

Original article

Comparison of a computer-administered and paper-and-pencil-administered questionnaire on health and lifestyle behaviors

Carine A. Vereecken, M.Sc.* and Lea Maes, Ph.D.

Department of Public Health, Ghent University, Ghent, Belgium

Manuscript received February 3, 2004; manuscript accepted October 26, 2004

Abstract

Purpose: The Health Behavior in School-aged Children (HBSC) study is a cross-national survey examining health and lifestyle behaviors of adolescents, traditionally administered by paper and pencil in a school setting. The purpose of the present study was to investigate if a computer format of the questionnaire would affect the responses of the adolescents in comparison with the paper and pencil format.

Methods: In 2000, the Belgian (Flemish) HBSC survey was administered in 81 secondary schools by paper and pencil ($n = 4083$) and in 19 schools by computer ($n = 1008$). Eight hundred four computer participants (aged 12–20 years) were matched with paper and pencil participants on the basis of gender, age, educational level, socioeconomic status, and type of school authority. The questionnaire included items on lifestyle behaviors (e.g., nutrition, substance use, physical inactivity, sexual behavior), psychosomatic health, and social relations.

Results: For the majority of lifestyle behaviors, we found that mode of administration had no significant effect on adolescents' responses, whereas for several questions about feelings/affective states, more socially desirable responses were found in the paper and pencil format than in the computer format.

Conclusion: The present findings suggest a need for further exploration of potential mode effects on questions about feelings and affective states before transition from the paper and pencil HBSC-survey to the computer format. © 2006 Society for Adolescent Medicine. All rights reserved.

Keywords:

Adolescents; Health survey; Computer-administered questionnaire

Since 1990, Belgium-Flanders has participated in the cross-national study Health Behavior in School-aged Children (HBSC). The overall goal of the HBSC study is to gain new insights into, and to increase understanding of, health behavior, lifestyles, and their context in young people [1]. The international HBSC surveys are administered every 4 years. Flanders administers its survey every 2 years. All participating countries follow a standard protocol. The uniform measures, sampling, and implementation procedures of the HBSC study, designed to be consistent across participating countries and across successive surveys, provide a

unique opportunity to allow between-country comparisons and trend analyses. Traditionally, the HBSC data are collected by means of standardized paper and pencil questionnaires (PP).

The increase of computer facilities in schools makes it practically and financially feasible to consider computer-administered querying (PC) for future HBSC surveys. Moreover, computerized interviewing is attractive in terms of efficiency, economy, and respondent preference. The latter is not unimportant, as the quality of survey data depends in part upon respondents' willingness to expend the effort needed to provide accurate answers [2]. Responding to questions requires that the respondent interpret the meaning of the question, search his/her memory extensively for all relevant information, integrate that information carefully into summary judgment, and report the summary judgment

*Address correspondence to: Drs. Carine Vereecken, Department of Public Health, Ghent University, University Hospital, Bloc A, 2nd floor, De Pintelaan 185, 9000 Ghent, Belgium.

E-mail address: carine.vereecken@ugent.be

as clearly and precisely as possible [3]. If, however, a respondent is less motivated to participate, he or she might engage with these cognitive processes less thoroughly, thus compromising the quality of response [4]. Given previous research suggesting that PC respondents are more enthusiastic [5], use of a PC format might increase motivation to proceed more carefully through the necessary cognitive processes to give an optimal answer.

Besides these cognitive factors, the validity of adolescents' self reports may also be affected by situational factors. Factors considered especially influential include the presence of others while responding to questions and respondents' perceptions of the level of privacy or confidentiality [6].

Use of a computer may create an atmosphere that the respondent perceives as impersonal and nonjudgmental, fostering a greater sense of privacy [7], thereby reducing inhibitions and the tendency to respond in a socially desirable manner. This is supported by Wright et al. [8] and Supple et al. [9], who found that adolescents were more likely to report substance use and less desirable aspects of psychological well-being using a PC format than when using a PP format. In the absence of an external criterion by which the adolescents' responses can be validated, it has customarily been assumed that these higher prevalence rates equate with more valid reporting [10,11].

Beebe et al. [12], however, found significantly more reports of sensitive behavior for those who did the questionnaire with PP than their counterparts who completed a PC format. In the studies of Hallfors et al. [13] and Millstein [14], and for the majority of health behaviors in the study of Webb et al. [15], administration mode made no significant difference on adolescent's reports.

The critical factor explaining the mode effect in these studies seems to be the degree to which the interview format allows respondents to record their answers without revealing potentially embarrassing information to an interviewer or to others nearby, for example, parents, teachers, or fellow pupils [16,17].

