

THREE-YEAR OUTCOMES OF EXPOSURE TO A SCIENCE CURRICULUM

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Summary. --- This paper reports the results of a study of the effects of a science-based anti-smoking curriculum and on the occurrence of tobacco use behavior among adolescents. A sample of 1137 seventh and eighth graders was surveyed using a paper-and-pencil measure.

Introduction

The American Lung Association reports that one in five deaths is due to smoking. In addition, smoking costs the US economy over \$150 billion annually in health care costs and lost productivity (American Lung Association, 2002). Life long smoking addictions often start in adolescence and the American Lung Association estimates that 13% of youth under the age of 18 are smokers. (2002). These figures indicate a need for concern in the precursors and causes of smoking among children and adolescents.

Because of the magnitude of this problem there have been many efforts to curb smoking among children and adolescents. Settlements of lawsuits with major cigarette companies have pumped money into cessation and prevention programs aimed at young people. The most visible programs try to change knowledge about the effects of smoking and thus change attitudes about smoking. The messages in anti-smoking television commercials are that smoking will make you sick, smoking makes you look foolish, or big corporations are getting rich off of your smoking habit. Tobacco education programs in the schools are another method being used to reduce the number of adolescent smokers. These programs often work to increase the young person's knowledge base about the dangers of smoking. The assumption here is that changing knowledge works to change attitudes and that, in turn works to change behavior.

This paper reports a study that investigates the links between knowledge, attitudes, and behavior in a population of middle school students a subset of whom have been exposed to a science education program designed to impact tobacco use behavior. The curriculum, Science, Tobacco & You was designed to excite students about science and indirectly affect tobacco use.

Literature

There is a great deal of research on the tobacco use behavior of children and adolescents. One branch examines external pressures on young people to smoke. Phenomena such as peer pressure, family member tobacco use, the availability of tobacco, and parental sanctions are just some examples (Jackson, Bee-Gates & Henrickson, 1994, Wang, Fitzhugh, Turner, & Fu, 1997, Boyle, Claxton, & Forster, 1997; Ma, Shive, Legos, & Tan, 2003). One area of examination has been the role in tobacco use behavior played by attitudes (c.f. Ragon & Mouzon, 1999, Botvin, Batson,

Witts-Vitals, Bess, Baker, and Dusenbery., 1989, Botvin, Baker, Filazzola, and Botvin, 1990). While theory, such as Fishbein and Ajzen's theory of reasoned action, would predict that attitudes are precedent to and causal of behavior there is some recent research questioning this classic model (Fishbein & Ajzen, 1975). Aside from arguments about order and causality there is newer research suggesting that attitudes toward smoking are not important predictors of smoking behavior (Tyas & Pederson, 1998). The argument is that the internal predisposing factors such as knowledge, beliefs, and attitudes are poorer predictors than such external factors as socio-economic variables (McNeil, Jarvis, Stapleton, Russell, Eiser, and Gray, 1988). Still, there seems to be evidence that tobacco knowledge provides some protection against the onset of smoking (Piko, 2001; Ma, et al., 2002).

Method

We surveyed 1142 seventh and eighth grade students across northern Florida. These students were from schools that had participated in the "Science, Tobacco, & You" curriculum three years earlier. "Science, Tobacco & You" is a fourth and fifth grade science curriculum which is based on a series of hands-on activities. The curriculum is designed to make science classes more interactive and fun. An anti-smoking theme runs through the year-long course material. The students would have been in grades four and five, three years prior to this study, when exposed to the science program. After submitting a proposal and gaining approval from the school administration, self-administered, two-page questionnaires were completed by the subjects during class time. These forms contained a seven-item test designed to measure knowledge about the effects of tobacco on the human body, two items designed to measure attitudes toward cigarette smoking, a three-item scale from the Florida Youth Tobacco Survey (Florida Department of Health, 1998) measuring smoking behavior, two items measuring intention to smoke and a three-item scale measuring attitude toward science (Mittal & Lee, 1989). The forms also contained a five-item scale asking about whether or not the student remembers having participated in four of the more unique activities included in the "ST&Y" curriculum and whether they remembered participating in that curriculum. Each of the scales will be expressed as summed scores for purposes of analysis. The questionnaire also contained questions on age, sex, and ethnicity.

