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The Effects of Integrated Interdisciplinary Classroom Instruction on a School-Based Smoking Program[1]

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Abstract

This study examines the implementation and effectiveness of a pilot interdisciplinary tobacco awareness/education and decision-making skills program for public and private middle grade students (grades 5-8) mandated for sixth graders for the school year 1999/2000 by the Florida Department of Health Office of Tobacco Control. This program was designed to be implemented by regular classroom teachers in a variety of subject specialties, and so incorporated an interdisciplinary, integrated approach to learning as well as theories of cognitive flexibility and situated learning. Students' knowledge, attitudes, and decision-making skills about tobacco use were examined both before and after involvement in the program in order to determine the amount of impact the program made on students.

For many years the federal government and many state governments have promoted and funded efforts to reach children about the dangers of smoking and tobacco use, sometimes using legal settlements with the tobacco industry (U.S. Office of the Surgeon General, 1995; U.S. General

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Accounting Office, 1998; Glynn, 1993). The goals of such efforts have been either to induce youth who smoke to stop (cessation programs), or to cause youth never to begin smoking (prevention or resistance/refusal programs). A number of these programs are school-based at the primary and secondary levels. The channel of instruction in most school-based programs is either through health and physical education classes or special pull-out or time-limited events at the school led by dedicated personnel such as police officers and outside advisors (Bangert-Drowns, 1988; Glynn, Greenwald, Mills, & Manley, 1993). In both cases the perception is that specialists, whether health or physical education teachers or outside law-enforcement officers and experts, are the personnel best suited to deliver instruction in this particular subject. As a result, students often receive brief, intense exposures from a small number of adults at the school, while the remainder of the school year is passed without attention to the subject. The record for effectiveness of tobacco education programs is not great, and more evaluation work is needed (Dukes, Stein, & Ullman, 1997; Lamkin, Davis, & Kamen, 1998; White & Pitts, 1998; Ennett, Tobler, Ringwalt, & Flewelling, 1994; Rosenbaum, Hanson, 1998; Sieber & Austin, 1994; Romero, 1994; *Systemic,* n.d.; Perry, Pirie, Holder, Halper, & Dudovitz, 1990; Smith, Zhang, & Colwell, 1996).

Surprisingly few tobacco education programs have taken advantage of the theories of learning that indicate that children learn best in regular,

everyday contexts, by repeated exposure to material, and by making interdisciplinary connections between and across subjects (Fogarty, 1991; Vars, 1987; *Integrated Learning,* 1987; Beane, 1993; Jacobs, 1989; Lounsbury, 1992; Brandt, 1991; Forte & Schurr, 1993; Schurr, Thomason, & Thompson, 1996; Noskin, D. P, 1995; Detterman & Sternberg, 1993). These theories call for a tobacco education program that is interdisciplinary, fully integrated with other learning and subject matter, and implemented in ordinary classroom contexts by regular teachers. According to Vars (1987), "skills taught as they are applied are learned more effectively and are more likely to be carried over into real life." The appropriate middle school curriculum, Beane (1993) said, "would derive its central themes from the intersection of early adolescent concerns and compelling issues in the larger world." Interdisciplinary teaching in middle schools is carried out through teacher teams and thematic units, school-wide efforts, or subject-integrative approaches by the teacher in the self-contained classroom. Topics that lend themselves to being understood only by multiple disciplines often are in danger of falling into the cracks between the academic subject specialties of secondary school teachers. Yet by emphasizing topics that lend themselves to interdisciplinary treatment, teachers can lead students to learn more deeply, relate and apply what they know better, and achieve more useful outcomes. As Brandt (1991) remarked, "many of the most urgent and interesting curriculum topics, and a good many of the outcomes we value

most, . . . do not fit neatly into a single subject area." By using regular classroom teachers, students are exposed to a daily continuity in instruction, which integrates concepts across disciplines.

