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# Effects of transfer-oriented curriculum on multiple behaviors in the Netherlands

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## SUMMARY

Many school health promotion curricula address a single health behavior, without paying attention to potential learning effects in associated behavioral domains. We developed an innovative curriculum about smoking and safe sex that also focused on promoting students' transfer of knowledge, skills and attitudes to other domains. In a quasi-experimental study involving 1107 students (Grades 7 and 8) in the Netherlands, the curriculum was compared with regular lessons about smoking and safe sex. The central research questions

were to what extent the transfer-oriented curriculum: (i) had effects on psychosocial determinants and behaviors in the domains of smoking and safe sex, (ii) had effects on determinants and behaviors in three domains about which no lessons were taught (consumption of alcohol, fruit and breakfast). Multi-level analyses showed that the answer to both questions is positive. The results indicate that a transfer approach may have surplus value over the classic domain-specific approach and warrant further elaboration in the future.

*Key words:* school health promotion; effectiveness; transferability; health behaviors

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## INTRODUCTION

Health-compromising lifestyles such as smoking, binge drinking, unsafe sex, poor dietary habits, physical inactivity and behaviors that contribute to unintentional injuries and violence are widely prevalent among young people in western societies (Currie *et al.*, 2004; Eaton *et al.*, 2006). Evidence has accumulated that many of these behaviors tend to co-occur or cluster: adolescents who are involved in a particular health behavior are more likely to also be or become involved in other health behaviors (Donovan *et al.*, 1991; Basen-Engquist *et al.*, 1996; DuRant *et al.*, 1999; Wiefferink *et al.*, 2006; Li *et al.*, 2007; Prochaska *et al.*, 2008; Van Nieuwenhuijzen *et al.*, 2009). Some behaviors are more closely related than

others: most studies report clustering of, or strong associations between, the adolescent 'problem behaviors' of smoking, drinking, drug use and precocious intercourse and weaker or inverse associations of these behaviors with dietary and physical activity behaviors (Donovan *et al.*, 1991; Basen-Engquist *et al.*, 1996; Van Nieuwenhuijzen *et al.*, 2009).

In spite of the evidence for associations between health behaviors, many adolescent health promotion programs focus on a single health-related behavior (Paulussen *et al.*, 1998; Flay, 2002; Jackson *et al.*, 2012). In addition, many of these programs address similar psychosocial constructs, such as factual knowledge, attitudinal beliefs, social influences and refusal skills (Botvin *et al.*, 1995; Summerfield, 2002; Schaalma *et al.*,

2004), which suggests at least some conceptual overlap in programs between behavioral domains. The single-behavior organization of health promotion programs neglects the evidence for associations between health behaviors and conceptual overlap between programs. Moreover, it may cause barriers for implementation. Most adolescent health programs are implemented in schools as supplements to the regular curriculum, and have to compete with other extracurricular themes in schools, such as civic and moral education, multiculturalism and environmental education (Ten Dam *et al.*, 2000). From the perspective of educational practice, the multitude of uncoordinated single health-behavior programs threatens to overload the school curriculum and teaching staff (Greenberg *et al.*, 2003; Lee *et al.*, 2004; Leurs *et al.*, 2005a).

In addition to whole-school approaches which may help tackle the problem of overload [e.g. see (Leurs, *et al.*, 2005b)], there are increasing calls for integrative approaches to health promotion. Such approaches focus on integration at the content level of health promotion by systematically connecting various health behavior domains, so that a single intervention program may impact on multiple behaviors simultaneously (Paulussen *et al.*, 1998; Catalano *et al.*, 2002; Flay, 2002; Greenberg *et al.*, 2003; Prochaska, 2008).

In the present paper, we report the effectiveness of a particular integrative approach: transfer-oriented learning. A transfer-oriented approach is one that stimulates students to apply independently and flexibly the knowledge, attitudes and skills they have learned in one context or domain (e.g. refusal skills with respect to smoking) to other contexts or behavioral domains that are not explicitly addressed (e.g. refusing alcohol) by focusing on specific features of the teaching–learning processes (Elshout-Mohr *et al.*, 1999). This approach originates from theory and research in education and psychology [e.g. (Campioni *et al.*, 1995; Marini and Genereux, 1995; Perkins and Salomon, 1996; Beach, 1999; Tuomi-Gröhn and Engeström, 2003; Lobato, 2006)] and is now applied to the health promotion field to our knowledge for the first time. We restricted the study to the four health behavior domains that are most often addressed in secondary schools in the Netherlands: smoking, drinking, safe sex and healthy nutrition (Dafesh, 2006). The underlying research rationale for this choice is explained at the end of the Introduction section.

### Preconditions for a transfer-oriented approach

In theory, a transfer-oriented curriculum can impact several behaviors simultaneously while keeping time and effort spent by schools and teachers at an acceptable level (Salomon and Perkins, 1989; McKeough *et al.*, 1995; Bransford and Schwartz, 1999; Bransford *et al.*, 2000). Paulussen *et al.* (Paulussen *et al.*, 1998) emphasized that transfer of learning can be expected if the following preconditions are met: (i) the target behaviors are associated and have similar determinants, (ii) the methods by which these determinants can be modified are similar across these behaviors and (iii) students should be stimulated to apply the learned knowledge and skills to multiple behaviors. Preliminary research activities in the form of systematic literature reviews indicated that the first two preconditions are fulfilled with respect to the four selected behavioral domains (Wiefferink *et al.*, 2006; Peters *et al.*, 2009a,b). The review results for behavioral clustering showed fairly strong correlations between smoking and drinking (0.43–0.60) and between smoking-drinking and precocious sex (0.29–0.54) (Wiefferink *et al.*, 2006). Although no correlations of these behaviors with safe sex and dietary behavior had been reported (Wiefferink *et al.*, 2006), at least one study showed that sexual risk behavior is part of the same cluster of behaviors as substance use, whereas low fruit and vegetable consumption is part of a different cluster (Basen-Engquist *et al.*, 1996). Our review results for similarities between determinants showed various determinants to be relevant to all four behaviors (Wiefferink *et al.*, 2006; Peters *et al.*, 2009b): beliefs about immediate gratification, beliefs about social advantages, peer norms, peer and parental modeling, and refusal self-efficacy. As for the second precondition, various effective elements of interventions were found to be similar across the target behaviors (Peters *et al.*, 2009a), including using (social-cognitive) theory; addressing social influences; addressing cognitive-behavioral skills; using interactive methods and training facilitators. The third precondition involves the question by which teaching methods transfer of learning can be expected.

### Transfer-oriented learning

Transfer of learning occurs when learning in one context or domain (e.g. smoking) impacts on

competences or behavior in another context or domain (e.g. nutrition). Transfer is a key concept in education and learning theory because most education aspires to transfer. After all, a central goal of education is to provide learning experiences that are useful beyond the classroom or the specific task at hand (Marini and Genereux, 1995; Perkins and Salomon, 1996; Barnett and Ceci, 2002; Saljö, 2003; Lobato, 2006). Transfer is more difficult to realize as the transfer context or domain is less similar to the learning context (Perkins and Salomon, 1996; Barnett and Ceci, 2002) and very often does not happen by itself (Perkins and Salomon, 1996; Bransford *et al.*, 2000; Saljö, 2003). Research into transfer, which mainly originates from the theoretical perspectives of cognitive psychology and situated learning {The model of situated cognition is based upon the notion that knowledge is contextually situated and is fundamentally influenced by the activity, context and culture in which it is used [see (McLellan, 1996), p.6].}, has identified several conditions under which transfer is more likely to occur [e.g. see (Bransford *et al.*, 2000; Tuomi-Gröhn and Engeström, 2003)].

