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ORIGINAL PAPER

Computeen: A Randomized Trial of a Preventive Computer and Psychosocial Skills Curriculum for At-Risk Adolescents

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Abstract Computeen, a preventive technology and psychosocial skills development program for at-risk adolescents, was designed to improve computer skills, self-esteem, and school attitudes, and reduce behavior problems, by combining elements of community-based and empirically supported prevention programs. Fifty-five mostly Latino adolescents from 12 to 16 years old who were living in affordable housing communities participated in this randomized wait-list control study. Results showed considerable improvements in computer self-efficacy, decreases in internalizing behavior problems, and excellent attendance and consumer satisfaction. Self-esteem and school motivation results were mixed. Computer self-efficacy mediated the relationship between improved computer skills and self-esteem. Younger adolescents showed greater improvement than did older adolescents. *Editors' Strategic Implications*: Although there are limitations to this study's sample size and scope, Computeen appears promising as a developmentally appropriate, strengths-based prevention program.

Keywords Prevention · Adolescent · Psychosocial · At-risk · Computer · Community

Introduction

Children living in impoverished urban environments are frequently exposed to acute and chronic stressors, such as family disruption, domestic violence, parent mental

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illness, rampant drug abuse, deviant peers, and community violence (Dubow et al. 1997; Evans 2004; Garmezy 1993). Exposure to these stressors puts children at high risk for developing emotional, behavioral, and social problems (Egeland et al. 1993), particularly if they experience multiple stressors (Sameroff et al. 1987). These problems impede educational and occupational success and put the child at risk for additional stressors, thereby perpetuating a maladaptive cycle of school failure and delinquency (DuBois et al. 1992; Henry and Huizinga 2007).

Minority youth are especially at risk, in part due to the dramatic difference in poverty rates between African Americans (25%), Latinos (22%), and Caucasians (8%) (DeNavas-Walt et al. 2008). Nationally, Latinos and African Americans significantly trail Caucasians in college enrollment and graduation rate (United States Census Bureau 2008). The gap is especially large for Latinos, with a high school graduation rate of 60% (91% for Caucasians) and a 4-year college graduation rate of 13% (32% for Caucasians). Many children in impoverished urban areas are at increased risk for developing educational, social, or behavioral problems, even though they may "get by" for some time before serious problems are identified. Kazdin (1990) reported that up to 70% of clinically distressed youth never receive formal mental health treatment, and many of these youth are from disadvantaged urban areas. In poor communities and schools, many children may have social, academic and/or behavioral difficulties that go undetected or untreated because of the number of severely troubled children and limited school, family, and community resources. These problems may not get them the same attention as aggressive youth, but may inhibit success in school and pursuit of further education, and may precipitate the onset of more serious problems. Youth from these neighborhoods are also more likely to have low self-esteem (Abernathy et al. 2002).

A wide range of prevention programs for at-risk youth exists, including both community-based and empirically supported programs. Although these approaches are not mutually exclusive, there are often important differences between programs developed in communities and those developed and studied by researchers. Traditional community-based programs typically involve tutoring, mentoring, athletics, and other after school activities (e.g., Boys and Girls Club). These programs are often appealing; they focus on youths' strengths, are relationship-based, and provide an alternative activity during the after-school hours when adolescents are most likely to get into trouble. However, community-based programs often lack empirical evaluations, are usually not theoretically grounded, and may not directly address the risk factors that participating youth face.

In contrast, most empirically supported prevention programs are theory driven, include rigorous evaluations, and have well-trained providers. However, as others have noted (Allen et al. 1997; Durlak and Wells 1998), these programs tend to address risk factors through a deficit-oriented and potentially stigmatizing approach involving cognitive or social skills training, direct education (e.g., substance abuse), or parent training. Most occur in schools (Kulic et al. 2004), often for convenience reasons and despite research suggesting that most adolescent risk factors have the strongest influence outside of the school (Durlak and Wells 1998; Reese et al. 2000). Additionally, effectively transporting empirically supported programs from the tightly controlled academic settings where they are often developed into "real world"

communities is largely unsuccessful (Fixsen et al. 2005). Few published programs combine the strengths of these different approaches. In one rare exception, Allen et al. (1997) found that an experimentally evaluated community-based volunteer service program called Teen Outreach reduced behavior problems and teen pregnancy even though the program did "*not* explicitly focus upon the problem behaviors it seeks to prevent" (p. 738), but instead enhanced developmentally appropriate skills like decision making and peer interaction through volunteer service.

