

Diffusion of a School-Based Substance Abuse Prevention Program: Predictors of Program Implementation¹

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Background. The present study addresses diffusion of a psychosocial-based substance abuse prevention program, including: (a) teacher adoption, implementation, and maintenance; (b) teacher characteristics associated with implementation; (c) the relationship between integrity of program delivery and program outcomes; and (d) the effectiveness of teacher training and school principal involvement in increasing implementation.

Methods. Participants were teachers ($n = 60$), school principals ($n = 25$), and fifth-grade students ($n = 1147$) from four Los Angeles area school districts. Districts were randomly assigned to an intensive or brief teacher training condition. Schools were randomly assigned to a principal-intervention or a no-principal-intervention condition. Assessments included teacher and principal self-reports, classroom observations of program delivery, and evaluation of immediate program outcomes.

Results. During the first year, 78% of trained teachers implemented one or more program lessons. During the second year, only 25% maintained implementation of the program. Implementors reported fewer years of teaching experience and stronger self-efficacy, enthusiasm, preparedness, teaching methods compatibility, and principal encouragement than did nonimplementors. The principal intervention increased rates of implementation, but the intensive teacher training did not. Integrity of program delivery was positively associated with immediate program outcomes.

Conclusions. Program implementation was highly variable, suggesting that widespread teacher use of psychosocial-based programs cannot be taken for granted. Strategies for increasing implementation and maintenance need to be developed. © 1993 Academic Press, Inc.

INTRODUCTION

During the past several decades, considerable effort has been devoted to developing and testing innovative school-based approaches to substance abuse prevention. Approaches based on theories of the psychosocial processes involved in an individual becoming a substance user have undergone the most rigorous experimentation. Efficacy trials of two models using a psychosocial-based approach, social influences and life/social skills training programs, have resulted in reductions in experimental smoking rates among adolescents of up to 50% (1). Preliminary evidence suggests that programs based on such models may also reduce marijuana use and excessive drinking (2-10, 40).

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Research on psychosocial-based substance abuse prevention programs currently is undergoing a change in emphasis from efficacy trials, in which programs are delivered under optimum conditions, to effectiveness trials, in which they are evaluated under "real world" conditions with greater variation in levels of program delivery and acceptance (11). During the 1970s and 1980s, prevention research generally did not address how to achieve institutionalization within, or diffusion beyond, school districts that participated in efficacy trials (12–14). Recently, it has been suggested that the potential public health impact of efficacious school-based prevention programs may be increased by exposing a greater number of young people to them. Researchers have been encouraged to turn their attention toward developing and testing strategies for widespread diffusion of efficacious programs (15, 16).

The Diffusion Process

Diffusion is defined as the spread of new knowledge, usually referred to as an innovation, to a defined population over time through specific channels. Innovations are ideas, practices, or objects that are perceived as new by units of adoption (17). The diffusion of innovative school-based programs is characterized as a four-stage process (12, 17, 18). The first stage is *dissemination*, in which school districts are made aware of programs and encouraged to adopt them. The second stage is *adoption*, in which districts make a commitment to initiate a program. The third stage, *implementation*, occurs when teachers or other appropriate personnel deliver the program. The final stage is *maintenance*, in which school administrators and teachers are encouraged to continue use of the program.

Research on educational innovations has tended to focus on the adoption and dissemination stages in the diffusion process. Considerably less effort has been devoted to determining whether and how innovations are used in classrooms (19). The assumption has often been made that adoption at the organizational level—school or school district—results in adoption and implementation at the teacher level. However, program adoption, whether by school administrators or teachers, does not guarantee implementation, and teachers' initial attempts at implementation will not necessarily result in continued use of the program. Thus, it is critical that systems for diffusion of educational innovations pay close attention to issues of implementation and maintenance if long-term impact on students is to be achieved (20). The present study addresses the implementation and maintenance of one type of educational innovation—psychosocial-based substance abuse prevention programs.

Measuring Program Implementation

Our current knowledge about the diffusion of psychosocial-based substance abuse prevention programs in schools is limited (18). During early generations of research on these programs, most interventions were delivered by health educators who were trained and supervised by researchers. When programs were implemented by regular classroom teachers, little attention was paid to variation in program implementation and its effect on program outcomes. Recently, however,

several research groups have studied program implementation and evaluated its relationship to school-based prevention program outcomes (3, 21–26).

Program implementation has been operationally defined in several ways. One component is the *quantity* of program implementation, or program exposure, which is typically determined by the numbers of program lessons, activities, objectives, or components that are delivered and the amount of time spent on each. A second component is the *quality* of program implementation, often referred to as program integrity or fidelity. Measures of implementation quality assess the extent to which a program was implemented as designed (51).

Preliminary studies suggest that both quantity and quality of implementation are determinants of school-based prevention program outcomes. Two large-scale evaluations of comprehensive health education curricula found a positive relationship between changes in students' health knowledge, attitudes, and practices and "full" program implementation, as assessed by teacher self-reports of the quantity and integrity of implementation (23, 24). Pentz and colleagues (21) found that the amount of implementation of a psychosocial-based substance abuse prevention program reported by teachers had a significant effect on changing adolescent substance use behavior. Other studies have employed classroom observation procedures to show that fidelity of implementation significantly predicts prevention program effects on substance use (3, 22) and on mediators such as resistance skills and normative beliefs (25).

Determinants of Program Implementation

Educational research has shown that a combination of individual and organizational factors predict implementation of innovative programs. Organizational factors that are positively correlated with implementation include strong teacher morale; a high degree of teacher involvement in decision making; active support of principals, and general support of district superintendents, for the innovation; and a good fit between the innovation and local needs (27–29). Principals, in particular, appear to be "gatekeepers" of new curricula; their attitudes and behaviors have been shown to significantly facilitate or inhibit implementation (30, 31).