This study examines the implementation and effectiveness of a pilot interdisciplinary tobacco awareness/education and decision-making skills program that was designed for public and private middle grade students (grades 5-8). The program was mandated for sixth graders for the school year 1999/2000 by the Florida Department of Health Office of Tobacco Control. This program was designed to be implemented by regular classroom teachers in a wide variety of subject specialties (Paradox Learning Systems, Inc., 1989), and so incorporated the interdisciplinary, integrated approach to learning as well as theories of cognitive flexibility (Spiro, Coulson, Feltovich, & Anderson, 1988) and situated learning (Brown, Collins, & Duguid, 1989). The rationale for this study was to determine whether or not the program was effective in obtaining desired student outcomes in the areas of student knowledge, attitudes, and decision-making skills. Students' knowledge, attitudes, and decision-making skills about tobacco use were examined both before and after involvement in the program in order to estimate the amount of impact the program made on students. One purpose of this study was to determine whether the theory of the benefits of integrated, interdisciplinary instruction was warranted with regard to a subject (tobacco/smoking),

which is usually marginalized in, or excluded from, regular classroom curriculum.

Method

Subjects

More than 3,000 students were drawn from thirteen middle schools in seven school districts in west central Florida. The school districts ranged from large and urbanized with diverse and international student bodies to rural with smaller, more homogeneous student populations.

The evaluation plan called for a minimum of 3,000 pretests, 1,000 posttests, and 10 case studies. This sample size was larger than required for an appropriate sample of Florida 6th graders, if calculated from general formulas when variance in the population is not known. With 95% confidence bands and a 0.05% margin of error, assuming maximal variance, the required sample size did not need to be above 400. On the other hand, the method of sampling was a quasi-experimental combination of availability and purposive sampling. Schools were selected that represented the range of diversity of school profiles from urban to rural, from high or moderate SES to low SES, from large and even over-crowded public schools to very small private schools, from densely populated metropolitan districts to sparsely populated and less developed districts. The breakdown by gender, ethnicity, and group in the pretest/posttest samples is provided in Table 1.

Table 1.
Description of Sample

	Gender	
	Pretest	Posttest
Male	50.5	49.9
Female	49.4	50.1
	Ethnicity	
	Pretest	Posttest
White	67.0	67.8
Black	13.7	13.6
Hispanic	12.8	12.7
Asian	1.7	1.4
Pacific Islander, American Indian, or Other	4.5	4.2
	Treatment Condition	
	Pretest	Posttest
Treatment	66.7	60.2
Control	33.3	39.8

Classrooms varied by subject taught, depending on the availability of volunteer teachers and the decisions of school administrators. In some schools, all 6th-grade teachers were involved in the evaluation of *Know Smoking* during one period; in other schools a smaller number of teachers evaluated *Know Smoking* during all the periods of one subject taken by all students. The organization of middle schools in some cases made it very

difficult to create a control group of students who did not intermingle with the treatment group, since students were routinely mixed for enrichment or alternated teachers or in some other way did not stay separate as a group. For this reason, in some cases, the control group was larger than the treatment group.

For the case studies, case study evaluators were assigned to study one classroom in depth. The case studies involved a wide range of involvement of the case study manager, from meeting with the teacher to explain the evaluation, to assisting in verifying the accuracy and usefulness of pretest/posttest data. The main responsibilities of the case study evaluators, though, were to observe the program lessons being implemented in classrooms, to interview teachers, and to conduct student focus groups.

Case study evaluators were to observe as many lessons as possible while they were being taught in the classroom by the case study teachers. In some cases, coordinating and communicating a convenient time to do so was one of the most difficult aspects of the evaluation. Teachers rarely scheduled lesson plans very long in advance, and, in many cases, did not give case study evaluators advance notice when they did teach a lesson so it could be observed. Still, the compiled classroom observations provided some of the richest data about the implementation of the program by classroom teachers. Case study evaluators analyzed lessons by using the

Classroom Observation Checklist instrument and by recording additional notes and comments in a notebook.