The purpose of this study was to evaluate Computeen, a novel prevention program that was developed to bridge the gap between community-based and empirically supported prevention programs. Computeen is a community-based prevention program that is grounded in risk and resiliency research. In a review of the literature on conduct disorder and adolescent violence, the Group for the Advancement of Psychiatry Committee on Preventive Psychiatry (1999) identified a variety of protective factors found across studies, including competency in nonschool skill areas, prosocial peer groups, positive relationships with an adult, and support from adults in the community. In another review of prevention programs, those that used varied teaching methods, were theory driven, provided opportunities to make positive relationships, and were socioculturally relevant were most effective (Nation et al. 2003). There is also evidence that self-esteem and self-efficacy moderate the relationship between low socioeconomic status (SES) and poor outcomes (Bradley and Corwyn 2002; Turner et al. 1995).

Computeen was designed to strengthen these protective factors through an asset-based, self-efficacy enhancing (Bandura 1977) approach to prevention, where the adolescent tasks of autonomy, competency, and forming peer relationships are supported. Participants are trained to be computer and technology experts in their communities to build their competency, self-efficacy, and self-esteem, and to foster a prosocial after school peer activity in a supervised setting with positive adult role models. The computer curriculum integrates practical technology skills with psycho-education and psychosocial skills of particular importance to low-SES, minority adolescents, including development of a positive ethnic identity, understanding educational options, coping with community violence, and social problem solving.

Computer training was selected as the core activity around which to build self-efficacy because technology is inherently appealing to adolescents and because computer proficiency can be achieved regardless of academic ability. There is also evidence that after school computer use is positively correlated with school grades (Rocheleau 1995). In addition, minority youth, especially those of low SES, face large gaps in the use of technology, computers, and the Internet (United States Department of Commerce 2002, 2004). In Latino homes where Spanish is the only spoken language, which is common in many impoverished urban neighborhoods, only 14% use the Internet (United States Department of Commerce 2002). Computer and Internet skills have become increasingly important for success in education and employment, and a disproportionately low number of low-SES children eventually pursue careers in technology and mathematics (National Science Foundation 2007). Although this disparity is certainly the result of a number of complex economic, psychosocial, and educational factors, the gap in technology skills between minority and Caucasian adolescents likely plays a role.

The primary hypotheses of this study were that Computeen participants would have higher computer skills and computer self-efficacy, improved self-esteem and school related attitudes, and decreases in maladaptive behaviors compared to wait-list controls. We sought to test whether improvements in computer skills predicted increased self-esteem and whether this relationship was mediated by improvements in computer self-efficacy. Further, it was hypothesized that increases in computer self-efficacy would predict improvements in school attitudes and behavior problems, and that this effect would be mediated by improvements in self-esteem. Because adolescent girls report enjoying computers much less than boys do (Christensen et al. 2005), we sought to determine whether males would have increased participation and improved outcomes compared to females. Finally, experimental age comparisons were also planned to identify the best target population for the program.

Method

Design

A randomized wait-list control design was used. Four affordable housing communities in Los Angeles County were selected to participate in the study. Although data on non-participants was not available, the four communities did not differ from each other on family income, parent education, ethnicity, or other demographic variables based on the participants from each community. Each of the four housing communities was randomly assigned to either the immediate or wait-list condition. All recruited participants in each community were subsequently in the assigned group (e.g., either immediate or wait-list). Randomization was by community because some communities did not have enough participants to have both an immediate and a wait-list group.

Immediate group participants completed three assessments (pre-group, post-group, and follow-up), whereas wait-list controls completed four assessments (pre-waitlist, pre-group, post-group, and follow-up). This allowed for group vs. wait-list comparisons as well as examining aggregate data from all participants at pre-group, post-group, and follow-up.

Participants

Fifty-five participants from the four affordable housing communities were initially recruited and completed the first interview. At each site, participants were recruited at community meetings where informed consents were presented to parents and adolescents. The only inclusion criteria were that participants lived in the affordable housing community and were between 12 and 16 years old ($M = 13.8$, SD $= 1.4$) at the time of consent. There were 31 males and 24 females recruited, and the sample consisted of 49 Latinos, 3 African-Americans, 2 of mixed race, and 1 Caucasian. Mean annual family income of the sample was between \$13, 000 and \$14, 000. Most participants reported knowing "very little" to "some" about most of the Computeen computer skill areas, with the exception of Microsoft Word and email ("know a good amount"), and 56% reported having a computer in their home.