At the program provider level, adoption and implementation of innovative programs are related to attributes of the innovation as well as to cognitive, social, and psychological attributes of the providers themselves. Classroom teachers are most likely to implement educational innovations that are well specified and require the same teaching strategies that they normally use (28, 30). For example, Levenson-Gingiss and Hamilton (32) found that intention to continue teaching an innovative sex education course after the first year of implementation was positively associated with comfort with the content and approach of the program and positive attitudes toward it. Recent studies of smoking prevention program facilitators who were not regular classroom teachers showed that program integrity was positively associated with an enthusiastic, confident, and nonauthoritarian teaching style (33) and characteristics such as being outgoing, adventurous, and organized (34).

One factor that appears to be critical to effective program implementation is

teacher training. It has been shown that for curriculum innovations in general, and school health innovations in particular, the provision of preimplementation training increases the likelihood that teachers will implement the curriculum fully and with integrity (24, 27, 28, 30, 35–38). Training may be especially important to prepare teachers to implement psychosocial-based prevention programs, in that current approaches employ teaching methodologies that differ significantly from the lecture and discussion methods traditionally used (37, 39, 52). However, the optimal amount and type of training required for effective program implementation have yet to be determined.

Overview of the Study

The present study addresses adoption, implementation, and maintenance of a psychosocial-based substance abuse prevention program by classroom teachers. Specifically, it addresses the following research questions:

- (a) To what extent will teachers implement a psychosocial-based substance abuse prevention program that has been adopted by their school district?
- (b) What teacher attributes predict implementation?
- (c) Does the type of training that teachers receive affect program implementation?
- (d) Does a principal intervention affect implementation?
- (e) What is the effect of program integrity on program outcomes?

METHODS

Project AAPT

Adolescent Alcohol Prevention Trial (AAPT) is an 8-year efficacy trial designed to prevent substance use among fifth- and seventh-grade students in the Los Angeles metropolitan area (25, 40–43). The 13-session AAPT curriculum primarily focuses on preventing alcohol use and misuse, but also addresses tobacco and marijuana use. The key program components include resistance skills training, normative education, and information about the consequences of substance use. The curriculum is nondidactic and employs teaching techniques that have been associated with successful prevention program outcomes, including the Socratic method, small group experiential activities, modeling and rehearsal of resistance skills, and the assistance of same-age peer opinion leaders. Each program session is 50 min and consists of four to five individual activities. The program content is described in detail elsewhere (25, 42).

At present, four panels of fifth- and seventh-grade students have participated in the AAPT trial. Results of the first panel indicated that the program was efficacious in reducing the onset of tobacco, alcohol, and marijuana use among seventh-grade students (40).

Participants

Participants in the present study included elementary school teachers, principals, and students from four school districts that had participated in Year 1 (1986–

1987) of the Project AAPT efficacy trial. The districts serve predominantly lower-middle and middle socioeconomic populations.

Recruitment

At the beginning of the 1987–1988 school year, administrators in the seven districts that had participated in Year 1 of the efficacy trial were contacted to determine interest in adopting the AAPT curriculum. During the efficacy trial, the program was delivered by health educators, without the direct involvement of classroom teachers. For the present study, adoption was operationalized as administrators' commitment to encourage, but not require, teachers to participate in teacher training and implement the program. Administrators in four of the seven eligible districts chose to adopt the program.

All fifth-grade teachers ($n = 89$) in elementary schools ($n = 30$) in the four districts were sent a letter offering the opportunity to adopt the AAPT curriculum. The letter specified that if teachers adopted the program, they were expected to attend teacher training and implement the program during the 1987–1988 school year.

Sixty teachers from 25 elementary schools agreed to participate (73% adoption rate). Approximately two-thirds of the teachers were female, 84% were white, 8% were Asian, 5% were Latino, and 3% were African-American. Years of teaching experience ranged from less than 1 to 40, with a mean of 15 years. Sixty-two percent of the teachers had observed delivery of the AAPT curriculum in their classroom during the efficacy trial.

School principals were also sent a letter describing the study. Their participation in the study was solicited if at least one of their fifth-grade teachers adopted the program. All principals who were contacted ($n = 25$) agreed to participate. Thirteen of the principals were male, and all were white. Years of experience as a school principal ranged from less than 1 to 28, with a mean of 10.3 years.

Students ($n = 1147$) of participating fifth-grade teachers completed measures of immediate program outcomes. The student sample was 51% white, 37% Latino, 9% Asian, and 3% other.

Research Design

The study design was a 2×2 factorial, in which two strategies to improve implementation, intensive teacher training and a principal intervention, were tested. School districts were randomly assigned to either the intensive or the brief teacher training conditions. Within each district, schools were randomly assigned to either the principal-intervention or the no-principal-intervention condition. The numbers of teachers and schools per experimental condition are shown in Table 1.

Interventions

Teacher Training

Training was conducted by health educators who had developed the curriculum, had implemented it extensively, and had prior experience in teacher training.

TABLE 1
EXPERIMENTAL DESIGN: NUMBER OF TEACHERS AND (SCHOOLS) PER CONDITION

Principal intervention	Teacher training	
	Brief	Intensive
Yes	24 (9)	10 (4)
No	16 (7)	10 (5)

The intensive training was a full-day workshop that incorporated components that are necessary to prepare teachers to implement psychosocial-based curricula (39). The intensive training model, which was based on social learning theory (44), included presentation of the theoretical rationale for the prevention program, modeling of program-specific teaching skills, and guided practice in use of the skills. The objective of the training was to increase teachers' self-efficacy, motivation, and preparedness to implement the program. The brief teacher training used as a comparison consisted of a 2-hr meeting in which the curriculum lessons were described.