One condition, largely based on situated learning perspectives, is that knowledge should be personally meaningful to students in order for it to be carried over to a similar problem or behavioral domain (Saljö, 2003). Meaningfulness promotes students' deep processing of the subject matter, because it activates students to share knowledge and ideas, as well as their ability and willingness to apply the knowledge (Brown *et al.*, 1989). Meaningfulness implies that the learning content should build on the students' pre-existing knowledge and experiences (Bransford *et al.*, 2000), invite them to consider the content in light of their personal goals and questions and help them look for applications in real life (Wardekker *et al.*, 2011). Active and interactive learning methods and working on authentic problems are best suited to address the students' perspective (Newmann and Wehlage, 1993; Van Oers, 2009). A second condition, based on cognitive educational psychology, is alternating explicit abstraction and application in various contexts. The teaching should connect domain-specific issues to general principles and vice versa and requires alternate processes of contextualization (learning new skills in one context), decontextualization (deducing a general principle) and recontextualization (examining application in other contexts) (Wang *et al.*, 1993;

Elshout-Mohr *et al.*, 1999). If students have practiced recontextualization in several contexts, transfer may occur to contexts that were not addressed. A third condition, stemming from both cognitive and situated views, is the explicit promotion of the students' awareness of how and what they are learning and why this is important for them. Within cognitive psychology the importance of metacognitive knowledge of one's own learning processes is emphasized (Hattie *et al.*, 1996; Perkins and Salomon, 1996; Elshout-Mohr *et al.*; 1999; Dignath and Büttner, 2008; Hattie, 2009). In the social learning domain, metacognition involves reflection on one's own social and emotional processes, such as learning to recognize and regulate group influences on one's own thinking (Volman and Ten Dam, 2000). From a situated perspective, it is argued that in order to bridge different contexts, students need to reflect on their personal development while constructing new knowledge and new ways of looking at issues (Beach, 1999; Boersma *et al.*, 2010).

The above paragraph posits that transfer often must be actively promoted by taking the above-mentioned conditions into account when designing the teaching–learning process. An interesting question in applying the transfer approach to health behavior intervention research is not only whether this approach is effective, but also whether effectiveness differs with the target behavior in question. Since transfer to a similar domain occurs more easily than to a dissimilar domain (Perkins and Salomon, 1996; Barnett and Ceci, 2002), we assume that transfer from one behavioral domain to another is easier to realize as the behaviors are more strongly correlated. Based on this assumption and the results of our review of behavioral clustering previously described (Wiefferink *et al.*, 2006), we selected smoking and safe sex as the domains to address explicitly in the experimental curriculum and we selected the closely related domain of alcohol consumption and the less closely related nutritional domains of fruit and breakfast consumption as the criterion domains for examining transfer effects. The research questions for the study are as follows:

- (i) To what extent is a transfer-oriented curriculum about smoking and safe sex effective in changing student behavior and behavioral determinants in the domains of smoking and safe sex that were taught?

- (ii) To what extent is a transfer-oriented curriculum about smoking and safe sex effective in changing student behavior and behavioral determinants in the domains of alcohol, fruit and breakfast consumption that were not taught?
- (iii) Does the effectiveness of the transfer-oriented curriculum differ for the domains that were not taught? If so, can this difference be attributed to the strength of association between taught domains and untaught domains?

## METHODS

### Study design

The evaluation study was conducted from September 2006 to July 2007. It featured a quasi-experimental design, with teachers assigned to the experimental condition (Exp) or to a control condition (Con). Teachers in the experimental group taught the transfer-oriented curriculum about smoking and safe sex and control group teachers taught their regular (non-transfer-oriented) lessons about smoking and safe sex. Thirty-three teachers from 23 schools from all regions of the Netherlands participated. Due to recruitment difficulties the planned random assignment to conditions could be executed only for 12 of the 33 teachers, 6 in each condition. The other teachers were recruited by colleagues after initial allocation, were allocated by preference, or were specifically recruited for the control condition. However, experimental and control teachers were comparable on all teacher/school variables measured (age, gender, years of teaching experience, level of teacher training, percentage teaching biology, public vs. confessional school). Because of the quasi-experimental design, we also carefully checked and corrected for confounders at the student level, such as grade and school level.

Student data were collected in three waves of questionnaires (baseline, post-test and follow-up). Teachers were instructed to teach the experimental curriculum (Exp) or their regular lessons about smoking and safe sex (Con) between baseline and post-test, and to not teach about alcohol or nutrition in that period. Between post-test and follow-up teachers were free to teach about all subjects, including alcohol and nutrition; it was not considered feasible in Dutch educational practice to have schools not

teach about alcohol or nutrition all year. The baseline was administered between September and December 2006, the post-test within 1 month after intervention ending and the follow-up on average 4 months after intervention ending.

### Participants

Secondary schools from all regions of the Netherlands were randomly selected and were contacted by telephone to recruit teachers in relevant school subjects (Biology and Care). Eligibility criteria involved: (i) teaching students in Grade 7 or 8, (ii) in a school level that prepares for at least higher vocational education and (iii) willingness to adhere to the study protocol with respect to timing of lessons (see the section Study design). Over 200 schools and teachers were contacted; 33 teachers from 23 schools agreed to participate.

At baseline, 15 teachers from 12 schools participated in the experimental group with a total of 25 classes and 568 students. In the control group, 18 teachers from 14 schools took part with 23 classes and 539 students. In three schools, teachers from both conditions participated, in the remaining schools only one condition was represented; therefore, the total number of schools was 23. The participating students were in Grade 7 (16%) or 8 (84%), were on average 13.50 years old (range 11.83–16.08) at baseline and were 48.3% female. As for ethnic origin, which was operationalized following definitions of Statistics Netherlands, 12.6% had at least one parent who was born in a non-western country (mainly Turkey, Morocco, Antilles, Surinam) and 5.7% had at least one parent who was born in a western country other than the Netherlands (Europe, North America, Oceania, Japan and Indonesia). Baseline differences between the two experimental conditions were observed for some background factors and psychosocial determinants (see Supplementary data, S1 for more information, including a table). Background factors and baseline scores were controlled for in all analyses of effects.

### Attrition

In total, 134 students (12.1%) dropped out at post-test (Exp  $n = 67$ , 11.8% vs. Con  $n = 67$ , 12.4%, ns) and 365 (33.0%) dropped out at follow-up (Exp  $n = 182$ , 32.0% vs. Con  $n = 183$ ,

34.0%, ns). See Supplementary data, S1 for more information about dropout and any baseline differences between dropout groups.