Dropouts vs. Completers

Participants who dropped out before the second interview in either the wait-list condition ($n = 1$) or the immediate condition ($n = 8$) were compared to those who did not drop out ($n = 46$) on all baseline measures using independent samples *t*-tests. Dropouts had significantly more maladaptive attitudes about school goals, $t(53) = 2.90$, $p < .01$, less school motivation, $t(53) = 2.78$, $p < .01$, and higher externalizing behavior problems, $t(48) = 3.84$, $p < .01$. They did not differ from completers on any other variables. Participants who dropped out either moved or did not respond to phone calls about the program. We were unable to complete a second interview with any of the dropouts, so intent to treat analyses were not conducted.

Immediate Group vs. Wait-List Controls

Demographic data for the 21 wait-list and 25 immediate group participants who completed interviews at the second interview (e.g., non-dropouts) are shown in Table 1. Independent samples *t*-tests and chi-square analyses were conducted to assess group differences on the demographic and outcome variables at the first interview. Out of these 23 comparisons, one was significant. Immediate group participants were significantly more likely to live with both parents than were wait-list participants ($\chi^2 = 5.99$, $df = 1$, $p = .01$). Independent samples *t*-tests showed that living with both parents was not significantly related to any of the outcome variables, so it was not covaried in subsequent analyses.

Table 1 Sample demographic data and condition comparisons for all participants (excluding dropouts)

	Immediate ($n = 25$) *M* (SD)	Wait-list ($n = 21$) *M* (SD)		*df*	*t*
Age	13.42 (1.22)	13.87 (1.61)		44	1.10
Grade	7.56 (1.19)	7.81 (1.47)		44	0.64
Number of siblings	2.36 (0.99)	2.57 (1.40)		44	0.60
Mother's education (years)	7.76 (3.79)	8.97 (4.33)		44	1.01
Father's education (years)	7.77 (4.15)	8.22 (3.63)		20	0.27
Family income^	4.56 (1.36)	4.43 (1.83)		44	0.28
	Immediate (%)	Wait-list (%)	Total (%)	*df*	χ^2
Gender (% male)	52.0	61.9	56.5	1	0.46
Latino/hispanic	96.0	76.2	87.0	1	2.40
Lives with both parents	88.0	52.4	67.4	1	5.99*
Born in the United States	68.0	94.7	80.4	1	3.79
Parents speak english	60.0	71.4	65.2	1	0.66

^ Family income scale: 1 = 0–$3,000; 2 = $3,000–$6,000; 3 = $6,000–$10,000; 4 = $10,000–$14,000; 5 = $14,000–$18,000 6 = $18,000–$22,000; 7 = $22,000–$30,000; 8 = $30,000–$40,000; 9 = over $40,000

* $p < .05$

Procedure

To keep participants and staff blind to group assignment during the initial assessment, housing communities were randomly assigned after all participants and parents in the community completed the first interview. Participants completed the assessments through interviews in their community, whereas parents were interviewed over the telephone. Parents chose whether to be interviewed in English or Spanish, and they received a $15 grocery store gift card for each interview completed. Once the first interviews were complete, the 16-week program was implemented in the two communities assigned to the immediate condition. The second interviews were conducted approximately 5 months after the first; after the second interviews, the wait-list controls began the program. Wait-list controls completed their third (post-group) interview following their group, and their fourth (follow-up) interview 3 months later. The immediate group members completed their third (follow-up) interview 3 months following their second (post-group) interview.

Program Structure/Curriculum

Computeen groups consisted of 5 to 11 adolescents and two group leaders. Each participant had a computer for their own use during the groups, which were conducted in the computer lab of each housing community. The curriculum consisted of 16 weekly 2-h sessions designed to teach computer skills relevant to adolescents and/or that can be used to complete schoolwork. Skills taught included facility with Microsoft Word, PowerPoint, Excel, Front Page, Printshop, and Internet use as well as hardware knowledge, digital photography, and basic networking. Skills were taught through individual and group projects that targeted topics and/or psychosocial skills of importance to low-income and at-risk youth. Lessons were designed to encourage positive interaction among the participants. For example, an individual lesson on Internet searching and designing posters in Printshop focused on ethnic identity. Participants created a poster of the positive things associated with their ethnic group within Printshop, in part by using pictures they found searching online, and then shared their posters with other participants. Another lesson required the participants to design the materials for a business they might like to start. For example, to 'create' a restaurant, the student made a menu in Word, a web site advertising the restaurant in Front Page, tracked the expenses in Excel, and created "Help Wanted" signs in Printshop. The first author developed the curriculum with input from a professional computer consultant and the second author, who developed the SPARK group counseling curriculum for at-risk adolescents, upon which some of the Computeen activities were based (Waterman and Walker 2009). Participants were assigned "homework" each week, which usually consisted of a small project practicing a program or skill they had just learned. A copy of the curriculum is available from the first author upon request.

