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Searching for similarities: transfer-oriented learning in health education at secondary schools

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Chapter 6

PROMOTING CURRICULUM EFFECTS IN MULTIPLE HEALTH BEHAVIOR DOMAINS: A MEDIATION TEST OF TRANSFER¹

In a recent, quasi-experimental intervention study of transfer-oriented learning (1107 students, grades 7 and 8) we observed transfer effects in three health behavior domains (alcohol, fruit, breakfast consumption) that were not addressed by our experimental transfer-oriented curriculum about smoking and safe sex. Transfer was hypothesized to occur by teaching general cognitive-behavioral skills relevant to multiple domains. In this paper we examined: a) to what extent the intervention had effects on students' learning experiences regarding general cognitive-behavioral skills, b) to what extent these learning experiences mediated the intervention effects in the three untaught domains. Learning experiences were measured by using an open-ended learner report (OLR) and a closed learner report (CLR). The intervention had significant effects on both OLR and CLR measures. Regression analyses ($N=541$) revealed no evidence of mediation for CLR learning experiences. For OLR learning experiences, a mediation effect occurred on some outcome measures in the fruit and breakfast domains, but not in the alcohol domain, although more intervention effects occurred in this domain. The results suggest that the effects in the alcohol versus nutrition domains were brought about by distinct transfer mechanisms and have implications for designing interventions to promote transferable learning results in multiple health behavior domains.

1. INTRODUCTION

Within the school health promotion sector there are increasing calls for integrative approaches that target multiple behavioral domains simultaneously (Flay, 2002; Greenberg et al., 2003; Prochaska, 2008). These calls are mostly instigated by the limited capacity in schools to implement a variety of health promotion programs (Greenberg et al., 2003) and the growing evidence that various health behaviors are associated (Basen-Engquist, Edmundson, & Parcel, 1996; Donovan, Jessor, & Costa, 1991; Prochaska, Spring, & Nigg, 2008; Wiefferink et al., 2006). Also, various health behaviors appear to be grounded in similar psychosocial determinants, such as outcome expectancies, social influences and skills (Flay & Petraitis, 1994; Peters, Wiefferink, et al., 2009; Wiefferink et al., 2006). This is in line with the observation that, across behavioral domains, effective programs share a number of characteristics (Nation et al., 2003; Peters, Kok, et al., 2009).

¹ Peters, L. W. H., Paulussen, T. G. W. M., Zijlstra, B. J. H., Kocken, P. L., Buijs, G. J., & Ten Dam, G. T. M. Promoting curriculum effects in multiple health behavior domains: A mediation test of transfer. *Manuscript submitted for publication.*

In response to these observations we recently tested – and found evidence for – the effectiveness of a particular integrative approach based on transfer-oriented learning (Peters et al., 2011). Transfer refers to a process when knowledge and skills learned in one context (e.g., refusal skills with respect to smoking) are applied to another context (e.g., refusing alcohol) (Barnett & Ceci, 2002; Perkins & Salomon, 1996). Our study tested whether an experimental transfer-oriented curriculum that focused on the prevention of smoking and unsafe sex, was able to also produce effects on three other behavioral domains that were not explicitly taught: consumption of alcohol, fruit and breakfast. The analyses showed significant positive effects in the tobacco domain – but hardly in the safe sex domain. In the three untaught domains, positive effects were observed on several psychosocial determinants, as well as a positive effect on behavior in the alcohol domain (Peters et al., 2011). In the present paper we seek to further understand and explain the observed transfer effects in these untaught domains by focusing on the potential mediation effects of students' self-reported learning experiences.

1.1 Transfer-oriented learning

Transfer can be said to be 'near' or 'far', depending on the degree of apparent similarity between contexts. The notions of near and far, however, are intuitive and do not have strictly defined boundaries (Perkins & Salomon, 1996; Barnett & Ceci, 2002). These two types of transfer are hypothesized to involve two distinct mechanisms of transfer. Transfer to rather similar contexts (near transfer) often involves triggering of semi-automatic responses which have been extensively practiced, the so-called low road transfer. Transfer between contexts that seem remote and alien to another (far transfer), often requires mindful abstraction from the context and a deliberate search for connections. This so-called high road transfer involves applying a general principle to a very different context.

Research has shown that transfer, especially far transfer, very often does not happen by itself (Perkins & Salomon, 1996). However, research has also shown that transfer is more likely to occur under certain conditions (Tuomi-Gröhn & Engeström, 2003), which have implications for the design of teaching-learning processes that aim to promote transfer (Campion, Shapiro, & Brown, 1995; Elshout-Mohr, Van Hout-Wolters, & Broekkamp, 1999): alternating explicit abstraction (learning general skills) with application in various contexts (Wang, Haertel, & Walburg, 1993); meta-cognitive reflection on one's thinking processes (Volman & Ten Dam, 2000); learning content that is personally meaningful to students (Boersma, Ten Dam, Volman, & Wardekker, 2010; Saljö, 2003); and self-confidence in one's ability to bridge different settings and apply knowledge and skills in new situations (cf. Beach, 1999).

We incorporated these transfer-promoting conditions into our experimental curriculum on smoking and safe sex. One particular aspect was that – in addition to domain-specific learning content about smoking and safe sex – the curriculum explicitly addressed general cognitive and behavioral skills. The general skills pertained to decision-making, problem-solving, and refusal and negotiation skills.