### Intervention

The experimental curriculum ‘Multiple Choice 4 U’ was designed as a 10-session classroom curriculum and consisted of a student book, a video and a teacher manual. It focused sequentially on the domains of smoking and safe sex and, throughout the curriculum, included assignments to stimulate transfer to other health behavior domains. The curriculum focused mainly on three psychosocial behavioral determinants: outcome expectancies (short-term physical, social and other consequences and health risks), social influences (prevalence estimates, social norms and peer pressure) and self-efficacy (risky situations, refusal and negotiation skills, and condom use skills). These are central to the theory of planned behavior (Ajzen, 1991), social-cognitive theory (Bandura, 1986) and the theory of triadic influence (Flay and Petraitis, 1994), and have shown to be relevant for the domains of tobacco and safe sex as well as alcohol and nutrition (Wiefferink *et al.*, 2006; Peters *et al.*, 2009b). In addition, the concept of anticipated regret was addressed (Richard *et al.*, 1995; Sandberg and Conner, 2008). The domain-specific portions of the curriculum were partly adapted from existing Dutch theory- and evidence-based curricula on smoking (Cuijpers *et al.*, 2002; Crone *et al.*, 2005) and safe sex (Schaalma *et al.*, 1996; Van Fulpen *et al.*, 2002).

The transfer-oriented approach was based on theory and research in the field of education and psychology [see for an overview (Bransford *et al.*, 2000), pp. 51–78] and was operationalized by (i) stimulating reflection on the learning content and its personal relevance, (ii) addressing personal beliefs and giving students opportunities to make their own choices in curriculum assignments in order to enhance personal meaningfulness of learning), (iii) addressing general (decontextualized) cognitive and behavioral principles pertaining to decision-making, problem-solving, refusal and negotiation skills and (iv) prompting students to apply these general principles to other behaviors in so-called ‘excursion assignments’ (recontextualization). The theme of ‘making choices’ was chosen as the central theme that connected all general principles. It was partitioned into three subthemes, which correspond to the main determinants in

the theory of planned behavior: making your own choices (attitude), other people’s choices (social influences) and implementing your choices (self-efficacy). Table 1 gives an overview of the conceptual design of the intervention.

The lessons were interactive, were mostly conducted in pairs or small groups and used a variety of instructional strategies, including: small and large group discussion, creative assignments (creating a poster, writing a film script or cartoon, giving advice to fictional characters in a letter or rap song), elicitation and modeling of refusal skills on video, condom demonstration and practice, interviewing smokers and non-smokers, self-tests and searching information on the Internet.

Teachers in the experimental group attended a minimal (3-h) instruction session, in which the study design, the conditions for transfer and the importance of adherence to critical learning activities were explained and discussed. Teachers in both groups were instructed to give no lessons about alcohol or nutrition between baseline and post-test. If students spontaneously mentioned alcohol or nutrition examples as a result of ‘excursion assignments’, experimental teachers were allowed to discuss these examples briefly—similar as for other examples—since this can be regarded as a spontaneous result of the transfer approach. Teacher log sheets indicated some degree of alcohol and nutrition examples: on a sum scale from 0 = no examples to 26 = many examples, mean scores were 8.61 (SD 5.14) for alcohol and 7.22 (SD 5.06) for nutrition.

### Implementation

On average, experimental teachers taught the experimental curriculum in 13.73 (SD 4.84) sessions of 50 min. The control teachers taught an average of 2.18 (SD 2.42) sessions on smoking and 5.65 (SD 4.73) sessions on sexuality or reproduction, of which 1.65 (SD 1.27) specifically on safe sex. More than half of the control group teachers used one particular Biology/Care textbook for their lessons.

Despite clear instructions not to teach any lessons about alcohol or nutrition, some teachers in both groups had taught about these domains between baseline and post-test or between baseline and follow-up. Alcohol instruction had been given to 26% of experimental students and 40% of control students at post-test (mean number of sessions 0.84 vs. 0.55,  $p < 0.001$ ), and to 37% of

**Table 1:** Conceptual design of the transfer-oriented curriculum

Theory	Construct	Smoking and safe sex	Operationalization of transfer-oriented conditions
Theory of planned behavior, social-cognitive theory, theory of triadic influence	Attitudinal beliefs, outcome expectancies, anticipated regret	<p><i>Smoking:</i> answering questions about smoking by searching the internet (correct knowledge about health consequences); interviewing an adult smoker, non-smoker and quitter about their reasons; discussing reasons for smoking presented in vignette (including image-related reasons which also pertain to social influences); creating own advice for the vignette person or the smoker who was interviewed.</p> <p><i>Safe sex:</i> answering questions about safe sex by searching the internet (correct knowledge about health consequences); examining and discussing personal opinions about delaying sex, using condoms and getting tested in response to vignettes; creating own advice for vignette persons</p>	<p><i>Decontextualization:</i> the following general principles were explicitly addressed in the textbook, highlighted by a background color</p> <p><i>Making your own choices (~attitude)</i></p> <p>Behavior can have positive and negative consequences, e.g. for your health. It is wise to correctly know all short- and long-term consequences and think them over; it can help you prevent future regret. Distinguish opinion from fact. People make excuses for behaviors they know are unwise. Decision-making action plan: define the problem or situation; think out possible solutions/ actions; consider the pros and cons of each solution; make sure your information is correct and distinguish opinion from fact; think about possible regret; choose the solution that offers you the most pros and the least cons and regret</p> <p><i>Recontextualization:</i> ‘excursion’ assignments: (i) name two behaviors you do which have positive consequences for your health and two behaviors with negative consequences. (ii) Choose one behavior with negative health consequences and write down which pros and cons it has for you, and what consequence you might regret in the future. (iii) Classroom application of the decision-making action plan to a vignette, followed by a discussion of the usefulness of the action plan. (iv) Create a poster about behaviors with health consequences, show what is healthy or unhealthy about it, show why people do or do not do it (pros and cons, barriers), show how many people do or do not do it</p> <p><i>Personal meaningfulness:</i> students were given the opportunity to make their own choices in assignments (e.g. by choosing the behavior in excursion assignments). Many assignments asked about students’ personal beliefs, opinions and examples from their own lives. Also, many assignments set out to confront students with real-life dilemma situations, to which they were asked to come up with their own solutions. Discussion and collaboration between students were stimulated as they can lead to co-creation of shared meanings</p> <p><i>Reflection:</i> the excursion assignments can be regarded as reflective assignments. Also, many assignments asked students to first give their personal beliefs or to think of solutions to a posited problem, and then to discuss their beliefs or solutions with other students. Moreover, each chapter in the student book concluded with some logbook questions, in which students could indicate what they thought of the learning content in terms of usefulness for their life, and any unanswered questions they might have</p>