To encourage participation, group members earned "points" for attendance, involvement in activities, and homework assignments, with the amount of points varying with the time and effort required to complete the task. For example, attending each 2-h class was worth up to four points, active participation in a

specific activity was worth up to two points, and homework assignments were worth one to three points. These points could be redeemed for prizes at the end of the group. The prizes included blank CDs (two points), computer games (45 points), or computer hardware, such as a printer (75 points) or used computer (115 points). Students were advised of the points and prize system at the time of consent.

Group Leaders

Each group had two trained leaders. The primary leader had previously led a similar group for adolescents, whereas the secondary leader had familiarity with the computer skills utilized in the program. Most groups had one male and one female co-leader. All groups had at least one leader who was a graduate student in clinical psychology, and group leaders had weekly supervision with a licensed psychologist to address clinical concerns about the participants, group dynamics, and how to implement the curriculum.

Treatment Integrity

All group sessions were audiotaped. Undergraduate research assistants were initially trained to rate practice audiotapes for treatment adherence to a 90% agreement level prior to coding actual tapes. Twenty-five percent of the tapes from each group were rated for adherence, with one tape selected randomly from each quartile of the 16-week program. Treatment adherence was 86% for all group activities. Deviations from the curriculum occurred when a specific program or piece of hardware was unavailable during the designated week for that activity. Nearly all of these activities were completed during subsequent sessions.

Measures

Computer self-efficacy was measured with the computer self-efficacy scale (CSE; Cassidy and Eachus 2002). The CSE is a 30-item measure of general computer self-efficacy in adults and adolescents. Items include "I seem to have difficulties with most programs I have tried to use," and "I am very confident in my ability to use computers." In this sample, $\alpha = .81$.

Computer skills were measured with the Computeen Computer Skills Inventory. This 20-item self-report measure was developed for this research and inquires about one's proficiency in the hardware and software skills targeted by the Computeen curriculum (e.g., Microsoft Word, Printshop, installing hardware). Answers are on an eight-point Likert scale, where 0 is "never used/done it" and 7 is "I'm an expert." In this sample, $\alpha = .83$.

Computer use was self-reported time spent using a computer per week, in hours.

Self-esteem was measured with the Rosenberg self-esteem scale (RSE; Rosenberg 1965). The RSE is a widely used and well validated 10-item measure of global self-esteem in adolescents and adults, with items answered on a 4-point Likert scale. In this sample, $\alpha = .79$.

School motivation and *goal valuation* were measured with two subscales from the school attitude assessment survey—revised (SAAS-R; McCoach and Siegle 2003). The SAAS-R is a 35-item measure of school attitudes. Goal Valuation (in this sample, $\alpha = .82$) is a 6-item subscale measuring the importance of doing well in school, and Motivation/Self-Regulation (in this sample, $\alpha = .92$) is a 10-item subscale that measures motivation to complete schoolwork.

Internalizing and externalizing behavior problems were measured with the child behavior checklist/4–18 (CBCL; Achenbach 1991), a well-validated measure completed by parents. The CBCL was completed over the telephone as part of the parent interview.

Group participation was measured by separately standardizing raw score points earned for attendance, involvement in group activities, and homework in order to equally weight these three methods of participation. These three standardized scores were then summed to create the Group Participation score.

Results

Outcome Analyses

The following analyses were conducted with group as a between-subjects factor, time as a within-subjects factor, and without covariates. A repeated measures multivariate analysis of variance (MANOVA) was conducted across all outcome variables together. There was a significant Group × Time interaction, $F(8,31) = 7.86$, $p < .001$, indicating that there was a significant difference between the immediate and wait-list groups over time. Results from a univariate analysis of variance (ANOVA) computed for each outcome variable are shown in Table 2 with means, standard deviations, and Cohen's *d* effect sizes (Cohen 1988). Participants in the immediate group displayed significant improvements over time in computer self-efficacy, computer skills, computer use, and internalizing behavior problems compared to wait-list controls. There were no significant group differences on the other outcome variables.