Teachers in both training conditions were provided the materials necessary to implement the program. All were encouraged to implement the entire program as written.

Principal Intervention

The principal intervention took place on site, immediately following teacher trainings. The intervention consisted of a one-to-one meeting, conducted by the same individual (the first author), for an average of 30 min. The intervention provided a persuasive communication about the effectiveness of a psychosocial-based approach to substance abuse prevention and the importance of principal support for implementation. An explicit request was made of the principals to encourage and monitor program implementation in their school. Principals in the no-principal-intervention schools did not receive the intervention and were contacted only to request completion of the principal questionnaire.

Measures and Assessment Procedures

Teacher Self-Reports

Teachers completed three self-report questionnaires (a) at the end of training, (b) at the end of initial implementation, and (c) at 1 year following initial implementation. All of the questionnaires were developed for this study. The questionnaire items are described briefly below. (See Appendix 1.)

Sociodemographic variables included *ethnicity*, *gender*, and *years of teaching experience*.

Psychosocial variables were assessed in the post-training questionnaire using analog scales with numerical anchors from 0 to 100. Estimates of internal reliability (Cronbach's α) for each construct are presented in parentheses below.

Compatibility of teaching methods in the program with the teacher's usual methods was assessed using six items concerned with how often teachers utilized role play, the Socratic method, and small group activities in their classrooms and how effective they were in use of those methods (0.73). *Beliefs about the program* were measured using five items concerned with how effective teachers thought the program would be in deterring substance use and how much expertise program developers had about prevention (0.77). The *teacher morale* scale included three items concerned with morale within their school and degree of teacher involvement in decision making (0.74). *Enthusiasm* was measured using two items concerned with the extent to which teachers looked forward to program implementation (0.86). *Preparedness to implement* was assessed using four items concerning how well prepared teachers felt they were to implement key program components (0.91). *Implementation self-efficacy* was assessed using six items concerned with how confident teachers were that they could implement the program effectively (0.88). The *principal encouragement* scale included four items concerning teachers' perceptions of principal encouragement to adopt and implement the program (0.94). *Program acceptance*, which is the only psychosocial variable that was assessed following implementation, included three items concerned with how comfortable teachers were in use of the program (0.82).

Quantity of initial implementation was measured at the end of the first year of implementation. Teachers indicated whether or not they had implemented each of the 13 program lessons. Their responses were added and converted to a percentage of program implementation.

Maintenance of program implementation was assessed at the end of the second year of program implementation. The follow-up questionnaire was mailed to all teachers who had been trained in the first year of the study. Those who failed to return it within 3 weeks received a phone call reminder. The response rate for the follow-up questionnaire was 68%. Questionnaires assessed the number of program lessons that teachers implemented during the second year and, if relevant, reasons for discontinuance of implementation.

Other Teacher Measures

Each teacher was assigned a value for the *percentage of program delivery observed during the efficacy trial*. Because the AAPT efficacy trial tested three individual program components (resistance training, normative education, and information about consequences), not all of the teachers in the present study had observed delivery of the same program components. Teachers were assigned values of 0, 33, 66, and 100% if they observed none of the components, one component, two components, or all three, respectively.

Ratings of teachers' *participation at training* were completed by health educators who conducted the trainings. The primary trainer rated each teachers' degree of participation on a 10-point scale (1 = very inactive; 10 = very active).

Ratings of teachers' overall *teaching skills* were completed by their school principal. The skills were rated on a 10-point scale (1 = poor; 10 = excellent).

Classroom Observation Measures

When teachers chose to participate in the study, they agreed to permit us to

observe three core curriculum lessons during the first year of implementation. All observations were scheduled in advance. Some were arranged at the end of the teacher training, and others were scheduled by phone. Teachers who did not answer phone calls were visited by data collectors at the school site to arrange for observation. Despite these efforts, only 36 teachers permitted us to observe delivery of any program sessions. The number of observation sessions per teacher ranged from 1 to 3, with a mean of 2.4.

The classroom observation procedure utilized in the present study was adapted from Project AAPT (25). Two observers were present at the majority (67%) of observation sessions. The observers were blind to the experimental condition of the teachers. Observers rated each of five activities in the sessions. The same items and 7-point scales were used for each activity. The items measured *class control*, *teacher enthusiasm*, *class enthusiasm*, and *appropriateness of the delivery*, i.e., the degree to which delivery met the goals of the program.

Interobserver reliability was assessed for the classroom observation sessions in which paired observers were present ($n = 62$). The intraclass correlation coefficients (45) for the four variables were as follows: 0.85 ($P < 0.0001$) for classroom control, 0.83 ($P < 0.0001$) for teacher enthusiasm, 0.88 ($P < 0.0001$) for student enthusiasm, and 0.89 ($P < 0.0001$) for appropriateness of delivery.

A composite *Program Integrity Index* was derived for each of the teachers who was observed. For those sessions in which paired observers were present, observers' ratings on each variable were averaged. Next, a composite integrity index was created for each session by standardizing and averaging the four variables. A summary Program Integrity score was then developed for each teacher, averaging the composite integrity indices for each of the sessions observed.