Theory of planned behavior, social-cognitive theory, theory of triadic influence	Social influences, norms, perceptions	<p><i>Smoking</i>: examining and correcting students' prevalence estimates and discussing reasons for over- or underestimation; mapping and discussing students' personal norms and image-related beliefs about teen smoking; examining and discussing (the firmness of) perceived parental norms about smoking; mapping and discussing the school rules about smoking and creating and lobbying for own rule.</p> <p><i>Safe sex</i>: examining and correcting students' prevalence estimates of intercourse and condom use and discussing reasons for over- or underestimation; discussion about gendered beliefs and gender roles in relationships and sexuality; sharing and discussing personal opinions about romance, having sex, using condoms and getting tested</p>	<p><i>Decontextualization</i>: the following general principles were explicitly addressed in the textbook, highlighted by a background color</p> <p><i>Other people's choices (~social influences)</i> People can have different norms and values and can value consequences differently and act differently. All opinions, also yours, are justified as long as they are based on correct knowledge and valid arguments. Most people wish to conform to what they think is normal and accepted by others. But this perception may be wrong. If you want to know what other people think or do: ask instead of assume. Other people may try to influence your choices, e.g. support or obstruct you. Think for yourself and determine how much you care about the opinion of others. It takes some confidence to express your opinion</p> <p><i>Recontextualization</i>: (i) in the poster about behaviors with health consequences (see above Recontextualization) students also reported how many people perform the behaviors. (ii) Class discussion about reasons for group belonging, group behavior and peer pressure, including students' personal examples</p> <p><i>Personal meaningfulness</i>: see above</p> <p><i>Reflection</i>: see above</p>
Theory of planned behavior, social-cognitive theory, theory of triadic influence	Self-efficacy beliefs	<p><i>Smoking (refusal skills)</i>: video portraying peer pressure situation, discussion of students' ideas for responding to peer pressure, video portrayal of preferred responses (say no, counterarguments, walk away), discussion</p> <p><i>Safe sex (condom purchase tips, condom use skills, refusal and negotiation skills)</i>: Barriers and tips for purchasing condoms and discussing condom use were presented as quotes from adolescents. Condom use instruction in textbook and class demonstration by student. Video portraying two peer pressure situations (yes–no go further than kissing/fondling, yes–no use condom), discussion of students' ideas for responding to partner, video portrayal of preferred responses, discussion</p>	<p><i>Decontextualization</i>: the following general principles were explicitly addressed in the textbook, highlighted by a background color</p> <p><i>Implementing your choices (~self-efficacy)</i> Attaining a certain goal may require knowledge, skill and courage. Practice helps you gain experience, don't give up on your first attempt. Chunk your goal into little steps, anticipate possible difficulties and try to find solutions. If you anticipate or experience peer pressure, think about what you can do or say (e.g. avoid situations, say no, use counterarguments, walk away)</p> <p><i>Recontextualization</i>: (i) discuss personal examples of peer pressure. (ii) After the video about smoking: describe two situations (not involving smoking) in which you would like to say no. How would you do that, and why so? (iii) After the video about safe sex: describe two situations (not involving sex or smoking) in which being able to say no may be important. How would you do that, and why so? (iv) Role play a peer pressure situation about another behavior than sex or smoking</p> <p><i>Personal meaningfulness</i>: see above</p> <p><i>Reflection</i>: see above</p>
	All constructs together, and intention		<p>At the end of the curriculum:</p> <p><i>Decontextualization</i>: self-test with feedback about general principles for good decision-making and problem-solving</p> <p><i>Recontextualization</i>: (1) Create a cartoon or film scenario about a healthful or unhealthful behavior (not involving smoking or sex) in which you show your mastery of at least one general principle. (2) Write down three behaviors you intend to pursue in the upcoming time and how you plan to stick to your intentions</p> <p><i>Personal meaningfulness</i>: see above</p> <p><i>Reflection</i>: see above</p>

experimental and 60% of control students at follow-up (mean 0.89 vs. 1.36,  $p < 0.001$ ). For nutrition instruction, the percentages were 19% experimental vs. 40% control at post-test (mean 1.55 vs. 1.04,  $p < 0.01$ ) and 74% experimental vs. 65% control at follow-up (mean 6.43 vs. 2.44,  $p < 0.001$ ).

## Data collection

### Students

Teachers administered self-report student surveys during regular class periods. To limit potential bias due to administration by teachers, the student instruction explained the confidential nature of the answers. After completion, students put their survey in a blank envelope and sealed it. Teachers were instructed to put the sealed envelopes in a larger envelope and seal it before the eyes of their students. The student survey was practically identical at each measurement point. Most items were based on existing Dutch questionnaires about smoking (Crone *et al.*, 2003, 2005), safe sex (Schaalma *et al.*, 1996; Yzer *et al.*, 2000; Van Fulpen *et al.*, 2002; [www.monitorgezondheid.nl](http://www.monitorgezondheid.nl)), alcohol (Cuijpers *et al.*, 2002; De Graaff and Poort, 2004; Van Dorsselaer *et al.*, 2007) and fruit and breakfast consumption (Martens *et al.*, 2005; [www.monitorgezondheid.nl](http://www.monitorgezondheid.nl)). The survey assessed demographics, students' involvement with the behavior for each behavioral domain (tobacco, safe sex, alcohol, fruit and breakfast) and psychosocial determinants of these behaviors. The psychosocial constructs pertained to knowledge (only measured for smoking and safe sex), attitude, outcome expectancies, risk expectancy, anticipated regret, self-efficacy, normative beliefs from parents and friends, and intention. Also a composite measure of determinants was constructed for each domain (see the section Data analysis). Supplementary data, S2 displays information about the measures used. Because of their skewed distribution, some of the behavioral variables were recoded into binary measures (see Supplementary data, S2). Constructs that were measured only once were: ethnic background (baseline), Rosenberg's (Rosenberg, 1965) self-esteem scale (baseline; 10 items, Cronbach's  $\alpha = 0.85$ ), a self-developed scale of attitude towards school (baseline; 16 items; Cronbach's  $\alpha = 0.84$ ) and evaluation statements about lessons on tobacco and safe

sex (post-test) and alcohol and nutrition (follow-up).

### Teachers

Teachers were asked to record the timing of the student surveys, the number of lessons on each of the domains and the additional educational materials used for these lessons. Experimental teachers were also asked to complete log sheets and evaluate the intervention.

## Data analysis

Psychometric properties of scales were examined, and scale means were computed for students who had answered at least 30% of scale items, to include as many students with single missing values as possible (scales had a maximum of 3.2% missing values, which was decreased by 1% at most). All continuous measures were tested for normality distribution and, if necessary, were log-transformed.

Because of the large number of psychosocial determinants per domain, and the concurrent risk of capitalizing on chance, a composite measure of determinants was calculated for each domain by averaging the standardized scores on psychosocial determinants. This measure included all determinants, except the knowledge measure in the domains of smoking and safe sex, and had satisfactory internal consistency in all domains (all Cronbach's  $\alpha$ 's  $> 0.70$ ). Analyses of the composite measures were used as a proxy for multivariate testing of effects on psychosocial determinants: effects on individual determinants were considered only if there was a statistically significant effect on the composite measure of determinants.

We used multilevel generalized linear models with a random intercept to estimate the treatment group effects. For continuous outcome measures, multilevel linear regression analyses with two levels (students nested within teachers) were used. Effect sizes (Cohen's  $d$ ) for these outcome measures were calculated using  $t$  test values and degrees of freedom. Binary outcome measures were analyzed with multilevel logistic regression analyses. All analyses of effects were performed on single outcome variables from post-test and follow-up and controlled for baseline score, background factors (gender, ethnicity, grade and school level), self esteem and attitude to school. Self esteem and attitude to school were controlled to reduce the error variance as these variables

were related to most of the outcome variables. In analyses of psychosocial determinants, the baseline score on the relevant measure of behavior was also controlled for, because experience with the behavior may influence the determinants [e.g. (Schaalma *et al.*, 1993)].