Wright et al. [8] and Supple et al. [9] interviewed respondents in their homes, often with parents or siblings nearby. PP respondents were significantly more likely to feel that others could see how they were answering the questions than the PC group [9] and this might have resulted in more cautiousness in revealing illegal activities. The study of Beebe et al. [12], on the other hand, was done in a school setting, where the visibility of the responses on the screens might have compromised their privacy. Their results provide evidence that distance between computers is an important factor, as those who used a computer that was very near another student had significantly fewer sensitive reports than others, whereas no difference was found between PP and PC respondents for those whose PC was at least 5 feet from another student. It should be noted, however, that the participants in this study were enrolled in

alternative education centers, representing a specific adolescent population (i.e., students who are performing below grade level, are pregnant, are chemically dependent, or who have been expelled from the regular school system) and therefore the findings may not be representative of mainstream schools. Hallfors et al. [13] also carried out their study in a school setting, but considerable care was taken to insure that computer screens were not visible to others, for example, by including cardboard blinders on either side of the computer screen. In the studies of Millstein and Webb et al., respondents were patients queried in a clinical setting, where the questions could have been expected.

If mode of administration were to affect the responses in HBSC surveys, this would have consequences for the comparability between countries and between consecutive surveys. Therefore, a first pilot study was done in Flanders in 1999 among first and second grade secondary school pupils to investigate the concordance, the reliability, the feasibility, and the acceptability of the computer format of the Flemish HBSC questionnaire [5].

The results of the pilot study were promising. The test-retest reliabilities of the questionnaires were comparable for both formats. For the majority of items, the mode of administration had no effect on adolescents' responses. In addition, there were fewer incomplete responses to items in the PC format, and, among pupils who completed both formats, most preferred the PC format.

To further explore the impact of the PC questionnaire on the collection of HBSC data in a real life school survey, Flemish schools were given a choice between the PC and PP format in the survey of 2000 (a year when the international HBSC survey was not being administered). Those respondents participating in the PC survey were then compared with a 1-to-1 matched sample of respondents participating in the PP survey. We hypothesized that if there was a difference between the two formats, PP would lead to more socially desirable answers. Although for both methods there might be some variation in proctors and distance between the pupils and screens, the exposure time of the answers on the screen is more limited because our program refreshes the screen after a response has been selected. In contrast, the questions and answers that have been marked on a PP form stay visible until a complete page has been completed.

Method

Procedure

The Flemish HBSC 2000 survey was approved by the ethical board of the University Hospital of Ghent.

In every school, one teacher was appointed as coordinator. He or she organized the data collection and administered the survey according to standard instructions: pupils had to complete the anonymous questionnaires individually and the coordinator was asked to respect the privacy of the

pupils. The PP format was completed in the school classroom, the PC format in the school computer labs.

Material

Concepts

Lifestyle behaviors. Food habits were assessed with a 14-item food frequency questionnaire. Leisure-time activity was assessed with items addressing TV viewing, computer use, and homework. Other health-related behaviors included sexual behavior (with a boy, with a girl, and number of partners they ever had), tooth brushing, seatbelt use, carrying a weapon, and truancy.

Alcohol use was assessed with questions asking about number of occasions alcohol was drunk over four different time periods (a subject's lifetime, the last 12 months, the last 30 days, and the last 7 days), number of alcoholic beverages during the last 7 days, and the last time they had alcoholic beverages and frequency of drunkenness. Tobacco use was measured by three items: smoking status, smoking frequency, and amount of cigarettes smoked in an average week.

Hashish use was assessed by two items asking about lifetime use and use over the past month. For other illicit drugs, items measuring the frequency of use of ecstasy, hallucinogens, cocaine, heroine, inhalants, and amphetamines were combined into two variables: lifetime use and use over the past month.

Psychosomatic well-being. Two items measured general health and well-being. Eight items measured specific health complaints: frequency of headache, stomachache, backache, feeling tired, irritability/bad temper, nervousness, sleeping disturbances, and dizziness during the past 6 months. Seven items measured the use of medication (for cough, cold, headache, stomachache, sleeping difficulties, nervousness and weight loss) over the last month.

Pupils were asked if they ever felt lonely, helpless, self-confident, and left out. Two questions were asked about suicide: whether they had ever thought about ending their life or ever tried to end their life. Actual height and weight were asked, as well as perceptions of weight and body image.

Social relations. The respondents were asked if it was easy to talk about their problems with their mother, father, older sister, and older brother. They were asked two questions about home: if they liked it and if they agreed with their parents about use of leisure time. They were asked their opinion about school, if they felt pressured by schoolwork, if they felt safe at school, if they bullied others or had been bullied, and they were asked how many good friends they had and if it was easy to make new friends.