Principal Measures

School principals were mailed a questionnaire at the end of the first year of program implementation. Those who failed to complete the questionnaire within 2 weeks received a reminder by telephone. Twenty-four of the 25 principals participating in the study returned a completed questionnaire. Variables were assessed using analog scales with numerical anchors from 0 to 100. Two *principal encouragement of implementation* items were concerned with the extent to which principals urged teachers to implement the program. *Principals' beliefs about the program* were assessed using five items concerning enthusiasm for the program and perceptions of the extent to which it would deter substance use among students. Cronbach's α 's for the encouragement and beliefs scales were 0.67 and 0.89, respectively.

Student Measures

Immediate program outcomes were assessed at the end of the initial year of implementation, using student self-report questionnaires and behavioral assessment procedures adapted from the AAPT efficacy trial (41–43). Both types of measures were administered by trained data collectors who were blind to the experimental condition of the teachers. The student self-report instrument contained items measuring *program-specific knowledge*, *normative beliefs about the*

prevalence of substance use among peers, attitudes toward substance use, and program acceptance.

A subsample of students ($n = 526$) was randomly selected to complete the behavioral assessment, which measured resistance skills and behavioral intentions utilizing a role play analog procedure (41, 43). A student assistant pretended to offer each subject a beer, utilizing a standardized script. Each role play was observed by the alternate assistant and an adult data collector. Following the role play, the student assistants, the adult, and the subject each completed a questionnaire that contained six items concerned with the assertiveness of the student's refusal, including verbal and nonverbal responses (46), and three items that assessed intentions regarding future alcohol use. Composite indices of *resistance skills* and *judged behavioral intentions* were created for each student by standardizing and averaging the four raters' judgments.

RESULTS

Quantity of Initial Program Implementation

At the end of the school year during which they were trained, 47 of the 60 teachers (78%) had implemented one or more of the program lessons. Thirteen of the teachers implemented none of the lessons. Among implementors, the percentage of lessons delivered ranged from 23 to 100, with a mean of 75.3%. Implementation of the three program components was approximately equal, with teachers reporting that they taught 76% of the consequences lessons, 75% of the resistance training lessons, and 68% of the normative education lessons.

Determinants of Initial Program Implementation

Teachers who implemented one or more lessons (implementors) were compared with those who delivered none (nonimplementors) on 11 teacher background and psychosocial variables. Table 2 presents means and standard deviations for the two groups of teachers. A discriminant analysis was performed to determine the subset of variables that best described differences between the two groups. The stepwise discriminant model was developed using the stepwise procedure of SAS (47). As shown in Table 3, membership in one of the two groups was predicted by four variables, teacher enthusiasm, perceived principal encouragement, years of teacher experience, and percentage of program delivery observed during the efficacy trial ($F_{11,46} = 2.82, P < 0.01$). This set of variables correctly classified 85% of the implementors and 73% of the nonimplementors.

Univariate tests of group differences demonstrated that implementors had significantly less teaching experience ($t_{58} = 3.63, P < 0.001$), had more experience with teaching methods that were compatible with psychosocial-based programs ($t_{58} = 1.99, P = 0.05$), reported more enthusiasm for the program ($t_{57} = 4.56, P < 0.0001$), demonstrated more active participation during the training ($t_{58} = 4.51, P < 0.0001$), had stronger implementation self-efficacy ($t_{58} = 3.35, P < 0.01$), felt better prepared to implement at the end of training ($t_{57} = 2.35, P < 0.05$), and reported greater encouragement from their school principal ($t_{58} = 2.98, P < 0.01$) than did nonimplementors.

TABLE 2
COMPARISON OF IMPLEMENTORS AND NONIMPLEMENTORS ON TEACHER BACKGROUND AND PSYCHOSOCIAL VARIABLES

Teacher variable	Implementors (<i>n</i> = 47) Mean (SD)	Nonimplementors (<i>n</i> = 13) Mean (SD)
Years of teaching experience	12.23 (9.82)	23.77 (11.25)***
Observation of efficacy trial ^a	48.37 (39.9)	40.14 (37.1)
Teaching skills ^b	9.12 (1.29)	8.75 (1.13)
Participation at training ^c	7.17 (1.80)	4.57 (1.95)***
Compatibility of methods ^d	0.09 (0.64)	-0.33 (0.78)†
Beliefs about program ^d	0.13 (0.73)	-0.23 (0.85)
Teacher morale ^d	0.07 (0.83)	-0.26 (0.74)
Principal encouragement ^d	0.58 (0.96)	-0.23 (0.83)**
Enthusiasm ^d	0.28 (0.62)	-0.93 (1.38)***
Preparedness to implement ^d	0.13 (0.86)	-0.53 (0.87)**
Implementation self-efficacy ^d	0.21 (0.46)	-0.50 (1.19)**

^a Percentage of program delivery observed.

^b Rating by school principal; 10-point scale.

^c Rating by health educator; 10-point scale.

^d Teacher self-report; standardized index.

***P* < 0.01.

****P* < 0.001.

† *P* < 0.10.

Maintenance of Program Implementation

To determine if respondents to the 1-year follow-up questionnaire differed from nonrespondents, a Multivariate Analysis of Variance (MANOVA) was conducted comparing the two groups on the 11 teacher background and psychosocial variables listed in Table 2. The overall test of differences was not significant.

Follow-up questionnaire results indicated that implementation rates declined significantly from the first to the second year of implementation. Of the 40 teachers who responded to the follow-up, only 10 (25%) had implemented one or more program lessons during the second year. The primary reasons for lack of program maintenance cited by teachers were that district administrators did not encourage implementation (43%), in some cases because other substance abuse prevention

TABLE 3
COMPARISON OF IMPLEMENTORS AND NONIMPLEMENTORS: RESULTS OF STEPWISE DISCRIMINANT ANALYSIS

Teacher variable	Discriminant weight	Partial <i>F</i> ^a
Enthusiasm	0.413	15.3
Principal encouragement	0.369	2.9
Years of teaching experience	-0.396	2.7
Observation of efficacy trial	0.404	2.7

^a Partial *F* values are indices of the relative discriminating power of each variable.

programs had been adopted, and teachers lacked sufficient time to implement the program (30%).