Our sample contained 585 or 52.7% girls. All children were 11 to 15 years old ($\mu = 13$). The sample contained rural and urban adolescents who reported being 58.5% white, 30.1% black, 4.1% Hispanic, 2.5% Asian, 1.4% Native American, and 3.4% other with 11 missing responses. Subjects with missing data are excluded from all analyses. This distribution closely matches the ethnic make up of the region. Of the sample, 13% reported being smokers. This figure matches the current estimate of adolescent smokers made by the American Lung Association (2002). Responses on ethnicity and on smoking behavior lead us to believe that we have captured a representative sample of middle school students for this region of the U.S. Because of the need for a brief survey, the measures were also necessarily brief. Only two scales could be assessed for reliability. The three items measuring smoking behavior showed an internal consistency of .79 as measured by Cronbach alpha. The three items measuring involvement with science showed an internal consistency of .74. These levels of internal consistency are deemed acceptable by Nunnally (1978). Neither the seven items representing tobacco knowledge, nor the five measuring participation in the program could be assessed via alpha because they are not designed to be unidimensional. By definition a measure of the objective knowledge of some subject is a set of independent measures and this violates the assumption of unidimensionality needed to measure internal consistency.

Findings

The substantive analysis was conducted using Pearson product-moment correlations. Table 1 displays these results. The signs of the correlations are somewhat confusing because of nature of the relationships between knowledge and the other variables in the case of tobacco use behavior. Usually we expect knowledge to be positively associated with attitudes toward the object (Alba & Hutchinson, 1987). In this case knowledge about what effects tobacco has on the body would be expected to lead to negative attitudes about smoking. This situation leads to the atypical direction of the coefficient signs. The correlations between tobacco knowledge, pro-smoking attitude, intention to smoke, and tobacco usage are all significant and as expected. Higher knowledge about the dangers of smoking is associated with lower pro-smoking attitude, lower intention to smoke and less tobacco usage. We found no strong correlations between exposure to "Science, Tobacco, and You" and any of the other measures.

Exposure to the science curriculum is associated with an improved attitude toward science. The findings on attitude toward science are interesting across the board. The three-item scale is significantly related to all other measures in the study. Attitude toward science was negatively correlated with attitudes toward smoking behavior. In addition, the science attitudes were related to lower tobacco usage and lower intention to smoke in the future.

Discussion

These findings on the three-year *post hoc* associations of exposure to a science curriculum designed to reduce smoking behavior are potentially interesting. Rather than directly reduce smoking, exposure to the curriculum was related to a more positive attitude toward science. More research is needed to begin to understand why improved liking of science was related to such important things as less smoking and a reduced intention to smoke among adolescents.

This study does not compare the effect of attitudes on behavior with those of other potentially important variables. This sample was one of convenience sample, albeit large, however, because it was our intention only to test and demonstrate the relationships among these variables, the sample was acceptable (Calder, Philips, & Tybout, 1981).

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Table 1

Correlations Among Survey Scores on Knowledge, Attitudes, Intention, Usage, and Program Exposure ($n = 1137$)

	1.	2.	3.	4.	5.	6.
1. Tobacco knowledge	1.00					
2. Pro-smoking attitude	-.35**	1.00				
3. Intention to smoke	-.11**	.25**	1.00			
4. Tobacco usage	-.32**	.32**	.37**	1.00		
5. Exposure to ST&Y	.02	.00	-.07*	.00	1.00	
6. Attitude toward science	.26**	-.21**	-.14**	-.24**	.12**	1.00

** $p \leq .001$

* $p \leq .01$