Internalizing Behavior Problems

The significant treatment effect on internalizing behavior problems was examined further. A series of Group × Time repeated measures ANOVA analyses on CBCL internalizing subscales did not reveal statistically significant improvements on any one scale. The 13 participants who were in the borderline/clinical range ($T > 60$) on internalizing behavior problems at the initial interview were analyzed to evaluate clinically significant (score dropping from 60 or greater to under 60) and reliable (at least 7 *T*-score points) change, following procedures for reliable change described by Jacobson and Truax (1991). In the wait-list group, one out of six participants showed both clinically significant and reliable change during the wait-list period. In the immediate group, six out of seven participants showed both clinically significant

Table 2 Group descriptives, main effects and interactions of condition and time, and effect sizes

Measure	Immediate ($n = 25$)		Waitlist ($n = 21$)		F^ Group	F^ Time	F^ G × T	d
	Pre M (SD)	Post M (SD)	Pre M (SD)	Post M (SD)				
Computer self-efficacy	124.1 (19.7)	134.6 (16.7)	129.7 (17.2)	125.8 (17.5)	0.11	3.97	18.46***	1.30+
Computer skills	54.4 (17.8)	96.2 (20.1)	53.0 (14.5)	60.6 (17.6)	16.24***	95.33***	45.89***	2.05+
Computer use	6.6 (7.1)	9.0 (7.7)	10.3 (10.2)	7.6 (8.5)	0.27	0.13	4.53*	0.64+
Self-esteem	29.4 (5.6)	31.4 (5.2)	29.3 (4.2)	30.2 (4.9)	0.23	6.20*	1.03	0.31+
School goal valuation	39.2 (3.4)	39.4 (2.9)	39.0 (2.7)	38.2 (3.2)	1.06	0.27	0.52	0.22+
School motivation	52.7 (10.6)	50.4 (13.8)	49.9 (10.4)	52.4 (7.3)	0.02	0.00	2.67	0.49−
CBCL externalizing	49.0 (7.6)	46.9 (9.3)	53.4 (10.7)	49.5 (10.6)	1.72	4.66*	0.40	0.19−
CBCL internalizing	55.4 (8.0)	47.5 (9.7)	55.5 (10.7)	54.6 (10.4)	0.70	5.93*	8.52**	0.88+

^ $df = 1,44$; + improved; − worsened

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

and reliable change. Using Yates' correction, this 2 × 2 chi-square is significant ($\chi^2 = 3.73$, $p = .05$).

Gender

Exploratory 2 (immediate, wait-list) × 2 (pre, post) × 2 (male, female) ANOVAs were conducted to examine the effect of gender on outcome variables. None of the Condition × Time × Gender interactions approached significance, indicating that there were no gender differences related to skill, attitude, or behavior changes in the groups.

Age

In order to test whether age moderated treatment effects, participants were divided into "younger" (age 12–14.4, $n = 35$) and "older" (age 14.5–16.9, $n = 11$) groups based on their age pre-group. Exploratory univariate ANOVAs for each outcome variable revealed only a significant Group × Time × Age interaction for self-esteem, $F(1,42) = 4.16$, $p < .05$, such that younger participants showed greater improvements than older participants.

Process and Outcome Measures for All Computeen Participants

Data from wait-list participants at pre-group, post-group, and follow-up interviews were combined with the pre-group, post-group, and follow-up data of immediate group participants in order to (a) assess attendance, participation, and satisfaction; (b) assess the maintenance of gains at follow-up; (c) test the mediation models; and (d) perform exploratory analyses. Of the 46 participants, four wait-list participants did not complete a post-group interview. Thus, 42 Computeen participants completed pre- and post-group interviews, and 37 participated in the 3-month follow-up.

Participation and Group Evaluation

Out of 16 classes, the average attendance rate for these 42 participants was 89% ($M = 14.2$, SD = 1.9, range 8–16). The average rate of involvement in group activities was 79%, whereas the average homework completion rate was only 28%. Group participation was significantly correlated with an increase in school motivation ($r = .37$, $p = .02$) from pre-group to post-group interview but not with any other outcome variables.

Participants and parents rated the groups and group leaders highly overall, with 98% of adolescents stating that they liked the groups and 84% of parents reporting that their child learned "Pretty Much" or "Very Much" in the group. Participants reported that the groups "Pretty Much or Very Much" helped them want to learn more about computers (88%), become better with computers (83%), feel better about

themselves (76%), want to go to college (95%), and want to do better in school (81%).