Teacher interviews were conducted by case study evaluators using the Teacher Interview Questionnaire instrument. In most cases, this interview was conducted face-to-face during a free planning period toward the end of the case study process. This procedure allowed for a wide range of input from the teacher in a nonthreatening manner. Case study evaluators conducted student focus groups using the Student Focus Group protocol instrument and the Web Site Focus Group protocol in small groups of approximately six students. Because the questions asked in the Student Focus Group were more personal and sensitive, written parental permissions were required for all participating students. Case study evaluators or case study teachers selected focus group students from among students with permissions, choosing students who were representative of the school. Student focus group questions probed for evidence of critical thinking skills, a key component in decision making.

Design and Procedure

The study design included several different measures. A pretest/posttest instrument measured student knowledge and attitude to determine gains from exposure to the program. The instrument consisted of specific multiple-choice items that were designed to test

interdisciplinary knowledge and awareness of issues surrounding tobacco used. The items were also designed to assess students' attitudes and ability to think critically and make decisions in a set of hypothetical, simulated scenarios. Open-ended/short answer items were designed to provide more concrete evidence of student knowledge. The evaluation matrix (Table 2) shows the scheme of evaluation design and procedure.

This evaluation focused on seven county school districts in central Florida. Students attending thirteen middle schools in these districts were pretested and posttested on multiple choice and short answer knowledge and attitude items. Twelve classrooms in the schools were used for case studies, which involved systematic classroom observations, teacher interviews, and student focus groups.

Table 3 presents the number and location of schools, case studies, and pretested/posttested samples. Case study evaluators randomly assigned classrooms to two groups: treatment and control. The treatment classrooms received instruction from at least eight specific program lessons between the dates of January 14 and March 10, 2000.

Table 2.
Description of Themes and Evaluation.

Domain	Theme for Evaluation	Evaluation Question	Indicator	Instrument	Sample
PROCESS	Quality of program implementation	What is the quality of program implementation?	*Qualitative:* Feedback from educators on program implementation	Case study protocols	Educators participating in case studies (Sample 2)
	Quality of program	What is the quality of the program?	*Qualitative:* Feedback from students on program	Case study protocols	Students participating in case studies (Sample 3)
OUTCOME	Knowledge acquisition	What knowledge about tobacco use did the students gain?	*Quantitative*: Results of pre/post test of tobacco-related knowledge	Pretest and posttest cognitive items	Students participating in pretest and posttest (Sample 1)
	Attitude change: effect of student knowledge about tobacco use and critical thinking skills on attitude	How have students' views on tobacco use changed as a result of their participation in Know Smoking?	*Quantitative*: Results of pre/post test of tobacco-related attitudes	Pretest and posttest affective items; case study protocols	Students participating in pretest and posttest (Sample 1); students participating in case studies (Sample 3)

Table 3.
School Location and Sample

School	Number of Case Study Classrooms	Students Pretested	Students Posttested
School A, (District 1)	2	363	352
School B, (District 2)	2	230	224
School C, (District 3)	1	175	278
School D, (District 4)	1	329	235
School E, (District 3)	1	263	232
School F, (District 5)	1	193	202
School G, (District 6)	1	355	338
School H, (District 7)	2	224	213
School I, (District 5)	1	426	328
School J, (District 4)	0	318	329
School K, (District 5)	0	38	35
School L, (District 5)	0	176	173
School M, (District 5)	0	163	100

The case study evaluators selected one or more case study classrooms to study in depth. In many cases, treatment, control, and case study classrooms could only be selected on a volunteer basis, rather than on a random basis. No monetary incentives could be provided to teachers, so the degree and extent of their participation was always on a voluntary basis. During the spring, preparations were also being made for FCAT

standardized testing, so participation was constrained by the demands of the schools' timetables and external pressures.

