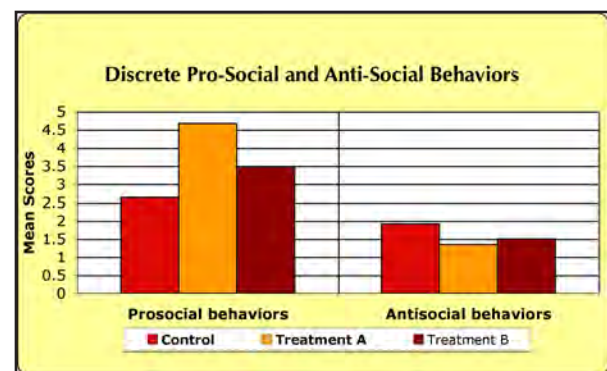


Figure 4. Difference in Mean Behavioral Scores for Treatment A, Treatment B, and Control Students

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.

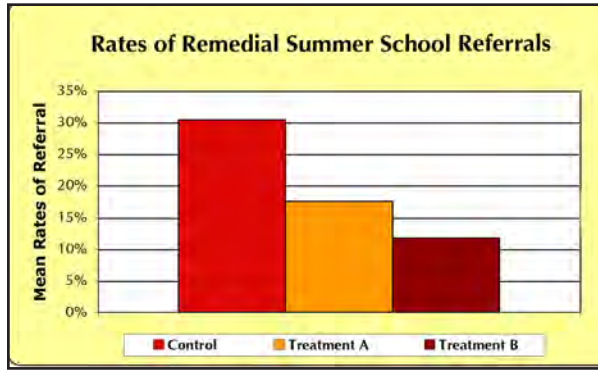


Figure 5. Difference in Mean Rates for Remedial Summer School Referrals

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 $\geq$ 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

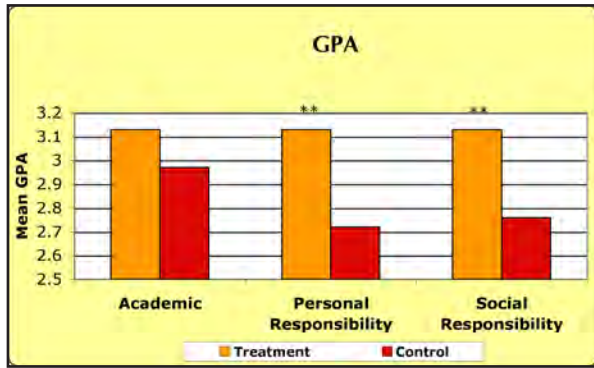


Figure 6. Difference in Mean GPA for Treatment and Control Students on Academic, Personal, and Social Grades ( $p < .001$ )

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  $p < .001$ . 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 eighth 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 10.5 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 1.11 to 2.21 from pre-to-post, while the control group's declined from 1.78 to 1.44, at a high level of significance ( $p < .001$ ). Discipline referral scores were also lower, but didn't reach the .05 level of significance.

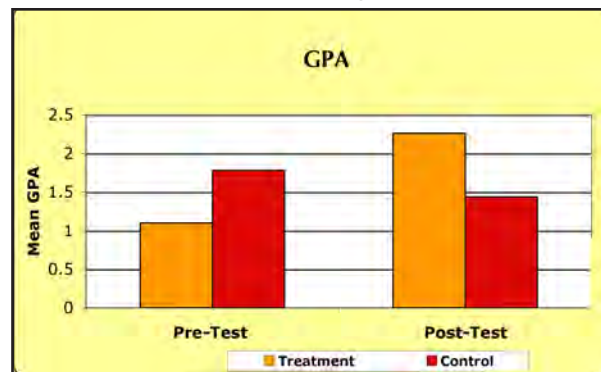


Figure 7. Difference in Mean GPA for Treatment and Control Students from Pre-Test to Post-Test

#### 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.

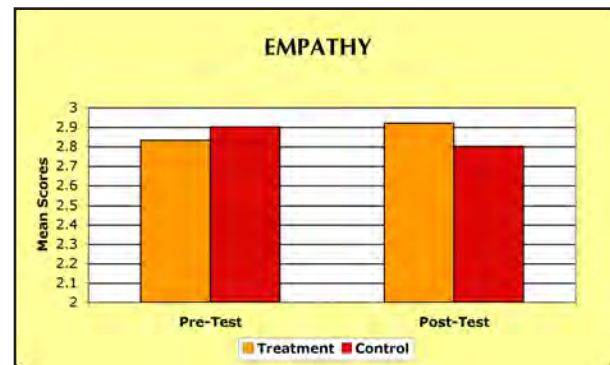


Figure 8. Difference in Mean Score Changes for Treatment and Control Students from Pre-Test to Post-Test for EMPATHY (Difference = 0.146\*;  $p = .02$ )

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

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

outcomes versus behavioral outcomes versus internal resiliency assets).

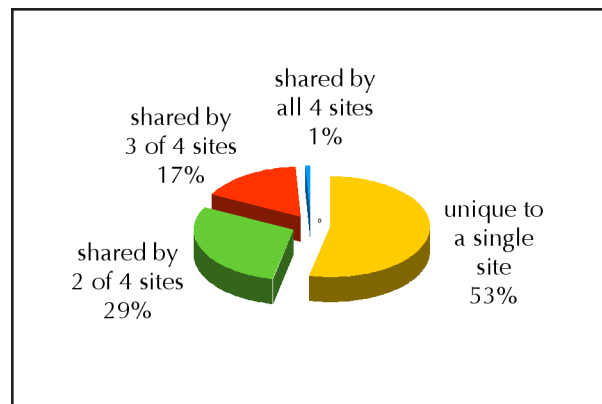


Figure 10. Pie chart of content differences

## 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 included 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 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 findings 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 to 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 mediation of content and adult monitoring of the process 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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