Outcome Analyses

One-way repeated measures ANOVAs, with post hoc *t*-tests for significant ANOVAs, were conducted across the three time points to assess the maintenance of gains at follow-up. As shown in Table 3, ANOVAs were significant for computer skills, computer self-efficacy, computer use, self-esteem, motivation, and internalizing and externalizing behavior problems. Consistent with the immediate/wait-list analyses, post hoc *t*-tests revealed significant pre- to post-group improvements in computer self-efficacy, computer skills, computer use, and internalizing behavior problems. There were significant decreases in school motivation. From the pre-group to follow-up interview, there were significant improvements in computer self-efficacy, computer skills, self-esteem, and internalizing and externalizing behavior problems. There was a significant decrease in school motivation. During the follow-up period, there were further significant increases in computer self-efficacy and no significant changes in other variables.

In order to understand the overall decline in motivation, age was examined as a moderator of the relationship between participation and school motivation using hierarchical linear regression. As shown in Fig. 1, a significant interaction was found such that at high levels of group participation, participants' motivation improved slightly regardless of age. However, at low levels of participation, younger participants continued to show modest gains while older participants showed large decreases in motivation. Thus, the overall decrease in motivation was largely driven by a subset of older adolescents with minimal participation.

Table 3 Pre-, post-, and follow-up means, SDs, and repeated measures ANOVAs with post hoc *t*-tests

Measure	Pre *M* (SD)	Post *M* (SD)	Follow-up			Post hoc *t*-tests		
			M (SD)	*df*	*F*	Pre-post	Post-FU	Pre-FU
Computer self-efficacy	126.6 (19.7)	134.3 (17.5)	138.1 (16.3)	2, 72	16.25***	4.50***	2.14*	4.66***
Computer skills	56.1 (16.7)	92.6 (21.6)	92.0 (20.8)	2, 72	91.12***	11.47***	0.33	9.77***
Computer use	6.4 (6.3)	10.2 (7.8)	8.0 (7.0)	2, 72	4.93**	2.59*	1.85	1.26
Self-esteem	30.1 (5.4)	31.1 (5.1)	32.1 (5.0)	2, 72	5.29**	1.80	1.72	2.98**
Goal valuation	39.2 (3.3)	38.7 (3.2)	37.1 (4.3)	2, 72	1.27			
School motivation	52.4 (9.9)	49.4 (12.8)	47.0 (13.5)	2, 72	6.22**	2.11*	1.97	3.09**
CBCL externalizing	50.5 (8.6)	47.6 (9.3)	48.5 (8.5)	2, 76	3.19*	1.63	0.83	2.18*
CBCL internalizing	56.0 (10.0)	49.0 (10.9)	51.7 (10.2)	2, 76	14.04***	4.74***	1.82	4.33***

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

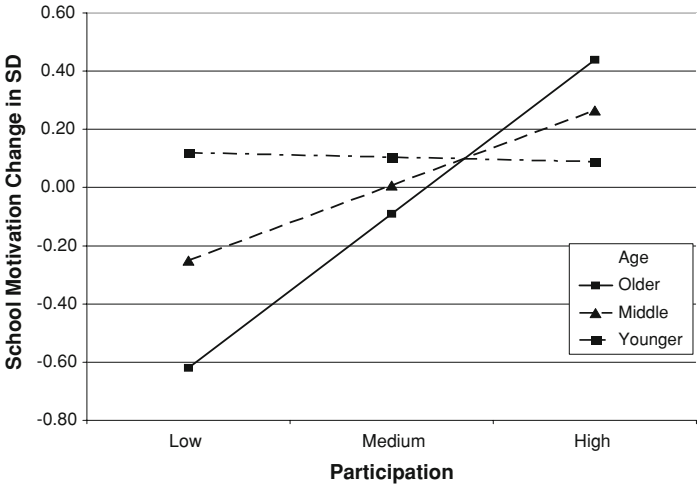

Fig. 1 Interaction of age and participation on motivation change

Mediation

The proposed mediation models were tested using bootstrapping procedures described by Preacher and Hayes (2008) to estimate the significance of indirect effects. Preacher and Hayes note that these methods are superior to the Baron and Kenny procedures in that they are better suited for small sample sizes, have more power, and do not depend on assumptions of normality. Following the recommendations of Preacher and Hayes, standardized residual change scores of each variable from pre- to post-treatment were used in the mediation analyses. The first model tested the hypothesis that computer self-efficacy would mediate the relationship between improved computer skills and increases in self-esteem. Computer skills predicted increased self-esteem ($\beta = .52$, $p < .001$), computer skills predicted increased computer self-efficacy ($\beta = .35$, $p = .02$), and computer self-efficacy predicted self-esteem controlling for computer skills ($\beta = .32$, $p = .02$). The bootstrapping estimate of the indirect effect was significant ($\beta = .11$, $p < .05$), supporting the mediation hypothesis.