Materials

The program consisted of 20 interdisciplinary lessons, a training videotape for teachers, a set of student reproducibles, and a Web site with games, surveys, and a voting section. The lesson plans and activities were keyed to FCAT assessments and the Florida Sunshine State Standards, including grade level benchmarks. The lessons covered historical, economic, social, and scientific areas for interdisciplinary integration, as well as techniques for understanding advertising, interpreting research, and analyzing the methods and consequences of decisions about tobacco use. The lessons also provided practice in mathematical concepts and applications related to the subject of tobacco, as well as reading and writing tasks.

Results

The classical experimental design using pretest/posttest assessments with control and treatment groups has certain shortcomings when applied to the educational setting. Schools, classrooms, and teacher assignments are nonrandom groupings, and the distribution of attributes of interest (SES, instructional styles, school culture, etc.) are extremely heterogeneous. Sampling of schools, teachers, and classrooms in almost all cases can only proceed by a process of self-selection (volunteering) or circumstantial

selection (involving the schools' and teachers' extraneous motives). History, pretest sensitization, mortality, novelty effect, and experimenter effect are all strong factors affecting the validity and generalizability of such evaluations. Nevertheless, there is a richness in the data resulting from this study that deserves close inspection.

Pretest

A total of 3,253 students were pretested on the 13 knowledge items and the 6 attitude items related to the program. For each of the 13 multiple-choice knowledge items, there was one correct answer, three distracters, and one answer option: "I don't know". The total score was the number of items correct, with a higher score indicating a higher knowledge. The mean for the treatment groups was 3.78 with a standard deviation of 1.92 and the mean for the control groups was 3.69 with a standard deviation of 1.96. The overall mean for both groups on the knowledge items was 3.75 with a standard deviation of 1.93.

For the 6 attitude items, Likert scales were avoided because such scales are inappropriate for use with the age-group of 6th graders. Instead, in each question, students were presented with a hypothetical scenario and asked how likely it was that they would respond in a particular way. There were five answer options ranging from "Very likely" to "Not at all" and "I don't know." Such attitude items could not be directly "scored;" instead, the answers were weighted with points in relation to preferred answers

(reflecting avoidance of tobacco and willingness to act on tobacco awareness). The highest possible score was 24. The mean for the treatment groups was 19.97 with a standard deviation of 3.13, while the mean for the control groups was 20.05 with a standard deviation of 3.24. The overall mean for both groups on the attitude items was 20.00 with a standard deviation of 3.17. Students did not think they would smoke to look older or cool, and they did not think it was likely most of their peers would use tobacco, although there was less confidence on the latter issue (in some cases those indicating a black ethnicity were slightly more confident). Most students thought it was likely they would say something to someone who smoked, including close friends and relatives.

The scores and variability indicated low knowledge and high attitude with considerable variation among students. Hypothesis tests were acceptable within significance limits, but ANOVA analysis indicated inconsistent differences between control and treatment groups within different schools. In some schools, the mean of the treatment groups was higher than the mean of the control groups, and in other schools the reverse was true. Cronbach's alpha measure of reliability was low (.39 for knowledge, .57 for attitude), but consistent with the length of the test and the low knowledge and uncertain attitudes expected in the pretest situation. It may have been indicative of a significant amount of guessing on the part of students.

Posttest

A total of 3,070 students were posttested on the 13 knowledge items and the 6 attitude items related to the *Know Smoking* program using the same instrument on which they were pretested. Possible practice effect of an identical pretest/posttest and pretest sensitization were partially controlled for by the use of specific detail questions and the time delay between pretest and posttest of three months (Hopkins, Stanley, & Hopkins, 1990, 145-146). Of those posttested, 1,832 scores could be successfully paired to pretest scores on the knowledge items, and 1,825 could be paired on the attitude items.