Analyses in the domains of alcohol, fruit and breakfast consumption also controlled for instruction time on alcohol and nutrition, respectively, because in both conditions some teachers had paid attention to alcohol or nutrition between baseline and post-test or between baseline and follow-up (see the section Implementation). Controlling for instruction time on alcohol and nutrition warranted the interpretation of intervention effects in these domains as transfer effects. Moreover, additional analyses were performed including an extra predictor in the model: the interaction term between instruction time (yes or no) and group (experimental vs. control). This was done to inspect whether the strength of the program effect depended on instruction time. Unfortunately, controlling for instruction time led to additional but small drop-out, as some teachers failed to provide clear information about this. Student retention rates in the experimental group ranged between 90 and 100%, depending on the specific measurement point (post-test, follow-up) and domain (alcohol, nutrition), and those in the control group ranged between 76 and 89%.

All analyses were performed with SPSS version 17.0, except multilevel analyses of effects on binary outcome measures, which were analyzed with MLwiN (Multilevel Models Project, 1998).

## RESULTS

### Effects on domains included in the curriculum: tobacco and safe sex

Table 2 presents the program effects at post-test and follow-up in the tobacco domain. A significant positive program effect on behavior was observed at post-test and follow-up, with experimental students being less likely than control students to be current smokers. At both measurement points, there were significant effects on the composite measure of psychosocial determinants. At the level of individual determinants, significant effects occurred on three factors at post-test (outcome expectancies, anticipated regret and intention) and on four factors at follow-up

(outcome expectancies, knowledge, perceived risk and self-efficacy). In addition, an effect that approached significance was observed for intention at follow-up ( $p = 0.06$ ). The effect sizes (Cohen's  $d$ ) for these factors ranged between 0.08 and 0.35.

Results in the safe sex domain (not shown in table) revealed that fewer experimental students than controls had recent experience with intercourse at post-test (OR = 0.19, CI = 0.05–0.73). There were no other effects on sexual behavior items or on the composite measure of determinants at neither post-test nor follow-up.

### Effects on domains not included in the curriculum: alcohol, fruit and breakfast

Table 3 displays the program effects in the alcohol domain. At post-test, no effect on alcohol behavior was observed. At follow-up, significant effects were found for both measures of behavior: frequency of consumption ( $d = 0.23$ ,  $p < 0.02$ ) and binge drinking (OR = 0.47, CI = 0.23–0.98). At the level of determinants, an effect on the composite measure of determinants was significant at both measurement points. At post-test, significant positive program effects were observed for anticipated regret and self-efficacy. At follow-up, significant effects were found for three psychosocial variables (anticipated regret, social norm and intention). In the fruit and breakfast domains, no effects on behavior were found at post-test or follow-up. There were significant effects on the composite measure of determinants at both measurement points in both domains. In both domains there were favorable program effects on two to three psychosocial predictors at each measurement point (see Tables 4 and 5, respectively), with effect sizes (Cohen's  $d$ ) ranging from 0.06 to 0.19.

#### *Do the program effects on alcohol, fruit and breakfast depend on instruction time?*

Because some teachers had taught about alcohol or nutrition between baseline and post-test or between baseline and follow-up, we inspected whether the interaction term between alcohol or nutrition instruction (yes/no) and group was significant. The interaction term was significant only for two outcomes at post-test (results not shown): the composite measure of determinants within the domains of alcohol and breakfast. Additional subgroup analyses revealed that the

**Table 2:** Program effects in the tobacco domain at post-test and follow-up

Variable <sup>a</sup>	Group	Post-test			Follow-up				
		<i>n</i>	Mean (SD), baseline	Mean (SD), post-test	Effect size <sup>b</sup>	<i>n</i>	Mean (SD), baseline	Mean (SD), follow-up	Effect size <sup>b</sup>
Behavior: % current smoker (OR, CI)	Exp	487	25 (5.1%)	25 (5.1%)	0.30 (0.11–0.83)*	376	20 (5.3%)	31 (8.2%)	0.44 (0.20–0.96)*
	Con	460	19 (4.1%)	35 (7.6%)		347	13 (3.7%)	36 (10.4%)	
Composite of determinants (mean of Z-scores)	Exp	489	0.07 (0.60)	0.10 (0.61)	0.21*	377	0.07 (0.63)	0.10 (0.69)	0.13*
	Con	458	–0.00 (0.59)	–0.08 (0.67)		348	–0.00 (0.59)	–0.05 (0.67)	
Knowledge <sup>t</sup> (0–5)	Exp	465	4.01 (0.99)	4.41 (0.91)	0.19	368	4.04 (0.98)	4.48 (0.85)	0.35*
	Con	455	4.32 (0.83)	4.53 (0.74)		344	4.33 (0.86)	4.39 (1.00)	
Attitude <sup>t</sup> (1–5)	Exp	489	4.70 (0.49)	4.73 (0.55)	0.11	377	4.69 (0.50)	4.62 (0.80)	–0.12
	Con	458	4.66 (0.56)	4.62 (0.66)		347	4.65 (0.57)	4.66 (0.63)	
Outcome expectancies (–1.875 to +2.25)	Exp	489	0.71 (0.62)	0.82 (0.61)	0.21**	377	0.71 (0.65)	0.86 (0.65)	0.21*
	Con	462	0.69 (0.56)	0.69 (0.59)		350	0.70 (0.57)	0.73 (0.61)	
Risk <sup>t</sup> (1–4)	Exp	490	3.51 (0.59)	3.47 (0.59)	0.04	378	3.52 (0.59)	3.45 (0.68)	0.13*
	Con	463	3.48 (0.57)	3.43 (0.61)		349	3.48 (0.60)	3.32 (0.65)	
Regret <sup>t</sup> (1–4)	Exp	488	3.74 (0.59)	3.72 (0.59)	0.12***	377	3.73 (0.59)	3.62 (0.72)	0.07
	Con	460	3.67 (0.63)	3.57 (0.72)		347	3.67 (0.62)	3.51 (0.78)	
Self-efficacy <sup>t</sup> (1–5)	Exp	489	4.15 (0.86)	4.25 (0.78)	0.16	377	4.20 (0.84)	4.24 (0.87)	0.08*
	Con	457	4.14 (0.85)	4.12 (0.88)		346	4.11 (0.84)	4.07 (0.74)	
Social norm <sup>t</sup> (1–5)	Exp	488	4.40 (0.59)	4.32 (0.65)	0.00	377	4.38 (0.58)	4.29 (0.72)	0.00
	Con	457	4.29 (0.59)	4.20 (0.66)		348	4.29 (0.59)	4.19 (0.74)	
Intention <sup>t</sup> (1–5)	Exp	488	4.79 (0.65)	4.75 (0.68)	0.26***	376	4.76 (0.70)	4.60 (0.94)	0.17
	Con	453	4.77 (0.65)	4.55 (0.92)		345	4.80 (0.61)	4.48 (1.02)	

High-end scores on determinants are conducive to preventive behavior.

<sup>a</sup>Variables indicated by superscript t were log-transformed in analyses of effects. The means and SD presented are for original variables.

<sup>b</sup>Effect sizes are Cohen's *d* for continuous variables and Odds Ratio (OR, CI) for binary variables.

*p*-values are based on multilevel analyses and are indicated by: \* < 0.05, \*\* < 0.01, \*\*\* < 0.001.