We hypothesize that the observed transfer effects in the domains of alcohol, fruit and breakfast consumption in our study (see Peters et al., 2011) were the result of high-road transfer to these domains, in that experimental students, compared to con-

control students, learned general cognitive-behavioral skills and perceived them as important or useful. This hypothesis is examined in this paper by focusing on the extent to which students, in their response to learner report questions (“What have you learned in the lessons?”) (Antonenko, 2010; Janssen & Rijlaarsdam, 1990; Marum, 1996), reported learning general, non-domain-specific skills. These learning experiences were measured in two ways: by means of an open-ended (OLR) and a closed learner report (CLR).

The research questions were:

- 1) Do experimental students report more learning experiences with respect to general cognitive-behavioral skills than control students?
- 2) Do these learning experiences (measured at post-test) mediate intervention effects in three untaught domains (measured at follow-up)?

2. METHOD

For this paper, data from an intervention study were used, which is described more in detail elsewhere (Peters et al., 2011). The study was conducted according to the declaration of Helsinki and passed the internal TNO Ethical Review Board.

2.1 *Study design*

The intervention study featured a quasi-experimental design, with 15 teachers assigned to the experimental condition (Exp) and 18 teachers assigned to a usual care control condition (Con). Teachers in the experimental group taught the transfer-oriented curriculum about smoking and safe sex, control group teachers taught their regular, non-transfer-oriented lessons about smoking and safe sex. Student data were collected in three waves of self-report questionnaires (baseline between September and December 2006, 1-month post-test, 4-month follow-up) to examine intervention effects on outcomes in the taught domains (smoking, safe sex) and in three untaught ‘transfer’ domains (alcohol, fruit, and breakfast consumption). The selection of these domains was primarily based on evidence for differential clustering of behaviors and concurrent expectations of transfer effects (Wiefferink et al., 2006). Smoking and precocious sex correlate fairly strongly with alcohol use, and correlate much less with nutrition behaviors (fruit and breakfast). Given these associations, we expected more and larger transfer effects to the relatively ‘near’ domain of alcohol than to the ‘far’ nutrition domains. This expectation was confirmed in our effect study (Peters et al., 2011).

2.2 *Intervention*

The experimental curriculum ‘Multiple Choice 4 U’ was designed as a 10-session curriculum. 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 proximal behavioral determinants which are featured in various theories: attitudes, social influences and self-efficacy (Ajzen, 1991; Bandura, 1986; Flay & Petraitis, 1994). The domain-specific content of the

curriculum was partly adapted from existing Dutch interventions on smoking and safe sex. In line with the transfer-promoting conditions described earlier, the transfer-oriented learning activities provided students opportunities for: a) reflection on the learning content and its personal relevance, b) exploring personal beliefs and making their own choices in assignments in order to strengthen personal meaning in learning, c) addressing general (decontextualized) cognitive-behavioral skills pertaining to processes of decision-making, problem-solving, refusal and negotiation, and d) applying these general skills to other self-chosen behavioral domains in so-called ‘excursion assignments’ (recontextualization).

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.

2.3 *Data collection*

Students. Teachers administered the self-report student surveys during regular class periods. To ensure validity, the student instruction explained the confidential processing of data. The student survey was practically identical at each measurement point and included items about the five behavioral domains of interest (smoking, safe sex, alcohol, fruit, and breakfast). Table 1 displays information about all outcome measures reported in this paper. Most items were based on existing Dutch questionnaires about alcohol (Cuijpers, Jonkers, De Weerd, & De Jong, 2002; De Graaff & Poort, 2004; Van Dorsselaer, Zeijl, Van den Eeckhout, Ter Bogt, & Vollebergh, 2007), and fruit and breakfast consumption (Martens, Van Assema, & Brug, 2005; www.monitoregezondheid.nl). Constructs that were only measured at baseline were ethnic background, Rosenberg’s (Rosenberg, 1965) Self-Esteem scale, and a self-developed scale of attitude towards school.

In addition, the post-test survey also included an open learner report and a closed learner report for assessing students’ learning experiences. The closed learner report asked students to choose (to a maximum of four) the most important things they had learned in the lessons from ten pre-determined statements: five statements pertained to a general skill (see Table 1 for item wordings), two were tobacco-specific and three were safe-sex-specific. Scores for each category (general skill, tobacco, safe sex) were summed. The measure analyzed for this paper is the total score for general skills (range 0-4). Prior to the closed learner report, the open learner report asked students the same question in an open-ended format, again to a maximum of four. Each entry was coded into one or more of four categories (general skill, tobacco, safe sex, other). If an entry mentioned a combination of a general skill with one or more behavior-specific examples, it was coded for all relevant categories. General skills were only coded as such if they were framed in a general way (e.g., “say no”) or were combined with a behavior-specific example (e.g., “say no, for instance to cigarettes”), not if they were totally framed in a behavior-specific way (e.g., “say no to cigarettes”). Scores were summed for each category (range of 0-4), except the ‘other’ category. The first author coded all entries and discussed all doubtful entries with the last author, after entries of 200 students had been coded independently by the first author and a master’s level researcher, with satisfactory inter rater reliability

(kappa for the general skills variable=.87, $p<.001$). For this paper, only the score for the general skill category was used; this variable was later dichotomized due to an uneven distribution of scores across experimental conditions.

We expect the evidence for intervention effects and mediation to be stronger for OLR learning experiences compared to CLR learning experiences, since the OLR format is likely to require more metacognitive reflection from students on personal lessons learned than the CLR format. In the CLR format, students can just tick a box. For both the OLR and CLR, students without any entry were coded as missing.