Effects of Teacher Training

It was hypothesized that the intensive teacher training would result in a greater quantity of initial program implementation than would the brief training. It was further hypothesized that training effects would be mediated by teacher self-efficacy, enthusiasm, and preparedness to implement.

The effects of both interventions were tested utilizing a mixed-model Analysis of Variance approach (57–59) and SAS GLM (47). To test the effect of teacher training, individual teacher was the unit of analysis. School district nested within teacher training condition was treated as a random effect, and training condition was a fixed effect. Results indicated that there was no effect of teacher training condition on quantity of initial implementation, teacher self-efficacy, enthusiasm, or preparedness. The effect of district nested within training condition was non-significant for all variables except preparedness ($F_{2,56} = 3.69, P < 0.05$).

Effects of Principal Intervention

It was hypothesized that the principal intervention would result in a greater quantity of initial program implementation by teachers, which would be mediated by principals' encouragement of implementation and beliefs about the program. School was the unit of analysis for testing the effects of the principal intervention. Each statistical model included two terms: one for the main effect and one for the interaction between principal intervention condition and district, with the interaction as the error term for the main effect test.

Results indicated that there was an effect of the principal intervention on quantity of initial implementation ($F_{1,24} = 9.50, P < 0.05$). The mean quantity in principal-intervention schools was 70.4% (SD = 24.3), whereas in no-principal-intervention schools it was 49.3% (SD = 36.9). However, differences between the two groups of schools in principal measures of encouragement of implementation, teacher measures of principal encouragement, and principal self-reported beliefs about the program were not significant. For all models, the interaction between principal condition and district was not significant.

Integrity of Program Implementation

To examine relationships among integrity of program implementation, teacher training, teacher attributes, and program outcomes, the subsample of teachers who permitted observation of program delivery ($n = 36$) was studied. To determine whether this subsample differed from other teachers in the study, we conducted two analyses. First, we compared teachers who agreed to observation with all other teachers in the study, some of whom implemented the program and some of whom did not ($n = 24$). The MANOVA test showed that teachers who were observed differed overall from other teachers in the study (Wilks' λ statistic, $F_{10,47} = 2.77, P < 0.01$). Univariate tests indicated that the observed teachers had less teaching experience ($t_{58} = 4.19, P < 0.0001$), participated more actively in training ($t_{59} = 3.89, P < 0.001$), and had greater enthusiasm about the program ($t_{57} =$

2.18, $P < 0.05$) than did other teachers in the study. Second, we analyzed the subset of teachers who implemented the program ($n = 47$) to determine whether implementors who agreed to observation differed from implementors who did not agree. The MANOVA test for overall differences between the two groups of implementors was not significant.

We hypothesized that teachers who received the intensive training would implement the program with greater integrity than teachers who received the brief training. Utilizing the mixed-model ANOVA approach, with the individual teacher as the unit of analysis and district nested within training condition as a random effect, we found no effect of teacher training on program integrity.

Correlation analyses were conducted to determine which teacher attributes predicted program integrity (Table 4). Attributes that were positively correlated with the Program Integrity Index included overall teaching skills, implementation self-efficacy, and program acceptance. Years of teaching experience was negatively associated with program integrity.

To determine whether program integrity was associated with program outcomes, teachers were dichotomized into High Integrity and Low Integrity groups on the basis of a median split on Program Integrity Index scores. Student responses on six indices of immediate program outcomes were aggregated to create classroom averages. They included two derived from behavioral observation (resistance skills and judged behavioral intentions) and four derived from student self-reports (normative beliefs, program-specific knowledge, substance use attitudes, and program acceptance). Table 5 presents the classroom means and stan-

TABLE 4
PEARSON CORRELATIONS BETWEEN TEACHER VARIABLES AND PROGRAM INTEGRITY INDEX
($N = 36$)

Teacher variable	Program integrity
Years of teaching experience ^a	-0.37*
Observation of efficacy trial ^b	0.06
Teaching skills ^c	0.48**
Participation at training ^d	0.13
Compatibility of methods ^a	0.12
Beliefs about program ^a	-0.08
Teacher morale ^a	-0.21
Principal encouragement ^a	0.01
Enthusiasm ^a	0.16
Preparedness to implement ^a	0.06
Implementation self-efficacy ^a	0.33*
Program acceptance ^a	0.45**

^a Teacher self-report.

^b Percentage of program delivery observed during efficacy trial.

^c Rating by school principal.

^d Rating by health educator.

* $P < 0.05$.

** $P < 0.01$.

TABLE 5
EFFECTS OF PROGRAM INTEGRITY ON IMMEDIATE PROGRAM OUTCOMES

Student outcome variable	High integrity Mean (SD)	Low integrity Mean (SD)	$F_{1,35}$	P
Resistance skills ^a	0.07 (0.19)	-0.06 (0.16)	5.03	0.03
Judged behavioral intentions ^a	0.03 (0.32)	-0.06 (0.26)	0.80	0.37
Normative beliefs about peer substance abuse ^b	0.08 (0.32)	-0.08 (0.29)	2.66	0.11
Program-specific knowledge ^b	0.15 (0.35)	-0.10 (0.27)	5.74	0.02
Substance use attitudes ^b	-0.05 (0.18)	-0.01 (0.29)	0.49	0.49
Program acceptance ^b	0.12 (0.22)	-0.13 (0.20)	12.68	0.001

^a Behavioral observation, standardized index.