**Table 3:** Program effects in the alcohol domain at post-test and follow-up, corrected for sessions about alcohol

Variable <sup>a</sup>	Group	Post-test			Follow-up				
		<i>n</i>	Mean (SD), baseline	Mean (SD), post-test	Effect size <sup>b</sup>	<i>n</i>	Mean (SD), baseline	Mean (SD), follow-up	Effect size <sup>b</sup>
Behavior: alcohol frequency past 4 weeks <sup>t</sup> (1–7)	Exp	441	1.56 (1.00)	1.68 (1.07)	–0.24	334	1.60 (1.04)	1.79 (1.25)	–0.23*
	Con	366	1.57 (0.94)	1.93 (1.22)		265	1.54 (0.86)	1.98 (1.28)	
Behavior: % binge drinking past 2 weeks (OR, CI)	Exp	443	24 (5.4%)	29 (6.5%)	0.83 (0.37–1.88)	335	17 (5.1%)	28 (8.4%)	0.47* (0.23–0.98)
	Con	365	27 (7.4%)	31 (8.5%)		265	18 (6.8%)	41 (15.5%)	
Composite of determinants (mean of Z-scores)	Exp	442	0.09 (0.73)	0.11 (0.69)	0.14***	338	0.07 (0.73)	0.13 (0.76)	0.23*
	Con	365	–0.05 (0.64)	–0.10 (0.63)		265	–0.05 (0.64)	–0.10 (0.67)	
Attitude (1–5)	Exp	442	3.51 (0.98)	3.42 (0.99)	0.06	338	3.49 (0.96)	3.57 (1.10)	0.02
	Con	368	3.41 (0.92)	3.27 (0.87)		266	3.40 (0.92)	3.45 (1.01)	
Outcome expectancies (–3.429 to +1.714)	Exp	442	–0.72 (0.79)	–0.90 (0.81)	0.13	337	–0.74 (0.80)	–0.85 (0.85)	0.14
	Con	367	–0.90 (0.71)	–1.16 (0.75)		265	–0.87 (0.70)	–1.06 (.75)	
Risk (1–4)	Exp	441	2.49 (0.96)	2.31 (0.89)	0.00	337	2.50 (0.99)	2.56 (0.92)	0.02
	Con	365	2.34 (0.88)	2.17 (0.78)		264	2.31 (0.87)	2.36 (0.90)	
Regret <sup>t</sup> (1–4)	Exp	439	2.03 (1.11)	1.85 (1.03)	0.11***	337	1.99 (1.09)	1.99 (1.09)	0.14*
	Con	366	1.86 (1.01)	1.57 (0.87)		265	1.85 (0.98)	1.71 (0.95)	
Self-efficacy (1–5)	Exp	442	3.81 (0.95)	3.76 (0.95)	0.11*	338	3.82 (0.95)	3.89 (1.00)	0.16
	Con	364	3.70 (0.95)	3.54 (1.02)		266	3.71 (0.93)	3.63 (1.02)	
Social norm (1–5)	Exp	441	3.47 (0.75)	3.34 (0.72)	0.05	338	3.43 (0.74)	3.43 (0.78)	0.14*
	Con	364	3.36 (0.63)	3.20 (0.62)		266	3.35 (0.63)	3.25 (0.69)	
Intention <sup>t</sup> (1–5)	Exp	441	4.12 (1.10)	3.93 (1.20)	0.04	337	4.09 (1.12)	3.88 (1.30)	0.23**
	Con	363	4.05 (1.11)	3.82 (1.20)		265	4.11 (1.06)	3.63 (1.29)	

High-end scores on determinants are conducive to preventive behavior. Frequency of alcohol consumption: 1 = 0 times, 7 = 10 times or more.

<sup>a</sup>Variables indicated by superscript t were log-transformed in analyses of effects. The means and SD presented are for original variables.

<sup>b</sup>Effect sizes are Cohen's *d* for continuous variables and odds ratio (OR, CI) for binary variables.

*p*-values are based on multilevel analyses and are indicated by: \* < 0.05, \*\* < 0.01, \*\*\* < 0.001.

**Table 4:** Program effects in the fruit domain at post-test and follow-up, corrected for sessions about nutrition

Variable <sup>a</sup>	Group	Post-test			Follow-up				
		<i>n</i>	Mean (SD), baseline	Mean (SD), post-test	Effect size <sup>b</sup>	<i>n</i>	Mean (SD), baseline	Mean (SD), follow-up	Effect size <sup>b</sup>
Behavior: number of portions per week <sup>t</sup> (0–21)	Exp	480	5.89 (4.76)	6.08 (5.30)	0.00	375	5.80 (4.57)	6.31 (5.33)	–0.00
	Con	398	6.08 (4.67)	6.26 (5.10)		302	5.92 (4.72)	6.44 (5.33)	
Composite of determinants (mean of <i>Z</i> -scores)	Exp	478	–0.01 (0.66)	0.02 (0.69)	0.11**	375	0.00 (0.65)	0.05 (0.68)	0.16**
	Con	397	–0.00 (0.61)	–0.02 (0.60)		302	–0.00 (0.62)	–0.04 (0.64)	
Attitude <sup>t</sup> (1–5)	Exp	480	4.01 (0.74)	3.94 (0.79)	0.03	375	4.06 (0.74)	4.01 (0.84)	0.12*
	Con	400	4.08 (0.68)	3.98 (0.73)		302	4.08 (0.70)	3.94 (0.82)	
Outcome expectancies (1–5)	Exp	481	3.29 (0.71)	3.35 (0.78)	0.18*	372	3.32 (0.72)	3.35 (0.86)	0.07
	Con	398	3.37 (0.70)	3.29 (0.72)		302	3.37 (0.68)	3.35 (0.78)	
Risk (1–4)	Exp	474	2.12 (0.89)	2.12 (0.90)	0.06	372	2.14 (0.88)	2.14 (0.92)	–0.03
	Con	393	2.08 (0.83)	2.02 (0.85)		302	2.11 (0.85)	2.14 (0.86)	
Regret <sup>t</sup> (1–4)	Exp	478	1.34 (0.69)	1.42 (0.77)	0.07*	372	1.34 (0.69)	1.47 (0.84)	0.09
	Con	395	1.27 (0.60)	1.30 (0.66)		300	1.27 (0.62)	1.33 (0.70)	
Self-efficacy <sup>t</sup> (1–5)	Exp	474	4.21 (1.09)	4.23 (1.02)	0.11	374	4.20 (1.10)	4.32 (1.01)	0.19***
	Con	396	4.36 (0.94)	4.25 (0.99)		300	4.31 (0.99)	4.22 (0.99)	
Social norm parents <sup>t</sup> (1–5)	Exp	478	4.12 (1.01)	4.10 (1.04)	–0.04	375	4.17 (0.97)	4.19 (0.96)	0.09
	Con	398	4.19 (0.94)	4.21 (0.91)		301	4.19 (0.92)	4.12 (1.05)	
Social norm friends (1–5)	Exp	477	3.03 (1.02)	3.12 (1.10)	–0.10	372	3.09 (1.01)	3.44 (1.10)	0.03
	Con	399	2.98 (1.08)	3.19 (1.02)		302	2.97 (1.08)	3.28 (1.05)	
Intention (1–5)	Exp	480	3.75 (1.16)	3.78 (1.18)	0.00	376	3.76 (1.17)	3.79 (1.23)	0.07
	Con	399	3.74 (1.16)	3.76 (1.18)		302	3.73 (1.14)	3.68 (1.22)	

High-end scores on determinants are conducive to preventive behavior.