Teachers. Teachers were asked to record the number of any lessons taught about alcohol and nutrition between measurement waves. Instruction time for alcohol (0=0 lessons, 1=1-2.5 lessons, 2=3 or more lessons) or nutrition (0=no, 1=yes) between baseline and follow-up was used as a covariate in mediation analyses for the alcohol or nutrition domains.

2.4 Participants

At baseline, participating students (568 Exp, 539 Con) were in grade 7 (16%) or 8 (84%) of secondary schools which prepare for higher vocational education or university. They were on average 13.50 years old, 48.3% were female, and 12.6% had at least one parent who was born in a non-western country.

Dropout at post-test ($n=134$, 12.1%) and follow-up ($n=365$, 33.0%) did not differ between conditions. Additional loss of data from mediation analyses occurred because of missing values for the learner reports and missing information about instruction time for alcohol and nutrition (see also Data analysis and the flow diagram in Figure 1). This additional dropout from mediation analyses led to differential total dropout rates for the experimental and control group (Exp $n=240$, 42.3% vs. Con $n=314$, 58.3%, $\chi^2=28.33$, $p<.001$). For the sample used in mediation analyses, some baseline differences were observed between the two conditions and between participants who were retained versus dropped out. These differences pertained mainly to demographic factors and to some domain-specific variables (see Supplemental Table at the end of this chapter). For these reasons, demographic factors and baseline scores were controlled for in mediation analyses.

2.5 Data analysis

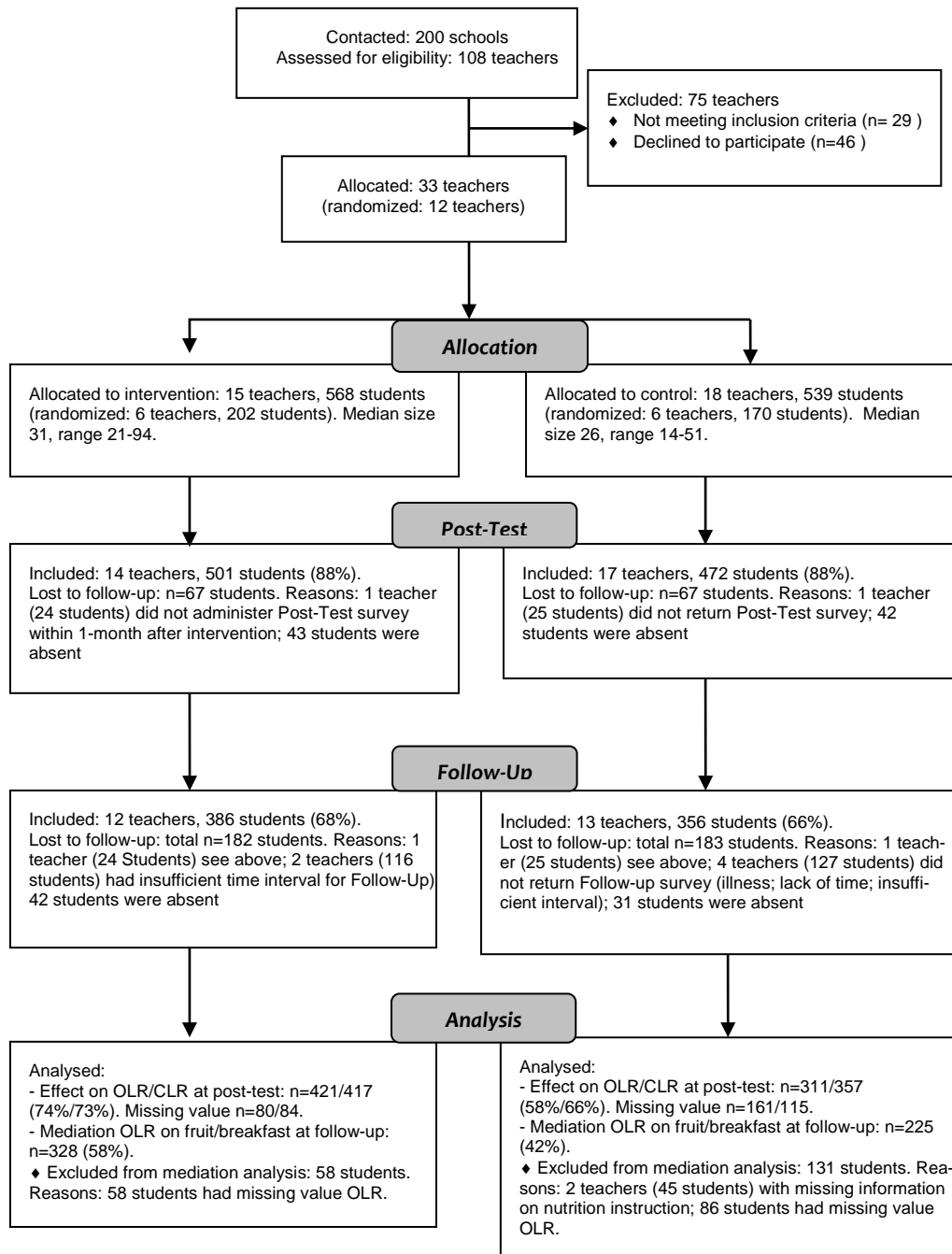
Preliminary analyses. Because of the large number of psychosocial determinants per domain, and the concurrent risk of capitalizing on chance, a composite score of all determinants was calculated for each domain by averaging the standardized scores

Table 1. Information on Measures of Psychosocial Determinants, Behavior, Generic Constructs, and Learning Experiences (n items and Cronbach's alpha)