For the 13 knowledge items, the mean for the treatment groups was 5.36 with a standard deviation of 2.49, and the mean for the control groups was 4.07 with a standard deviation of 1.89. Both treatment and control groups showed mean gains. The overall mean for knowledge items in both groups was 4.75 with a standard deviation of 2.38. ANOVA between pretest and posttest knowledge item scores indicate a very strong, statistically significant gain in knowledge ($p < 0.0001$) after treatment in the treatment group as compared to the control group. This was true across genders, ethnicities, and schools. The Cronbach coefficient alpha of .58 was also higher than in the pretest.

The posttest scores on the attitude items (overall mean for both groups = 19.71) did not reveal a statistically significant increase from the

pretest. They remained high as in the pretest. The Cronbach alpha increased to .55. Some variations did occur by school and by item. For example, statistical significance was found in variation by school. This is probably a reflection of the differences in the samples of students by school and the different teaching approaches employed by the teachers in different schools. Low changes in posttest scores are not uncommon when pretest scores are high, as they were in this case, since there is less room for an increase on the posttest. In summary, knowledge scores showed a statistically significant increase after treatment, while attitude scores remained high before and after treatment.

Case Studies

Student Focus Groups. For the student focus group, a small number of students were taken aside and asked questions from the Student Focus Group Script protocol or the special Web Site Focus Group Script protocol, with an encouragement of divergent thinking and free discussion of the questions. Students in focus groups reported they had learned from the program, especially about the physiological effects of tobacco use. Students also said they learned about the wide variety of interdisciplinary topics, such as decision-making skills, financial costs of tobacco use, advertising messages, social issues, history, and the law. They reported that they enjoyed learning facts about tobacco and decision-making skills. Teacher

presentation was also very prominent and important to them. Students gave evidence of higher-order thinking and affective learning (affective learning refers to learning dealing with feelings, values, and attitudes).

The program offered students a wide variety of information on different issues to support critical thinking and decision-making across disciplines and issues. Students reported that their attitudes about smoking had changed because of what they had learned. Some students reported that they had been given new reasons to support their previous conviction not to smoke. Some students acted on their knowledge and thinking skills by reporting action based on their knowledge, such as informing others about tobacco, or avoiding second-hand smoke. The largest number of responses from students indicated that they did not want to smoke based on what they had learned, and reported that they would never smoke.

Focus group questions about the program Web site indicated that there was a diversity of skills and abilities among students with regard to their computer literacy and use of the World Wide Web. Most student responses indicated that the Web site was easy to use and understand. The majority of the students felt they had learned something from the Web site, and that their attitudes had changed as a result. After viewing the Web site, students most frequently characterized tobacco as harmful, dangerous, or bad. Despite having friends who smoked, all students replied that they would not smoke. When asked what they liked best about the Web site,

students most often reported the activities and pictures there (especially the Camel that reminded one of the once very powerful tobacco company icon). They also enjoyed the voting section and survey and seeing how other students answered.

Overall, teachers seemed well-prepared, motivated, and involved in the lessons they presented to their students. On the other hand, classroom observations indicated a wide diversity of teacher styles employed in the program delivery. In a number of classes observed, student handouts from the available reproducibles were not evident. In some cases, teachers were observed using supplemental materials they had found on their own. Teachers, in many cases, exhibited inadequate instructional delivery methods, such as the failure to review previous lessons, failure to provide students with the listed program objectives for the lesson, and failure to provide closure to the lesson. Occasionally, some students were unresponsive to review or unclear on objectives, although in most cases students seemed to understand directions and seemed motivated and engaged in learning.

Some teachers emphasized a paper-and-pencil, lecture approach with few visuals and concentration only on verbal intelligence. Other teachers used cooperative learning, role-plays, discussions, personal anecdotes, and hands-on activities. Some teachers were comfortable adapting such things as content, vocabulary, math exercises, etc., to individual class and student

needs, whereas others were not. Some teachers clearly seemed pressed for time because of a lack of adequate planning time and the demands of state mandated FCAT testing in the spring.