<sup>a</sup>Variables indicated by superscript t were log-transformed in analyses of effects. The means and SD presented are for original variables.

<sup>b</sup>Effect sizes are Cohen's *d*.

*p*-values are based on multilevel analyses and are indicated by: \* < 0.05, \*\* < 0.01, \*\*\* < 0.001.

**Table 5:** Program effects in the breakfast domain at post-test and follow-up, corrected for sessions about nutrition

Variable <sup>a</sup>	Group	Post-test			Follow-up				
		<i>n</i>	Mean (SD), baseline	Mean (SD), post-test	Effect size <sup>b</sup>	<i>n</i>	Mean (SD), baseline	Mean (SD), follow-up	Effect size <sup>b</sup>
Behavior: number of days per week (0–7)	Exp	475	6.29 (1.71)	6.13 (1.90)	–0.03	371	6.24 (1.78)	6.14 (1.93)	0.05
	Con	397	6.36 (1.63)	6.24 (1.73)		298	6.35 (1.65)	6.16 (1.87)	
Composite of determinants (mean of <i>Z</i> -scores)	Exp	478	0.04 (0.68)	0.06 (0.68)	0.09*	383	0.04 (0.70)	0.07 (0.68)	0.10*
	Con	397	0.00 (0.63)	–0.02 (0.62)		302	0.00 (0.62)	–0.03 (0.65)	
Attitude <sup>t</sup> (1–5)	Exp	479	4.22 (0.69)	4.18 (0.76)	0.09*	373	4.23 (0.70)	4.18 (0.82)	0.18**
	Con	400	4.26 (0.71)	4.16 (0.79)		302	4.32 (0.66)	4.12 (0.87)	
Outcome expectancies <sup>t</sup> (1–5)	Exp	480	4.16 (0.71)	4.06 (0.74)	–0.03	371	4.18 (0.69)	4.08 (0.80)	0.06*
	Con	398	4.14 (0.67)	4.06 (0.72)		302	4.16 (0.64)	4.01 (0.74)	
Risk (1–4)	Exp	476	2.38 (0.96)	2.41 (0.93)	0.17*	372	2.37 (0.95)	2.35 (0.99)	0.04
	Con	394	2.39 (0.91)	2.24 (0.94)		302	2.35 (0.91)	2.29 (0.90)	
Regret (1–4)	Exp	477	1.95 (1.03)	1.96 (1.03)	0.04	370	1.95 (1.02)	1.90 (1.05)	–0.02
	Con	395	1.91 (0.98)	1.88 (0.96)		301	1.91 (0.96)	1.89 (0.97)	
Self-efficacy <sup>t</sup> (1–5)	Exp	472	4.41 (0.83)	4.40 (0.85)	0.08*	372	4.36 (0.84)	4.43 (0.87)	0.14***
	Con	395	4.39 (0.81)	4.31 (0.84)		300	4.38 (0.82)	4.31 (0.88)	
Social norm parents <sup>t</sup> (1–5)	Exp	480	4.69 (0.66)	4.62 (0.70)	–0.04	374	4.72 (0.61)	4.55 (0.88)	0.03
	Con	399	4.70 (0.61)	4.66 (0.68)		302	4.70 (0.61)	4.50 (0.94)	
Social norm friends (1–5)	Exp	478	3.76 (1.02)	3.81 (1.02)	–0.05	374	3.74 (1.02)	3.82 (1.07)	0.03
	Con	399	3.62 (1.05)	3.72 (1.07)		302	3.64 (1.04)	3.68 (1.03)	
Intention <sup>t</sup> (1–5)	Exp	480	4.17 (0.82)	4.14 (0.87)	–0.01	375	4.19 (0.83)	4.12 (0.97)	–0.08
	Con	399	4.10 (0.85)	4.09 (0.86)		302	4.07 (0.83)	4.08 (0.92)	

High-end scores on determinants are conducive to preventive behavior.

<sup>a</sup>Variables indicated by superscript t were log-transformed in analyses of effects. The means and SD presented are for original variables.

<sup>b</sup>Effect sizes are Cohen's *d*.

*p*-values are based on multilevel analyses and are indicated by: \* < 0.05, \*\* < 0.01, \*\*\* < 0.001.

program effect was higher in the subgroup without alcohol or nutrition instruction than in the group with instruction (composite measure alcohol  $d = 0.22$  vs.  $0.02$ ; composite measure breakfast  $d = 0.16$  vs.  $-0.14$ ). For all outcomes the interaction term was not significant at follow-up. These results indicate that the program effects in the alcohol, fruit and breakfast domains cannot be attributed to instruction about these domains. In fact, for two outcomes the program effects were found only for students who were not taught about these domains.

## DISCUSSION

This study was designed to test the effectiveness of a transfer-oriented curriculum in promoting positive changes—and preventing negative changes—not only in the domains of smoking and safe sex that were taught, but also in domains that were not explicitly taught: alcohol, fruit and breakfast. Three research questions were examined. The first research question—whether effects on the taught domains of smoking and safe sex occurred—can be answered in a positive way to a large extent. In the tobacco domain, there were significant program effects on several behavioral determinants and on behavior. The magnitude of behavioral effects is comparable to that found in meta-analyses and reviews of smoking prevention programs [see (Peters et al., 2009a)]. In the safe sex domain, however, there was only one significant program effect, namely on recent experience with sexual intercourse at post-test. Possibly, our safe sex component was not stronger than the lessons in the control group, despite its larger number of sessions and its basis in an effective safe sex program (Schaalma et al., 1996; Van Fulpen et al., 2002). Another possible explanation for the relative absence of effects on safe sex and for the difference in effects between the smoking and safe sex domains may lie in the quality of implementation. As found in other studies, teachers may have been reluctant to teach skill-oriented learning activities in the safe sex domain (Paulussen, 1994), but teacher log sheets did not indicate so. Teacher log sheets, however, did indicate a somewhat lower degree of implementation of assignments about safe sex compared with tobacco because of time constraints. This was because most teachers needed more than 10 sessions to teach the experimental curriculum

and time constraints became more urgent during the second half of the curriculum, which was about safe sex. Another explanation may be that the teachers may not have been sufficiently equipped to teach about sexuality/STD. Although various sources point to the need for adequate teacher training in sexuality/STD education (Schaalma et al., 1996; Peters et al., 2009a), our teacher training only focused on transfer, not on sexuality.

The second research question—whether transfer effects occurred on the untaught domains of alcohol and nutrition—can also be answered positively. We found favorable program effects on several psychosocial factors in the domains of alcohol, fruit and breakfast. In the alcohol domain we even found significant behavioral effects at follow-up, with effect sizes exceeding those reported in a meta-analysis of alcohol and substance abuse prevention programs ( $d = 0.08$ – $0.11$  in Tobler et al., 2000). The analyses showed that these transfer effects could not be attributed to spending instruction time on alcohol or nutrition. In fact, for two outcomes, transfer effects were only found in the group in which the teacher had not paid attention to these domains. The absence of behavioral effects on intake of fruit and breakfast appears to be not uncommon in the nutrition literature, as a recent review reported that only one of four nutrition programs for adolescents had produced an effect on fruit or vegetable intake (Knai et al., 2006).