Two additional models tested whether improved self-esteem mediated the relationship between computer self-efficacy and each of the two other significant outcome variables, school motivation and CBCL Internalizing problems, respectively. In the first model, computer self-efficacy predicted self-esteem ($\beta = .49$, $p = .002$), self-esteem predicted school motivation controlling for computer self-efficacy ($\beta = .40$, $p = .02$), and the bootstrapping estimate of the indirect effect of computer self-efficacy on school motivation was significant ($\beta = .19$, $p < .05$). Thus, even though computer self-efficacy did not directly predict school motivation ($\beta = .01$, $p = .94$), there was a significant indirect effect through self-esteem. In the second model, computer self-efficacy did not predict internalizing behavior problems ($\beta = -.010$ $p = .56$), computer self-efficacy predicted self-esteem ($\beta = .47$, $p = .003$),

and self-esteem did not predict internalizing behavior problems controlling for computer self-efficacy ($\beta = -.28$, $p = .12$). The bootstrapping estimate of the indirect effect was not significant ($\beta = -.14$, $p > .05$), indicating that there was no indirect effect and no mediation.

Gender and Age

As with the immediate vs. wait-list analysis, none of the Time × Gender interactions approached significance. Boys and girls responded similarly to the program over time. Also consistent with the immediate vs. wait-list analysis, there was one significant Time × Age Group interaction, such that younger participants showed more improvement in self-esteem than did older participants, $F(1,40) = 6.37$, $p = .02$. There were also two marginally significant Time × Age Group interactions, such that younger participants showed more improvement, for school motivation, $F(1,39) = 3.86$, $p = .06$ and goal valuation, $F(1,39) = 3.10$, $p = .09$. No other Time × Age Group interactions approached significance.

Discussion

This study evaluated the efficacy of Computeen, a computer and psychosocial skills curriculum designed to improve adolescents' computer skills, self-esteem, and school functioning while decreasing maladaptive behaviors. Parent and adolescent post-group evaluations were overwhelmingly positive, and the overall attendance rate (89%) was very high for community-based programs for at-risk youth. Computeen participants displayed significant improvements in computer skills, computer self-efficacy, computer use, and internalizing behavior problems compared to wait-list controls. Analyses with all Computeen participants also showed significant improvements from pre-group to follow-up in self-esteem and externalizing behavior problems. Computer self-efficacy was found to mediate the relationship between computer skills and improved self-esteem. However, an unexpected finding of decreased school motivation was found. No gender differences were observed, but younger adolescents displayed more improvements, primarily in self-esteem, than did older participants.

The improvements in computer measures are consistent with the technology focus of the program and indicate that Computeen participants perceived themselves as having learned new computer skills, felt more confident and capable using computers, and used computers more frequently than wait-list controls. The mean post-group and follow-up computer self-efficacy scores for participants were similar to scores of adults who completed a formal class in computer training (Cassidy and Eachus 2002). Follow-up evaluations confirmed that gains in computer skills held steady and that computer self-efficacy continued to increase significantly after the post-group evaluation. Thus, the program has a significant positive impact on computer skills and computer self-efficacy that lasted at least 3 months following the end of the groups.

Significant decreases in parent-reported adolescent internalizing behavior problems were found. There was also evidence of clinically significant and reliable improvement in the subsample of participants in the borderline/clinical range. In the group completer analyses, significant decreases in externalizing behaviors were also observed. Thus, the results provide support for the hypothesis that participation in Computeen reduces maladaptive behavior problems, as reported by parents. In a sample of low income youth unselected for behavior problems, this finding suggests that Computeen may have a preventive effect on emerging (particularly internalizing) problems.

The findings regarding predicted improvements in self-esteem were mixed. Compared to wait-list members, Computeen participants displayed small but non-significant increases in self-esteem ($d = .31$). Among group completers, self-esteem did increase significantly from pre-group to follow-up. Because self-esteem was not targeted directly, it is plausible that increases were slower to occur, and involved smaller changes, than the computer measures. In a review of programs designed to improve self-esteem and self-concept, Haney and Durlak (1998) found smaller effects of prevention programs ($d = .31$), consistent with results from the current study, than those targeting youth with known psychological problems ($d = .47$). Thus, Computeen's effects on self-esteem are similar to other prevention programs, but statistical power was limited by the sample size.