Teacher Questionnaires. For the teacher questionnaire, teachers were interviewed by evaluators and asked to answer 14 questions about their experience with teaching the program. In most cases, teachers reported that they were motivated to teach about tobacco since they were non-smokers and because they believed tobacco education and awareness were not necessarily taught at home or elsewhere in the curriculum. A significant number of responses showed that teachers appreciated the program's decision-making, critical thinking approach, rather than a scare-tactics approach. Overall, teacher reactions to individual lessons were very positive – they felt the lessons were effective with students and that the students enjoyed them.

Most frequent responses showed that the Backgrounds for the Teacher in each lesson were effective and useful. Teacher responses most often indicated the Integration Activities were effective when employed, but some teachers responded that they did not do as many as they would have liked due to time constraints. The largest number of teacher responses indicated that the Questions for Discussion were effective and enjoyed by students.

Teachers remarked that students' reaction to the program lessons were positive, especially because they allowed students to talk and share, personalize lessons, and relate lessons to real-life family and society.

Critical Thinking

In the case studies, 98 students were involved in focus groups ranging in size from three to twelve students per group. Since one of the focal points of the evaluation was to determine if students participating in the program could demonstrate evidence of critical thinking, a method of capturing this data and categorizing was developed (cf. Kuhn, 1999). Students in each group were asked the same questions ranging from "Does anyone in your family smoke?" and "What did you enjoy most about the *Know Smoking* program?" to "Do you feel that you learned something from the *Know Smoking* program?" and "Knowing what you know now, would you ever smoke?" Case study evaluators transcribed exact student responses as they were given (even if they made little sense or didn't answer the question directly). Categories of cognitive and affective domains were selected for the analysis with an explanation and example of the type of response that would fit the category. Student comments were then aggregated and categorized according to the appropriate classification. In this analysis, comments that did not specifically show evidence of the higher-order cognitive and affective thinking skills were classified as "Other."

Taxonomically, both cognitive and affective domains were examined. The taxonomy most accepted in education for assessing the cognitive domain is known as Bloom's taxonomy (Bloom, 1984). In this taxonomy, six levels are identified (knowledge, comprehension, application, analysis, synthesis, and evaluation) with each successive category building upon the previous one. Higher order thinking skills, or critical thinking skills, are most often identified as application, analysis, synthesis, and evaluation. In this study, analysis and synthesis were combined and evaluation was also included as a category. An affective learning taxonomy (Bloom, Krathwohl & Masia, 1964) also was used because of the prevalence of learning in the program that emphasized feelings, attitudes and values. The levels in the affective domain selected for this study, again at the higher levels, include valuing and organizing/ characterizing. The affective domain is appropriate in categorizing learning dealing with feelings and conflict, while the cognitive domain deals with the type of learning closely associated with formal education. Since the program contained elements of both types of learning to arrive at decision making, it was deemed appropriate to use categorization from both domains.

A breakdown of the categories used in this study, with explanations, examples and sample comments follows.

Cognitive Domain Higher-Order Thinking Skills

Analysis/Synthesis: The student demonstrated the ability to combine previously learned knowledge to create something new and/or demonstrated the ability to break down information into parts. Examples of this included the ability to adapt, generalize, invent, and combine, explore, discriminate and investigate.

Potential Analysis/Synthesis comments would include:

Statements or examples of how they feel about tobacco issues.
Statements or examples including information about tobacco issues.

Sample Comment: *"(I) learned that secondhand smoke is as bad as actually smoking and can give you lung cancer."*

Number of Comments Demonstrating Analysis/Synthesis: 130

Evaluation: The student demonstrated the ability to combine the various skills of knowledge, comprehension, application, analysis, and synthesis. Examples of this included the ability to judge, value, and defend.

Potential Evaluation comments would include:

Indications of strengthened attitudes.
Comments about personal values.