^b Student self-report, standardized index.

dard deviations for the High Integrity and Low Integrity groups on the six outcome indices.

A MANOVA was conducted comparing the High Integrity and Low Integrity groups on the outcome indices. Results indicated that there was a significant overall effect of program integrity (Wilks' λ statistic, $F_{6,29} = 3.03$, $P < 0.05$). Univariate tests of mean classroom differences showed that students' program-specific knowledge was significantly greater, resistance skills were stronger, and program acceptance was higher in High Integrity than in Low Integrity classrooms. In addition, there was a nonsignificant trend for lower estimates of peer substance use norms among High Integrity classrooms compared with Low Integrity classrooms.³

DISCUSSION

The findings of the present research are consistent with several previous studies that have demonstrated wide variation in teacher adoption and implementation of psychosocial-based school health education programs (3, 4, 22, 26, 56). Rates of adoption, implementation, and maintenance of the Project AAPT curriculum were highly variable and surprisingly low. Three-fourths of teachers who were eligible to adopt the curriculum chose to do so. The adopters received preimplementation training and all of the materials necessary to implement the program. By the end of the school year during which they were trained, 21% of the teachers had implemented all of the lessons in the program, 56% had implemented some of the lessons, and 23% had implemented none of them. During the school year following training, only 25% of teachers maintained implementation of any program lessons.

The results suggest that one cannot assume that school organizational level decisions to adopt innovative prevention programs will result in widespread acceptance and use of such programs by teachers. There has been a recent trend in diffusion research characterized by a shift in focus from the individual who makes

³ A MANOVA analysis using quantity of initial implementation as the predictor variable produced the same pattern of results.

a decision about adoption of an innovative program to the innovation—decisions of organizations. While it is important to study determinants of adoption at the school, school district, and state government levels, our results suggest that future diffusion research should place as much, or perhaps more, emphasis on the process by which innovative health education programs are implemented by teachers.

The present study is one of the first to examine relationships between the attributes of regular classroom teachers and their implementation of a psychosocial-based substance abuse prevention program. The results indicated that teachers who implemented the program differed from those who did not implement in several important ways. Implementors had less overall teaching experience, participated more actively in teacher training, were more enthusiastic about the program, had stronger self-efficacy, felt better prepared to teach, and had more experience with teaching methods compatible with psychosocial-based programs than did nonimplementors.

These findings suggest that some regular classroom teachers may be more suitable than others as implementors of psychosocial-based substance abuse prevention programs. A common model for diffusion of new school health programs has been one in which district administrators mandate teacher training and program implementation, regardless of the level of teachers' commitment and skills. A more cost-effective strategy may be to recruit and train teachers or other providers (e.g., counselors or nurses) who are skilled in the use of nondidactic methods, enthusiastic, and committed to teaching psychosocial-based programs. Resources could then be devoted to training individuals who are judged to be effective teachers and who are committed to providing drug education.

This study compared the effectiveness of an intensive preimplementation training approach, designed to enhance teacher self-efficacy and skills, with a brief approach that might be considered "usual care" preimplementation training. We found that the intensive training was no more effective in increasing teacher self-efficacy, commitment to the program, quantity of implementation, or program integrity than was the brief training. There are several plausible explanations for the lack of teacher training effects. First, it may be that the magnitude of difference between the two trainings was not great enough to affect teachers' motivation and skill mastery differentially. In order to observe a positive effect of intensive training on program implementation, one may need to compare training approaches that differ substantially in instructional methods and duration. Second, teachers in the intensive training may have had lower levels of motivation and skills prior to assignment to treatment condition than teachers in the brief training, which could have suppressed the effects of the intensive training.

More research is needed to determine how teacher training affects implementation of psychosocial-based substance abuse prevention programs. The optimal instructional approach to, and amount of, training required to prepare teachers for effective implementation has yet to be determined. Training approaches utilized in other areas of education might be explored. For example, ongoing training may be as, or more than, important as preimplementation training. There is some evidence to suggest that when teachers receive technical assistance or "coaching"

from experienced implementors during initial attempts at implementation, program integrity is increased (28). Ongoing training may improve implementation by providing teachers with the opportunity to exchange solutions to implementation problems (50, 53). The use of computer-assisted programmed instruction also appears to be an effective approach to prepare teachers for curriculum delivery (60). Finally, future studies might explore further our finding that observation of program delivery by health education specialists prior to preimplementation training may increase the rate of attempts at implementation.

Our results suggest that diffusion strategies focused on involvement of school principals may increase implementation of prevention programs. We found that rates of program implementation were higher in schools that received the principal intervention than in schools that did not. Although we were unable to demonstrate that this difference was mediated by increased encouragement on the part of principals who received the intervention, efforts to increase principal involvement may have communicated to teachers that program implementation was a high priority in the school district. Future diffusion studies should test strategies for increasing principal commitment to prevention programs and developing the principal's role as monitor and reinforcer of implementation.

It appears that teacher and principal training may be necessary, but it is not sufficient for maintenance of program implementation. The rate of program maintenance in this study was very low (25% in the second year of implementation). The most common reason cited by teachers for lack of maintenance was that district administrators did not encourage them to continue teaching the program. This suggests that, unless school districts develop and enforce policies mandating prevention program implementation, long-term maintenance is unlikely. Other studies have shown that one of the barriers to widespread diffusion of prevention programs is the tremendous competition for teachers' time (14). Health education curricula compete with other nonbasic skill programs for valuable classroom hours, and teachers are generally less accountable for the results of nonbasic skill programs than for other types of instruction. Therefore, widespread implementation and maintenance of prevention curricula may require that school districts both mandate programs and develop criteria for evaluation of their effects that are similar to those used to evaluate basic instructional programs.