There was also support for the hypothesis that computer self-efficacy mediated the relationship between improved computer skills and self-esteem. Thus, gains in a specific domain of self-efficacy following improved skill development resulted in improved overall self-esteem. This finding requires replication, but it is consistent with Allen et al. (1997) results showing improved outcomes for behavior problems that were not directly targeted in the Teen Outreach prevention program. Evidence also was found for an indirect effect of computer self-efficacy on school motivation (but not on internalizing behavior problems) through improved self-esteem. Thus, although increased computer self-efficacy does not directly improve school motivation, it does so indirectly through improved self-esteem. These findings have important implications for development of programs designed to improve self-esteem among adolescents, and suggests that self-esteem (and perhaps other behavioral outcomes) can be improved through strengths-based, developmentally appropriate, and non-stigmatizing prevention programs. The mechanism by which Computeen reduced internalizing behavior problems is unclear, although perhaps having a fun, engaging activity and prosocial peer group reduced internalizing symptoms, consistent with the effective behavioral activation treatment of depression (Dimidjian et al. 2006).

The mixed results regarding school motivation, with a trend towards decreases among Computeen participants, were unexpected. There were not significant differences between the immediate and wait-list participants, but self-reported school motivation decreased among all Computeen completers from pre- to post-group, and then decreased further at follow-up. It is possible that "unspoken" barriers to attending college that are often faced by minority and undocumented youth, such as lack of access to financial aid (or perceptions of lack of access) or family expectations of joining the workforce, could reduce motivation after youth began to think about the possibility of attending college during the groups. However, group participation was positively correlated with pre- to post-group

increases in school motivation, regardless of initial level of motivation. This effect suggests that the program itself is not contributing to the overall decrease in motivation. School motivation may have simply decreased with age, similar to research showing that adolescents gradually view themselves as less academically competent and motivated over time (Roeser et al. 1998; Wigfield et al. 1991). This hypothesis is consistent with the significant interaction of age and participation on school motivation, which revealed most of the decreases in school motivation were driven by older adolescents who participated minimally. Older adolescents, who are likely to be further behind academically and to have had more experiences of school failure, may have felt more hopeless and less motivated, especially if they did not become invested in the Computeen program and did not participate fully.

Post-group evaluations indicated that 81% and 95% of participants said the groups made them want to do better in school or go to college, respectively. Coupled with the decrease in school motivation, this might suggest a misunderstanding of what is required to reach these goals, a lack of planning to attain them, or a belief that they are not really achievable. Qualitative feedback from participants suggested that many of them wanted to go to college but that they did not understand what was required to do so or believed they could not afford to go. The Computeen curriculum included a module about educational options and college, but this may not have been comprehensive enough to counteract the daily difficulties facing poorly performing students in urban schools. More attention must be given to helping adolescents take small steps towards improving their school functioning, assisting them with obtaining extra academic support, and clarifying the link between these steps and their future career goals.

Limitations

Many of the limitations of any pilot intervention apply to this study. The relatively small sample size limited the power of analyses. Although there is strong evidence that the program increases computer skills and decreases internalizing behavior, these results cannot be generalized to other populations without further evaluation because the sample was mostly Latino. Additionally, computer skills were measured by self-report rather than a more objective measure, making it difficult to distinguish students' perceptions from their actual skills. It is also unclear how the program would differ if implemented by housing community staff, teachers, or others who are not graduate or undergraduate psychology students. Maintaining internal validity in a program based in multiple affordable housing communities also proved to be challenging. Although the actual groups were implemented consistently across communities, as evidenced by high treatment adherence rates, other factors, such as varying staff support or availability of the computer lab, might have affected the results.

Finally, the significant differences between dropouts and completers warrants further caution when interpreting the results. Dropouts had significantly more maladaptive school attitudes, lower motivation, and more behavior problems at the baseline interview. This suggests that Computeen may not be appropriate for more deviant adolescents, who would likely benefit from a more clinically focused intervention.

Suggestions for Future Research

Results from this study provide initial empirical support for the program in terms of improving computer skills and self-efficacy and reducing internalizing behavior. Further, we found support for the hypothesis that the increases in self-efficacy following improved competency in one domain (computer skills) can generalize to improvements in self-esteem. A larger study with more power is needed to replicate these findings and to clarify the mixed results regarding improvements in self-esteem and school functioning. Additionally, the mechanisms by which internalizing behavior problems decreased following the Computeen program should be explored further. Because younger participants tended to show greater improvements, it is recommended that the program be implemented with adolescents who are 12–14 years old when possible. Research will also be needed to evaluate whether the program is effective when implemented by housing community staff, teachers, or other adults. Finally, participants should be given the chance to continue developing their skills with advanced classes, internships, or other opportunities.

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