Psychosocial determinants (measured at all waves)						
Variable. <i>Sample item for alcohol (range)</i>	Alcohol		Fruit		Breakfast	
	n	α	n	α	n	α
General attitude. <i>Drinking alcohol is bad for me (1=certainly not, 5=certainly yes)</i>	3	.94	4	.88	4	.86
Outcome expectancies. <i>If I (would) drink alcohol, I think I (would) feel (-3) much more, (+3) much less at ease with others</i>	7	.87	4	.68	4	.71
Risk expectancy. <i>If I (would) drink alcohol, my chance of getting a disease later will be (1) much larger, (4) equal to if I don't drink alcohol</i>	1	-	1	-	1	-
Anticipated regret. <i>If I (would) drink alcohol, I will have (1) much, (4) no regret later</i>	1	-	1	-	1	-
Self-efficacy. <i>Imagine you've planned to drink no alcohol. Now, you're at a party where people drink a lot of alcohol. Will you be able not to drink alcohol? (1=certainly not, 5=certainly yes)</i>	3	.87	1	-	2	.75
Social norm parents and friends. (Fruit and breakfast: separate variables for parents and friends). <i>How would your parents or caretakers think about you drinking alcohol? (1=very good, 5=very bad)</i>	2	.77	2	-	2	-
Intention. <i>Do you intend to start or keep drinking alcohol at least once a week in the next six months? (1=certainly not, 5=certainly yes)</i>	1	-	1	-	2	.61
Composite measure of determinants. Mean of Z-scores on all above determinants	7	.85	8	.80	8	.80
Behavior items (measured at all waves)						
Alcohol: 2 items: frequency of consumption, binge drinking. <i>How often have you had alcohol in the past 4 weeks? (1=0 times, 7=more than 10 times)</i>						
Fruit: 2 items: days per week x servings per day. <i>In the past 4 weeks, how many days a week did you eat fruit? (0=(almost) never, 7=every day)</i>						
Breakfast: 1 item. <i>In the past 4 weeks, how many days a week did you eat breakfast? (0=(almost) never, 7=every day)</i>						
Generic scales (measured at baseline)						
Self-esteem: 10 items, $\alpha=.84$. <i>Sometimes I feel useless (1=describes me well, 4=describes me not at all)</i>						
Attitude to school: 16 items, $\alpha=.83$. <i>I am glad I am at this school (1=is not correct, 5=is totally correct)</i>						
Learning experiences with respect to general skills (measured at post-test)						
General skills reported in open learner report: 4 items. <i>Please write down below what you have learned in the lessons of Multiple Choice 4 U (Con: in the lessons about smoking and safe sex). Finish as many sentences as possible. I have learned/discovered/noticed that ... [4x]. [Responses that reflect a general skill were summed (0-4). This variable was later dichotomized into no-yes (0-1) general skill reported.]</i>						
General skills chosen in closed learner report: 10 items. <i>What do you personally think is the most important you learned from the lessons of MC4U/lessons about smoking and safe sex? To help you, we have selected some statements. Choose a maximum of 4 statements from the 10 statements below. [Scores for general skills were summed (0-4). Five statements/items reflected a general skill: Item 2: That the things you learned with respect to one behavior, e.g. smoking, can also be used for other behaviors. Item 3: How other people may influence what you think and do. Item 5: That you have to weigh all pros and cons before deciding whether or not to do something. Item 7: That, before doing something, you have to think about whether you may have regrets later. Item 10: How to stick to your opinion and do nothing against your will.]</i>						

Notes: - = not applicable.

Figure 1. Flow Diagram



on psychosocial determinants (see Table 1). These composite measures were used as a proxy for multivariate analyses of psychosocial determinants.

Covariates. Based on analyses of attrition and baseline equivalence, the following covariates were included in the analyses: socio-demographic variables (gender, ethnicity, grade, school level), the baseline score of the outcome variable, the baseline score of the relevant behavior, self-esteem, and attitude to school. In addition, the mediation analyses also controlled for instruction time for alcohol or nutrition between baseline and follow-up, since otherwise the effects in these domains cannot be interpreted as true transfer effects.

Level of analysis. Analyses were conducted at the student level, because the proportion of variance attributed to the teacher level was not significant for the model including covariates (Snijders & Bosker, 1999). The intra class correlation for all variables was below 0.035.

Analyses of intervention effects on learning experiences. The intervention effect on the OLR and CLR measures at post-test were analyzed with logistic and linear regression, respectively, which controlled for covariates (gender, ethnicity, grade, school level, self-esteem, school attitude).

Analyses of mediation. The CLR total score and the OLR variable were considered as hypothesized mediators. Following Baron and Kenny (1986), mediation was said to occur if three conditions were met: 1) the intervention has an effect on the outcome variable, 2) the intervention has an effect on the hypothesized mediator, and 3) the hypothesized mediator is associated with the outcome variable after controlling for the intervention variable. These mediation conditions were tested with linear and logistic regression, respectively, for dichotomous and interval level criterion variables. All analyses were performed on single outcome variables measured at follow-up and adjusted for the common set of covariates listed in the above paragraph about covariates, which was entered first into analyses. The significance level for all analyses was set at $p < .05$. However, because of the exploratory nature of this study, associations that approached significance ($p < .10$) were included as well. If mediation condition 1 was not met at $p < .10$ for an outcome variable, further analyses on the outcome variable were not conducted.

As the sample size in the analyses varied with the type of learner report (open vs. closed), domain (alcohol vs. fruit and breakfast) and specific outcome variable examined, the sample size is reported for each analysis.