In addition to ongoing encouragement from school administrators, successful maintenance of innovative school health education programs may require that the "linking agents," or those organizations and individuals that promote innovative programs, play a more visible role beyond the dissemination phase (49). As developers of the curriculum disseminated in the present study, we functioned as the linking agents. However, we made no efforts to promote program maintenance. That is, during the second year of implementation our only contact with the teachers and principals who participated in training was to send them a summary of the first-year evaluation results. Our contact with district administrators was limited to making arrangements for follow-up data collection in high schools for the AAPT efficacy trial. We did not provide funds for teacher training and program materials, as we had done during the first year of implementation. Two years after the teachers were trained, we found that administrators in three of the four

districts had adopted commercial substance abuse prevention curricula. In light of the current proliferation and marketing of commercial programs, maintenance of empirically based prevention programs may require ongoing contact with linking agents for the programs. Furthermore, maintenance of empirically based programs is more likely to occur if programs are packaged in attractive and pragmatic ways.

The present study supports previous findings that integrity of program delivery is a significant predictor of short-term program outcomes (3, 21, 22, 25). With the use of a highly reliable classroom observation procedure, we found that integrity of program delivery predicted students' resistance skills, program-specific knowledge, normative beliefs, and program acceptance. Although we did not obtain measures of long-term student behavioral outcomes, preliminary evidence from other studies suggests that the short-term outcomes that we did measure, such as the ability to resist peer pressure and beliefs about social norms, mediate adolescent substance use (54, 55). Furthermore, participants' acceptance of, or receptivity to, a program is a necessary condition for program effectiveness (11).

The program integrity findings have important implications for future diffusion of psychosocial-based prevention programs. It appears that AAPT, and programs like it, needs to be taught as designed to be effective. However, as a strategy for widespread diffusion, strong encouragement that teachers deliver a program as written may decrease the likelihood that they will adopt it and put it into use. Educational researchers have suggested that adaptation of innovations to the needs of teachers and specific settings may be necessary for implementation and maintenance (28, 48, 53). More research is needed to determine the extent to which psychosocial-based prevention programs may be adapted to local conditions without compromising program effectiveness.

Finally, several limitations of the present study should be noted. First, the experimental design would have been improved by random assignment of teachers or schools, rather than school districts, to teacher training condition. The primary reason that we assigned at the district level was to avoid contamination of interventions across schools within districts or teachers within schools. This could have taken the form of compensatory rivalry or resentful demoralization by teachers receiving the less desirable training (61), which would have posed a serious threat to the internal validity of the study. Contamination was less of a concern for the principal intervention, due to the nature of the intervention. Given that school districts were the unit of assignment, it would have been preferable to test for a teacher training effect at the district level. However, we utilized a statistical approach, the mixed-model ANOVA method, that leads to the same test statistic for program effects as an analysis that would treat district means as the elementary observations (59).

Second, there were limitations of our measures of program implementation. The self-reported quantity of implementation measure would have been more reliable had we assessed the quantity of curriculum segments, objectives, and/or activities completed by teachers within each of the program lessons. The program integrity findings should be interpreted in light of the fact that we were unable to observe all teachers who implemented the program. However, we did find that

implementors who agreed to observation did not differ significantly from implementors who did not agree with respect to psychosocial variables associated with program integrity. The reluctance of some teachers to be observed is not unique to this study (cf. (62)). In future research on program integrity, it may be important to address why classroom observation threatens some teachers and how their lack of cooperation affects implementation and program outcomes.

APPENDIX 1

A. Teacher Self-Report

Compatibility of Teaching Methods

(Scale: 1 = not at all; 2 = a little; 3 = pretty much; 4 = a great deal)

1. How much do you normally utilize the Socratic method in your classroom?
2. How much do you normally utilize role playing in your classroom?
3. How much do you normally utilize small group activities in your classroom?
4. How effective do you think you are in using the Socratic method?
5. How effective do you think you are in using role playing?
6. How effective do you think you are in using small group activities?

Beliefs about the Program

(Analog scales with anchors: 0 = not at all; 100 = a great deal)

1. How likely is it that your students will benefit from a drug prevention program?
2. How much do you believe that AAPT is effective in reducing substance use among young people?
3. How much expertise do you think (the trainer) has in the field of drug abuse prevention?
4. How sincere do you think (the trainer) is in what she says about Project AAPT?
5. How enthusiastic was (the trainer) during this training?

Teacher Morale

(Analog scale with anchors: 0 = very low; 100 = very high)

1. To what extent is experimentation in teaching encouraged at your school?
2. To what extent are teachers at your school consulted before new policies and programs are implemented?
3. How would you rate the morale among teachers at your school this year?

Enthusiasm for Implementation

(Analog scale with anchors: 0 = not at all; 100 = a great deal)

1. How much do you look forward to teaching Project AAPT?
2. How much enthusiasm do you have about teaching Project AAPT?

Preparedness to Implement

(10-point scale: 1 = not at all prepared; 10 = very prepared)

1. How adequately do you feel you have been trained to teach Session 2—Consequences of Drug Use?
2. How adequately do you feel you have been trained to teach Session 3—Techniques to Say ‘No’?
3. How adequately do you feel you have been trained to teach Session 6—Normative Expectations?
4. How adequately do you feel you have been trained to lead role plays?