Sample Comment: *"Didn't want to smoke before but now I definitely don't want to. The program definitely helped me decide not to smoke."*

Number of Comments Demonstrating Evaluation: 112

Affective Domain Higher Order Thinking Skills

Valuing: The student made a commitment to a value by choosing a concept or behavior deemed worthy by him or herself.

Potential Valuing comments would include:

Statements of belief about current or future behavior.
Statements indicating a commitment to a decision.

Sample comment: *"I have a friend that smokes and now he's sick. I'm not gonna do it even though he smokes because now I know what can happen to me."*

Number of Comments Demonstrating Valuing: 55

Organizing/Characterizing: The student could demonstrate evidence of a personal value system or plan and/or could articulate the beliefs and values upon which their plan was based.

Potential Organizing/Characterizing comments would include:

Statements including examples of whether they would or would not choose to smoke.
Statements including reasons why they would or would not choose to smoke.

Sample Comment: *"My Mom and Dad both started at an early age and they both can't stop. So, If I start smoking I'd probably get addicted to it and I don't want to because you can die from it."*

Number of Comments Demonstrating Organizing/Characterizing: 46

Other: These comments were responses by students to questions that did not fit into the higher-order cognitive and affective domains.

Other comments include:

> Answers to questions that require only a yes or no answer.
> Answers to questions that are classified as lower-level cognitive and affective thinking skills.

Sample Comments: "*Yes*" "*No*" "*I liked playing the games on the Web site*." "*I am very familiar with the world wide web*." "*I didn't like the test*."

Number of Comments in the Category Other: 372

Discussion

Comparison of scores on pretests and posttests of control and treatment groups showed that the difference in gain for the treatment group was very strong and statistically significant for all genders, ethnicities, and schools. Mean scores on the attitude items were high both before and after treatment. Noticeable variations in attitude scores occurred by school and by item. It is likely that these variations reflect mainly the differences in teaching approaches employed by the teachers in different schools.

Teachers explicitly informed students about the program and in many cases revealed to students that they were part of an evaluation of the program. Students were aware that they were being studied. Teachers in some cases also expressed their enthusiasm for trying a newly developed set of materials for smoking. The potential for Hawthorne/Novelty effect was somewhat controlled for by the knowledge items in the pretest/posttest. There was no attempt to control the delivery of the program by individual teachers. In fact, it became clear from the classroom observations and teacher interviews that a wide array of teaching styles and instructional strategies were employed. A slight school-group posttest effect provides quantitative confirmation of this.

The paper-and-pencil, lecture approach with few visuals and concentration only on one (verbal) intelligence is not recommended in the educational literature (Forte & Schurr, 1996). Cooperative learning, role-plays, discussions, personal anecdotes, and hands-on activities used by many teachers observed in this study come closer to the ideal envisaged by middle school educational theory. Some teachers were comfortable and skilled at adapting such things as content, vocabulary, and math exercises to individual class and student needs and the interdisciplinary topics, whereas others were not. The lack of interdisciplinary teacher team planning time was evident in this study, along with the problems of emphasis raised by high-stakes standardized statewide testing. Teacher

strategies were a key ingredient for promoting student reflection, making connections between things learned, and deepening or personalizing the lesson for students.

The interdisciplinary program examined in this study lent itself to flexible scheduling and implementation by a diversity of content disciplines and teaching styles, and also characteristic middle school instructional methods such as interdisciplinary teaming and thematic units. The strength and wisdom of this approach is probably borne out by the demonstrated results of the program over the time period it was evaluated and with the population examined. However, a crucial connection between program materials and their successful implementation was a deep understanding of the principle of genuine interdisciplinarity and the practical instructional strategies that go along with implementing interdisciplinary curriculum, such as interdisciplinary teacher teams with adequate planning time, teaching to multiple intelligences, integrating learning, active learning strategies, and motivational techniques.

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