Judging from the effects on alcohol behavior and the larger effect size for the composite measure of alcohol determinants compared with the nutrition domains, the effects in the alcohol domain are stronger than those in the nutrition domains. The third research question—whether effectiveness differs between the untaught domains—can thus be answered affirmatively. The stronger alcohol effects in this study are in line with our expectation that transfer is more likely to occur to behaviors that are closely associated.

The results in the domains of alcohol and nutrition in this study can be attributed to the transfer-promoting qualities of the experimental program and suggest that the applied transfer approach is promising. The transfer-oriented approach mainly relied on processes of contextualization (learning new knowledge and skills in one domain), decontextualization (generalizing the knowledge and skills) and recontextualization (prompting students to actively look for application of the

knowledge and skills in several other domains), on stimulating students' awareness of their learning process and on paying explicit attention to meaningfulness of the learning content.

### Transfer in relation to other integrative approaches

In addition to our program, various other integrative school programs have successfully impacted on multiple behaviors (Flay, 2002; Greenberg *et al.*, 2003), some with impressive and long-lasting results [e.g. (Hawkins *et al.*, 2008)]. Greenberg *et al.* (Greenberg *et al.*, 2003) captures these programs under the heading of social emotional learning (SEL). SEL programs constitute a broad range of programs, including classroom-based programs that address social-emotional competence (Frey *et al.*, 2000; Botvin and Griffin, 2004), and environment-focused efforts such as coordinated school level organization and planning [e.g. (Cook *et al.*, 2000)], creation of caring communities of learners and enhancement of school and classroom climate (e.g. Battistich *et al.*, 2000) or changing teacher instructional practices, increasing family involvement, teaching parenting practices and teaching social and emotional skills [e.g. (Hawkins *et al.*, 2008)].

Most of these programs focus on combining positive youth development with the prevention of typical problem behaviors such as substance use, precocious intercourse and disruptive or delinquent behavior. The environment-focused program components address distal-level factors that are relevant in the etiology of multiple behaviors, such as bonding to school and family, and parenting practices. These components do not appear to be amenable to a transfer approach at the student level, since they do not require the deliberate and intentional application of knowledge or skills to multiple domains by students. The transfer approach does seem to be relevant for the curriculum-based program components. These components address the distal-level factors of social and emotional competence, usually by teaching a broad array of social-emotional skills (basic social skills, decision-making, problem-solving, anxiety and anger management, goal-setting, conflict resolution, empathy, recognizing and resisting social and media influences), often in a large number of sessions and over several years. Most of these programs also address problem-behavior-specific factors such as

outcome expectancies. A collaborative group that promotes SEL programs advises to apply the social-emotional skills specifically and intentionally to the targeted problem behaviors, as students may not be able to generalize these skills to a range of behavioral domains (Payton *et al.*, 2000). However, transfer theory and the results of this study suggest that generalization to other domains is possible when specific conditions are taken into account. To our knowledge, one other program besides our program has shown to have effects on behavioral domains that were not taught: the Life Skills Training program for substance abuse prevention has had effects on risky driving and HIV risk behavior (Griffin *et al.*, 2004, 2006). The authors of these studies and others (Noar *et al.*, 2008) attribute these effects to the strong program focus on generic self-management and social skills. Although SEL programs might benefit from explicitly using insights into transfer, the positive results of SEL programs on multiple domains may suggest that our program could even be stronger if it would incorporate a broader array of skills (e.g. also basic social skills, goal setting, anger and anxiety management, empathy, conflict resolution).

### Strengths and limitations

Strengths of this study include the theoretical and empirical underpinning from the perspectives of health sciences and education, the relatively large sample size and the attention to implementation, which allowed us to control for important implementation variables in analyses. The study also had some limitations. One limitation is that assignment to conditions was only partly random. The conditions, however, did not appear to differ on the level of teachers and schools, but on the student level baseline differences were observed in demographic factors and some psychosocial factors. These differences led us to control for background factors and baseline scores in analyses of effects. Another limitation may be that teachers, and not schools, were assigned to conditions, thereby creating the risk of contamination. This risk appeared to be limited, as both conditions were represented in only 3 of the 23 schools, involving 3 experimental and 3 control teachers. A third limitation is that teachers administered the student questionnaires, which may have led students to provide desirable responses, although efforts were made to limit such bias. There are no reasons to expect

this bias to differ between the conditions. A fourth limitation is that attrition at follow-up was substantial, which may have affected the results. However, attrition rates did not differ between the conditions. A fifth limitation is that some teachers in both conditions had taught about alcohol and/or nutrition, which could undermine the validity of the claim of transfer effects. Therefore, we controlled for such teaching in the analyses of effects and we conducted additional analyses with interaction terms which showed that the transfer effects could not be attributed to instruction about alcohol or nutrition. Unfortunately, controlling for instruction time in analyses of the alcohol or nutrition domains led to additional drop-out of teachers and students, as some teachers had failed to provide information on instruction time. However, most of the students in the post-test and follow-up samples were retained in these analyses. Moreover, most of the observed effects were also found in analyses that did not control for instruction time. A sixth limitation is the considerably smaller number of sessions about tobacco and safe sex in the control group compared with the experimental group. We cannot exclude the possibility that the effects in the tobacco and sexuality domains in the experimental group may at least partly be attributed to the amount of instruction time rather than to the quality of the instruction. However, high-quality reviews in the substance use and sexuality domains have shown conflicting results with respect to the importance of instruction time [see (Peters *et al.*, 2009a)] and it is likely that a combination of both time and quality is important for obtaining effects. Nevertheless, we recommend repeating the experiment with a control condition that has the same number of lessons as the experimental condition. A seventh limitation is the relatively short duration of the study, which is not optimal for examining behavior change effects. It is all the more promising that we have observed program effects on consumption of tobacco and alcohol.

### Issues for practice and research

Notwithstanding the above-mentioned limitations, this study has convincingly shown that a health promotion curriculum about smoking and safe sex that was designed to stimulate transfer of learning to other domains, not only had effects on the taught domains, but also on untaught domains. This suggests that a transfer approach

may have surplus value over the classic domain-specific approach and deserves further attention in health promotion planning.

The results of this study may challenge program developers, practitioners and researchers to adopt a transfer approach, look beyond the boundaries of their particular behavioral domain of interest, and develop, implement and test more integrative and coordinated programming that connects multiple domains. Such programming may be welcomed by schools, as it may place a lesser burden on instruction time and continuous innovation than the myriad of single-domain programs. This paper has specified critical preconditions and methods for promoting transfer of learning (e.g. examine similarities in determinants across domains, teach generic skills that address these determinants by alternating contextualization, de-contextualization and recontextualization). Also, this paper has indicated which types of general skills may be relevant for program content. The emphasis on general skills in this paper, however, does not mean that domain-specific knowledge and skills are unimportant: programs that seek to impact a particular behavior should ensure that students have correct knowledge about this behavior and its consequences and have the skills necessary for performing the behavior. It may be worthwhile to develop a comprehensive program that can impact a whole range of health-promoting and health-compromising behaviors by adopting a transfer approach and including both domain-transcending skills and domain-specific knowledge and skills.

### SUPPLEMENTARY DATA

Supplementary data are available at *HEAPRO* online.

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