Implementation Self-Efficacy

(Analog scales with anchors: 0 = not at all confident; 100 = very confident)

1. How confident are you that you can do a good job teaching Project AAPT?
2. How confident are you that you can do a good job leading role plays?
3. How confident are you that you can control your classroom during Project AAPT activities?
4. Imagine the following scenario. You are in the classroom, leading role plays. In the role play, one of your students is offered a beer and he says “yes.” You stop the role play and remind him that the purpose of role plays is to practice saying “no.” You ask the same students to repeat the role play, and the student again says “yes.” How confident are you that you could maintain the flow of the lesson if this happened?
5. Imagine another scenario. You are teaching the Normative Expectations lesson and several of the students are questioning the results of the drug survey. They do not believe the statistics regarding drug use in their school; they think use is greater than the statistics indicate. How confident are you that you could deliver the lesson as written if this happened?
6. How comfortable do you think you will be with the teaching approach taken in Project AAPT?

Principal Encouragement

(Analog scales with anchors: 0 = none at all; 100 = a great deal)

1. How much pressure did you feel from your principal to attend teacher training?
2. How much pressure do you feel from your principal to implement Project AAPT this year?
3. How much pressure do you feel from your district administration to implement Project AAPT this year?
4. How much pressure did you feel from your principal to implement AAPT this semester?

Program Acceptance

(Analog scales with anchors: 0 = not at all comfortable; 100 = very comfortable)

1. Overall, how much did you like teaching Project AAPT?
2. Overall, how comfortable are you with the teaching approach taken in Project AAPT?
3. Overall, how comfortable are you with leading role plays for students to practice resistance skills?

B. Principal Self-Report

Principal Encouragement of Implementation

(Analog scales with anchors: 0 = not at all; 100 = a great deal)

1. How much did you encourage your fifth-grade teachers to attend the Project AAPT inservice training?
2. How much did you encourage your fifth-grade teachers to implement Project AAPT this year?

Principal Beliefs about the Program

(Analog scales with anchors: 0 = not at all; 100 = a great deal)

1. How enthusiastic are you about the Project AAPT curriculum?
2. How much do you believe that AAPT is effective in reducing substance use among young people?
3. How much will you encourage your fifth-grade teachers to teach AAPT to next year's students?
4. How much expertise do you think Project AAPT personnel have in the field of drug abuse prevention?
5. How professional are the Project AAPT staff?

C. Student Self-Report Questionnaire

Normative Beliefs

(a) Beliefs regarding prevalence of substance use (11-point scale: 1 = none of them; 2 = about 10; 3 = about 20; . . . 11 = all of them)

1. Out of every 100 fifth-grade students, how many do you think drink alcohol at least once a month?
2. Out of every 100 fifth-grade students, how many do you think smoke cigarettes at least once a month?
3. Out of every 100 fifth-grade students, how many do you think use marijuana at least once a month?
4. Out of every 100 fifth-grade students at your school, how many do you think have had any alcohol to drink in the past 30 days?
5. Out of every 100 fifth-grade students at your school, how many do you think have smoked any cigarettes in the past 30 days?
6. Out of every 100 fifth-grade students at your school, how many do you think have smoked any marijuana in the past 30 days?

(b) Beliefs regarding prevalence of substance offers (Scale: 1 = strongly agree; 2 = agree; 3 = disagree; 4 = strongly disagree)

1. A lot of people who go to my school offer cigarettes to their friends.
2. A lot of people in my school offer alcoholic drinks to their friends.
3. A lot of people who go to my school offer marijuana to their friends.

Attitudes toward Substance Use

(a) Beliefs regarding negative consequences of use (Scale: 1 = yes; 2 = probably; 3 = I don't think so; 4 = no)

1. If you were to drink alcohol often, do you think you would make a fool of yourself in front of friends?
2. If you were to smoke cigarettes often, do you think you would have bad breath?
3. If you were to smoke marijuana often, do you think it would give you brain damage?

(b) Beliefs regarding positive consequences of use (Scale: 1 = yes; 2 = probably; 3 = I don't think so; 4 = no)

1. Does smoking cigarettes make it easier to be part of a group?
2. Does drinking alcohol make parties more fun?

(c) Beliefs about alcohol use in specific situations (Responses: 1 = yes; 2 = no. Items added to create score.)

1. Scenario 1: Joe is 17 years old. His parents do not want him to drink. A couple of weekends a month, he goes to his best friend's house and drinks a couple of beers with him.

—Do you think what Joe did was OK?

2. Scenario 2: Linda, age 21 bought a new sports car. To celebrate, her boyfriend Frank bought a bottle of wine. They each had 4 or 5 glasses and decided to take a drive in the country.

—Do you think what Linda did was OK?

3. Scenario 3: Jim, age 14 is watching football on TV with his older brother and some of their friends. Their parents are visiting relatives and won't be home until late. Someone brought a six-pack of beer for everyone to drink. Jim gets one of the beers from the refrigerator and sips it as he enjoys the football game.

—Do you think what Jim did was OK?

(d) Beliefs about friends' attitudes toward alcohol use (Responses: 1 = yes, 2 = no. Items added to create score.)

1. Would most of your friends think what Joe did (in Scenario 1) was OK?
2. Would most of your friends think what Linda did (in Scenario 2) was OK?
3. Would most of your friends think what Jim did (in Scenario 3) was OK?

Program Acceptance

(Scale: 1 = terrible; 2 = not very good; 3 = O.K.; 4 = pretty good; 5 = great)

1. How much did you like Project AAPT activities?
2. How much did you like being in role plays?

Program-Specific Knowledge

- (a) General knowledge (3 items)
- (b) Consequences knowledge (3 items)
- (c) Peer pressure knowledge (3 items)
- (d) Resistance knowledge (3 items)
- (e) Normative knowledge (3 items)

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