3. RESULTS

3.1 *Intervention effects on learning experiences*

At post-test, experimental students reported significantly more learning experiences with respect to general cognitive-behavioral skills than control students. This effect was found for both the OLR variable [29.2% vs. 3.9%, $OR(CI)=16.10$ (8.43-30.76), $p < .001$] and the CLR variable (2.22 vs. 1.87, $\beta = .24$, $p < .001$).

Table 2. Results of mediation analyses in the alcohol domain

Variable ^a	Hypothesized mediator: Open learner report (OLR)				Hypothesized mediator: Closed learner report (CLR)			
	N ^b E - C	Condition 1 ^c A → C B (SE), p	Condition 2 ^c A → B B (SE), p	Condition 3 ^c B → C B (SE), p	N ^b E - C	Condition 1 ^c A → C B (SE), p	Condition 2 ^c A → B B (SE), p	Condition 3 ^c B → C B (SE), p
Behavior: frequency ^t	295-192	-0.059 (0.022), .006	3.281 (0.471), .000	0.006 (0.023), .776	295-207	-0.073 (0.021), .001	0.466 (0.111), .000	-0.014 (0.009), .102
Behavior: % binge	296-192	0.833 (0.395), .035	3.260 (0.471), .000	0.134 (0.478), .780	296-207	1.090 (0.422), .010	0.452 (0.111), .000	0.267 (0.167), .110
Composite of determinants	299-192	0.167 (0.055), .003	3.293 (0.471), .000	0.076 (0.058), .189	299-207	0.205 (0.052), .000	0.467 (0.112), .000	-0.025 (0.021), .245
General attitude	299-192	0.118 (0.101), .243			299-207	0.163 (0.099), .100	0.469 (0.112), .000	-0.018 (0.040), .651
Outcome expectancies	298-192	0.145 (0.068), .032	3.273 (0.470), .000	0.042 (0.071), .554	298-207	0.162 (0.065), .014	0.468 (0.112), .000	-0.004 (0.026), .871
Risk expectancy	298-191	0.145 (0.091), .109			298-206	0.180 (0.089), .044	0.475 (0.112), .000	0.023 (0.036), .526
Regret ^t	298-192	0.068 (0.021), .001	3.341 (0.473), .000	0.009 (0.022), .669	298-207	0.071 (0.020), .001	0.478 (0.112), .000	0.000 (0.008), .944
Self-efficacy	299-192	0.245 (0.098), .013	3.283 (0.472), .000	0.022 (0.102), .830	299-207	0.241 (0.093), .010	0.482 (0.112), .000	-0.039 (0.037), .300
Social norm	299-192	0.101 (0.069), .144			299-207	0.156 (0.067), .020	0.468 (0.112), .000	-0.034 (0.027), .201
Intention ^t	298-191	0.051 (0.023), .026	3.269 (0.470), .000	0.040 (0.024), .095	298-206	0.070 (0.023), .002	0.464 (0.112), .000	-0.013 (0.009), .174

Notes:^a Variables indicated by superscript ^t were logtransformed. ^b E=experimental group, C=control group. ^c A=experimental condition, B=hypothesized mediator C=outcome variable.

Table 3. Results of mediation analyses in the fruit domain

Variable ^a	Hypothesized mediator: Open learner report (OLR)				Hypothesized mediator: Closed learner report (CLR)			
	N ^b E - C	Condition 1 ^c A → C B (SE), p	Condition 2 ^c A → B B (SE), p	Condition 3 ^c B → C B (SE), p	N ^b E - C	Condition 1 ^c A → C B (SE), p	Condition 2 ^c A → B B (SE), p	Condition 3 ^c B → C B (SE), p
Composite of determinants	321-220	0.096 (0.047), .040	3.204 (0.451), .000	0.113 (0.056), .043	323-242	0.093 (0.044), .038	0.444 (0.093), .000	-0.009 (0.020), .658
General attitude [†]	320-220	0.023 (0.014), .114			322-242	0.030 (0.014), .029	0.439 (0.093), .000	-0.005 (0.006), .404
Regret	318-218	0.031 (0.016), .055	3.182 (0.452), .000	-0.017 (0.019), .394	320-240	0.017 (0.015), .251		
Self-efficacy [†]	319-218	0.047 (0.018), .011	3.206 (0.452), .000	0.017 (0.022), .441	321-240	0.042 (0.018), .018	0.459 (0.094), .000	-0.009 (0.008), .275

Notes:^a Variables indicated by superscript [†] were logtransformed. ^b E=experimental group, C=control group. ^c A=experimental condition, B=hypothesized mediator C=outcome variable.

Table 4. Results of mediation analyses in the breakfast domain

Variable ^a	N ^b E - C	Hypothesized mediator: Open learner report (OLR)			Hypothesized mediator: Closed learner report (CLR)			
		Condition 1 ^c A → C B (SE), <i>p</i>	Condition 2 ^c A → B B (SE), <i>p</i>	Condition 3 ^c B → C B (SE), <i>p</i>	Condition 1 ^c A → C B (SE), <i>p</i>	Condition 2 ^c A → B B (SE), <i>p</i>	Condition 3 ^c B → C B (SE), <i>p</i>	
Composite of determinants	319-220	0.091 (0.048), .060	3.146 (0.452), .000	0.151 (0.058), .009	321-242	0.085 (0.045), .061	0.440 (0.094), .000	-0.022 (0.021), .288
General attitude [†]	318-220	0.043 (0.016), .007	3.165 (0.451), .000	0.020 (0.019), .299	320-242	0.042 (0.015), .004	0.453 (0.094), .000	.00(0.007), .923
Outcome expectancies [†]	317-220	0.033 (0.015), .027	3.157 (0.452), .000	0.060 (0.018), .001	320-242	0.031 (0.014), .031	0.439 (0.094), .000	-0.004 (0.006), .519
Self-efficacy [†]	317-218	0.044 (0.017), .010	3.154 (0.452), .000	0.034 (0.020), .091	319-240	0.042 (0.016), .008	0.459 (0.095), .000	-0.009 (0.007), .192

Notes:^a Variables indicated by superscript[†] were logtransformed. ^b E=experimental group, C=control group. ^c A=experimental condition, B=hypothesized mediator C=outcome variable

3.2 *Did learning experiences mediate transfer effects?*

Table 2 (alcohol), Table 3 (fruit) and Table 4 (breakfast) present the results of mediation analyses with the OLR measure (left-hand part of tables) and the CLR measure (right-hand part). Results are only presented for outcome variables on which the intervention had at least a marginally significant effect ($p < .10$ for mediation condition 1) at follow-up. An intervention effect on the hypothesized mediator (mediation condition 2) was observed for all these outcome variables. Therefore, only results for mediation conditions 1 and 3 are discussed below.

3.2.1 *Results for the OLR measure of general skills*

In the alcohol domain, a significant intervention effect on the outcome variable (mediation condition 1) was found for the two measures of behavior, and for the composite measure of determinants, outcome expectancies, anticipated regret, self-efficacy, and intention. However, none of these outcome variables had a statistically significant association with the OLR measure, which means that mediation condition 3 was not met. To some extent, the results for alcohol intention might hint in the direction of a potential mediation effect, as condition 3 approached significance for this outcome variable ($p = .095$).

In the fruit domain, a significant intervention effect on the outcome variable (mediation condition 1) was found for the composite measure of determinants and for self-efficacy; an effect on anticipated regret approached significance ($p = .055$). As for mediation condition 3, a statistically significant association between the OLR measure and the outcome variable was found for the composite measure of determinants. This means that there is evidence of a mediating effect on the composite determinant measure, but not on self-efficacy or anticipated regret.

In the breakfast domain, significant intervention effects (mediation condition 1) were found for attitude, outcome expectancies, and self-efficacy, and the effect on the composite measure of determinants was marginally significant ($p = .06$). A statistically significant association with the OLR measure (mediation condition 3) was found for the composite measure of determinants and for outcome expectancies, and a marginally significant association for self-efficacy ($p = .091$). The results in the breakfast domain thus indicate that there is clear evidence for a mediating influence of the OLR measure on outcome expectancies, some evidence for such an influence on the composite measure of determinants, and a slight indication that there might be such an influence on self-efficacy.

3.2.2 *Results for the CLR measure of general skills*

The right-hand parts of Tables 2 to 4 show the results of mediation analyses with the CLR measure as the hypothesized mediator. Although mediation condition 1 was met for various outcome measures in all three domains, no mediation was found because condition 3 was not met: none of the outcome measures was significantly, or even marginally significantly, associated with the CLR measure of general skills.

4. DISCUSSION

This study was conducted within the framework of an effect study of a transfer-oriented curriculum. The curriculum about smoking and safe sex was designed to also promote transfer to untaught health behavior domains, among other things by explicitly addressing general cognitive-behavioral skills which are relevant for many domains (i.e., decision-making, problem solving, and refusal skills). As the effect study (Peters et al., 2011) had indeed shown effects in all three untaught domains measured (alcohol, fruit and breakfast consumption), the present paper addressed two research questions to shed further light on these effects. The first research question was whether experimental students reported more learning experiences regarding general cognitive-behavioral skills, as measured with an open-ended learner report (OLR) and a closed-ended learner report (CLR). The answer is clearly affirmative for both measures. The second research question was whether these learning experiences mediated the intervention effects in the three untaught domains. For the CLR measure, there were no indications of mediation, mainly because this measure was not significantly associated with any of the outcome variables. For the OLR measure, evidence was found of a mediation effect on some outcome variables in the fruit and breakfast domains. As we expected, the OLR measure thus appears to be a better indicator of personal lessons learned by students than the CLR measure.

Although there were more intervention effects in the alcohol domain than in the two nutrition domains, we found evidence of mediation via the OLR measure only in the two nutrition domains. These results suggest that intervention effects in the alcohol versus the nutrition domains may be brought about by different mechanisms. Possibly, intervention effects in the alcohol domain may have occurred in a less cognitively aware and more automatic way. The alcohol context may have been sufficiently similar to the contexts explicitly addressed in the curriculum (smoking and safe sex) for students to apply the learned knowledge and skills to the alcohol domain without consciously generalizing the information first. This explanation would suggest that intervention effects in the alcohol domain were the result of low-road transfer, whereas those in the nutrition domain – at least for some outcome variables – occurred through high-road transfer, requiring mindful abstraction and a deliberate search for connections. This explanation fits in well with results of studies of behavioral clustering, which have consistently shown that alcohol use is strongly associated with the behaviors addressed in our curriculum, more so than nutrition behavior (Basen-Engquist et al., 1996; Donovan et al., 1991; Van Nieuwenhuijzen et al., 2009; Wiefferink et al., 2006).

Although this study may not provide definite answers, the results do lead to intriguing speculations about potential implications. The above explanation of the results may implicate that even a domain-specific intervention may have transfer effects in nearby domains –even though such transfer effects were not strived for-, whereas for effects in farther domains an explicit transfer approach may be required. Various studies of alcohol- or tobacco-specific interventions have reported effects on substances not addressed by the intervention (Grossbard et al., 2010; Magill, Barnett, Apodaca, Rohsenow, & Monti, 2009; Myers & Prochaska, 2008), although a review of alcohol-specific interventions did not find evidence for an effect on to-

bacco use (McCambridge & Jenkins, 2008). To examine this intriguing implication, more intervention research is needed with respect to transfer-oriented as well as domain-specific interventions and potential mediating mechanisms. Such research would lead to valuable insights into the breadth or narrowness of effects of domain-specific and transfer-oriented interventions, and to better or more differentiated views on how transfer to nearby and far domains can be promoted.

The hypothesized mediating construct examined in this study - self-reported learning experiences regarding general cognitive-behavioral skills - was geared well towards the aims of this study, as it reflects aspects of several transfer-promoting conditions. The focus on general skills bears in it the aspect of decontextualization. Furthermore, it is a measure of metacognitive reflection, and, being about personal learning experiences, it also has an element of meaningfulness. The learner report has been shown to be a useful and robust tool for analyzing educational objectives that are difficult to measure straightforwardly (Janssen & Rijlaarsdam 1990; Marum, 1996). Especially the latter two aspects mentioned with regard to our measure - metacognitive reflection and meaningfulness - set it apart from other potential measures, such as 'knowledge of general skills'. However, such alternative measures may also be worth investigating. Recently, knowledge of general life skills was found to mediate intervention effects on tobacco and alcohol outcome measures (Bühler, Schröder, & Silbereisen, 2009). Unfortunately, that study did not examine intervention effects in untaught domains, so it cannot clarify a potentially mediating role of life skills knowledge in this respect. Botvin's Life Skills Training program for substance use prevention has had preventive effects on the untaught domains of risky driving and HIV risk behavior, which the authors attributed to the program focus on generic self-management and social skills (Griffin, Botvin, & Nichols, 2004; 2006). However, as mediation mechanisms were not examined in these studies, it remains unclear whether these effects can indeed be attributed to the program focus on generic skills, which might indicate high-road transfer, or to more automated, low-road transfer processes to closely related contexts. These are interesting issues for further research. Also other factors may be examined as potential mediators for transfer effects. The factors of meaningfulness and reflection are eligible candidates, as they are thought to be important for producing transfer.

4.1.1 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 controlling for important implementation variables in analyses. The study also had some limitations. One limitation is that the planned random assignment to conditions was only partly implemented with success. Another limitation is that attrition was substantial and differed between the conditions. Attrition had a negative impact on the power of the analyses, which may have affected the results. Also, baseline differences were observed between conditions and between attrition groups. In response, we controlled for these differences in analyses. Attrition was partly due to missing data on the learner report variables and on measures of instruction time for nutrition and alcohol. Controlling for instruction time on alcohol and

nutrition was necessary for interpreting the transfer effects as true transfer effects. As for the missing values on the learner reports, all students without any entry were coded as missing. Among this group, we were unable to distinguish students who skipped the learner report (truly missing) from students who felt they had not learned anything (unjustified missing), but this group did not include students who explicitly indicated they had learned nothing (they were scored 0). A different coding decision, i.e. giving all students without any entry a score of 0, would have reduced the number of missing values and could have produced different results, but would have been less valid in our opinion than the present coding decision.

Another issue with respect to coding the open learner report is that many student responses were brief (e.g., “say no”), which made it difficult sometimes to interpret and correctly classify the responses. However, the inter-rater reliability was satisfactory and all doubtful responses were discussed and agreed upon by the first and last author.

The significance level for each mediation condition was set at .05, mediation conditions that approached significance ($p < .10$) were also explored. This was done to explore potentially relevant relationships because attrition may have led to loss of power, and because, to our knowledge, this project was the first ever to explicitly promote and test transfer to untaught domains in health education. The results provide valuable insights into the potential mediation processes operating, which may be relevant to researchers, intervention designers and practitioners. The results suggest that transfer of learned knowledge or skills to relatively far domains can be stimulated – at least in part – by teaching general skills; transfer to closely related domains may occur more easily and more in an automated way.

Supplemental Table: Baseline equivalence of students in mediation analyses: comparison of experimental conditions and dropout groups

Dropout from mediation analyses varied with the type of learner report (open vs closed), domain (alcohol vs fruit and breakfast) and specific outcome variable examined. For clarity of reporting about dropout analyses, the decision was made to consider as dropouts those students who had not completed the follow-up survey, had a missing score on the open learner report or had missing teacher information about nutrition instruction between baseline and follow-up.

Variable *= \log transformed	Range or no. of levels	Experimental conditions in mediation analyses			Dropout from mediation analyses		p^a
		Exp $N=328$ M (%)	Con $N=225$ M (%)	p^a	Non-dropout $N=553$ M (%)	Dropout $N=554$ M (%)	
<i>Demographics</i>							
Grade	2 levels			***			***
7		48 (14.6%)	9 (4.0%)		57 (10.3%)	124 (22.4%)	
8		280 (85.4%)	216 (96.0%)		496 (89.7%)	430 (77.6%)	
Age at baseline	11.83-16.08	13.47 (.529)	13.66 (.512)	***	13.55 (.530)	13.46 (.697)	*
Gender (% female)	2 levels	159 (48.5%)	130 (57.8%)	*	289 (52.3%)	246 (44.5%)	**
Ethnicity	3 levels						
Dutch		255 (78.9%)	188 (84.3%)		443 (81.1%)	438 (81.6%)	
Other western		19 (5.9%)	14 (6.3%)		33 (6.0%)	30 (5.6%)	
Non-western		49 (15.2%)	21 (9.4%)		70 (12.8%)	69 (12.8%)	
School level	4 levels			***			***
Vmbo-havo (low)		47 (14.3%)	0		47 (8.5%)	98 (17.7%)	
Havo		97 (29.6%)	97 (43.1%)		194 (35.1%)	156 (28.2%)	
Havo-vwo		121 (36.9%)	35 (15.6%)		156 (28.2%)	160 (28.9%)	
Vwo (high)		63 (19.2%)	93 (41.3%)		156 (28.2%)	140 (25.3%)	
<i>Non-behavior-specific attitudes</i>							
Self esteem*	1-4	3.13 (.561)	3.22 (.487)		3.17 (.534)	3.18 (.541)	
Attitude towards school	1-5	3.04 (.649)	3.09 (.566)		3.06 (.617)	3.10 (.648)	

Variable *=logtransformed	Range or no. of levels	Experimental conditions in mediation analyses			Dropout from mediation analyses		
		Exp N=328 M (%)	Con N=225 M (%)	p ^a	Non-dropout N=553 M (%)	Dropout N=554 M (%)	p ^a
<i>Alcohol use</i>							
Behavior Freq. drinking occasions past mnth*	1-7	1.62 (1.076)	1.49 (.770)		1.57 (.964)	1.59 (.956)	
Behavior % Binge (>=5 drinks) past 2 wks	Yes-no	15 (4.6%)	13 (5.8%)	***	28 (5.1%)	46 (8.3%)	*
Composite determinants	Mean of Z-scores	.08 (.745)	-.05 (.662)	*	.03 (.713)	.04 (.699)	
Attitude	1-5	3.51 (.970)	3.35 (.928)		3.44 (.956)	3.52 (.919)	
Outcome expectancies	-3.429 – + 1.714	-.74 (.795)	-.85 (.713)		-.78 (.764)	-.79 (.790)	
Risk expectancy	1-4	2.49 (1.017)	2.34 (.849)		2.43 (.954)	2.39 (.884)	
Anticipated regret*	1-4	2.04 (1.105)	1.83 (1.000)	*	1.95 (1.068)	1.94 (1.063)	
Self-efficacy	1-5	3.78 (.981)	3.70 (.925)		3.75 (.958)	3.83 (.958)	
Social norm	1-5	3.45 (.747)	3.33 (.648)		3.40 (.711)	3.42 (.709)	
Intention*	1-5	4.10 (1.106)	4.12 (1.052)		4.11 (1.083)	4.04 (1.153)	
<i>Fruit consumption</i>							
Behavior No. portions per wk*	0-21	5.83 (4.646)	5.61 (4.401)		5.74 (4.545)	6.12 (4.958)	
Composite determinants	Mean of Z-scores	.03 (.652)	-.01 (.608)		.01 (.633)	-.02 (.622)	
Attitude*	1-5	4.07 (.736)	4.06 (.676)		4.07 (.711)	4.03 (.691)	
Outcome expectancies	1-5	3.32 (.734)	3.36 (.685)		3.34 (.714)	3.30 (.720)	
Risk expectancy*	1-4	2.16 (.890)	2.09 (.793)		2.13 (.851)	2.05 (.903)	
Anticipated regret	1-4	1.35 (.684)	1.26 (.595)		1.31 (.650)	1.32 (.675)	
Self-efficacy*	1-5	4.22 (1.062)	4.33 (.932)		4.27 (1.012)	4.33 (1.002)	
Social norm parents*	1-5	4.18 (.980)	4.19 (.925)		4.18 (.957)	4.13 (.997)	
Social norm peers	1-5	3.11 (1.013)	3.02 (1.088)		3.07 (1.045)	2.93 (1.065)	*
Intention	1-5	3.80 (1.160)	3.67 (1.139)		3.75 (1.152)	3.79 (1.136)	
<i>Breakfast</i>							
Behavior No. days per week	0-7	6.21 (1.828)	6.42 (1.554)		6.29 (1.723)	6.25 (1.784)	
Composite determinants	Mean of Z-scores	.06 (.689)	.00 (.612)		.04 (.657)	-.02 (.644)	
Attitude*	1-5	4.25 (.685)	4.32 (.667)		4.28 (.678)	4.16 (.715)	**

Variable *=logtransformed	Range or no. of levels	Experimental conditions in mediation analyses			Dropout from mediation analyses		
		Exp N=328 M (%)	Con N=225 M (%)	<i>p</i> ^a	Non-dropout N=553 M (%)	Dropout N=554 M (%)	<i>p</i> ^a
Outcome expectancies*	1-5	4.20 (.692)	4.19 (.613)		4.20 (.660)	4.07 (.731)	**
Risk expectancy	1-4	2.40 (.963)	2.32 (.866)		2.37 (.925)	2.40 (.945)	
Anticipated regret	1-4	1.96 (1.010)	1.89 (.948)		1.93 (.985)	1.91 (1.022)	
Self-efficacy*	1-5	4.38 (.837)	4.41 (.755)		4.39 (.804)	4.43 (.797)	
Social norm parents*	1-5	4.71 (.621)	4.66 (.644)		4.69 (.631)	4.68 (.663)	
Social norm peers	1-5	3.78 (.998)	3.66 (.982)		3.73 (.993)	3.61 (1.077)	
Intention*	1-5	4.20 (.821)	4.07 (.830)	*	4.15 (.826)	4.14 (.824)	

Notes: High-end scores on determinants are conducive to preventative behavior. Variables: *=logtransformed; the range and means presented are for original variables. ^a **p*<.05, ***p*<.01, ****p*<.001.