Table 1
School characteristics PP and PC schools

	PP	PC
School authority		
Catholic	53 (65.4%)	13 (68.4%)
Public	18 (22.2%)	5 (26.3%)
Organized by town government	6 (7.4%)	1 (5.3%)
Organized by the provincial board	4 (4.9%)	0 (0%)
School size; number of pupils enrolled, mean (SD)	561 (272)	553 (238)

Instrument

Visual Basic[®] 4.0 [18] was used to develop the PC format.

As response effects of computer questioning are, in part, a consequence of the specific question (screen) layout and the response protocols used [19], potential differences between PC and PP format were, where possible, minimized. First, a PP format shows a complete list of questions at once, whereas items in the PC format are displayed one at a time on the screen. To minimize this difference, items that could be considered as measuring the same concept were shown on the screen at the same time (for example, consumption frequencies of brown bread, white bread, and cereals). Second, in the PP format a respondent knows how much of the questionnaire he/she has completed or still has to complete. In the PC format, a progress bar was used to indicate completion status. Third, a PC format could be programmed not to allow inconsistencies or missing data. However, to keep PC and PP as similar as possible, a skip button 'I don't want to answer this question' was available on each screen of the PC format, and no inconsistency checks were programmed. Answering with the skip button was, however, discouraged by a message box giving the standard instruction to minimize the use of this button, shown the 5th, 9th, 12th, 14th and further screens each time the button was used. Fourth, returning to previous questions is very easy in a PP format, so in the PC format it was made possible to return to a previous page by pushing a button labeled "previous question": at the same time, the previous answer was removed. Finally, written surveys of adolescents in a school setting are supposed to guarantee anonymity. Pupils who completed the PP format were instructed to place completed questionnaires in an envelope. Responses of pupils who completed the PC format were saved on a floppy disk and there was no possibility to return to the completed questionnaire once it had been saved.

Subjects

Of the 100 secondary schools that agreed to participate in the 2000 survey, 19 schools preferred the PC format and 81 schools preferred the PP format. School characteristics are described in Table 1. No significant difference in type of school authority (Fisher's exact test: $p = .96$), nor school

size ($t = 0.12$, $df = 97$, $p = .905$) was found between PP and PC schools.

Random cluster sampling was used, the cluster being a class or class group. In each participating school, two classes or class groups (± 50 pupils) were selected at random, stratified by gender, grade, and education level (general, technical, and vocational). The PC format was completed by 1008 pupils, whereas the PP format was completed by 4083 pupils. We were able to individually match 804 PC participants with PP participants on the basis of gender, age, education level, socioeconomic status (based on the occupation of the head household), and school authority.

Statistical analysis

Differences between the matched samples of PC and PP format were measured using two related-samples tests. For ordinal variables, the Wilcoxon signed-rank test was used. The Wilcoxon signed-rank test considers information about both the direction and the magnitude of the difference between pairs. For dichotomous variables, the McNemar test was used.

Analyses were done for boys and girls separately, as some behaviors (e.g., frequent heavy drinking) might be more socially desirable/acceptable for boys than for girls and vice versa [20,21]. Additionally, there might be a different cognitive effect for boys and girls: the more positive attitude of boys toward PCs [22,23] could have a positive effect on the validity of their responses; conversely, boys also use computers more to exercise control and play, whereas girls regard computers more as a necessary tool to assist with work [23] and therefore girls might complete the PC format more seriously.

Results

The age of the matched sample ranged between 12 and 20 years; the mean age was 15.36 ($SD = 1.75$). Fifty-six percent of respondents were boys; 35% were from grade one and two of secondary school, whereas 65% were from grades three to six. Among the senior secondary students (grades three to six), 37% took general education classes, 29% technical education, and 34% vocational education. Twenty-six percent of the sample had at least one parent in the highest occupational category, 40% were coded in the medium group (highest occupation of both parents = medium level of skills), and 26% in the lowest category (highest occupational level of both parents = lower level of skills or economic inactive). Seven percent could not be coded into one of the three occupational categories because of incomplete job descriptions.

Lifestyle behaviors

Nutrition

For the 14-item food frequency questionnaire, only five differences were found: girls answering the PP format reported a higher consumption frequency of diet soft drinks ($PP_{girls} = 2.18$ days/week; $PC_{girls} = 1.57$; $p = .001$) and cereals ($PP_{girls} = 2.52$ days/week; $PC_{girls} = 2.14$; $p = .036$) and a lower consumption frequency of white bread ($PP_{girls} = 2.64$ days/week; $PC_{girls} = 3.22$; $p = .020$), whereas boys answering the PP format reported a higher consumption frequency of sweets ($PP_{boys} = 4.33$ days/week; $PC_{boys} = 4.04$; $p = .049$) and a lower consumption frequency of other milk products ($PP_{boys} = 3.11$ days/week; $PC_{boys} = 3.70$; $p = .002$).

Leisure-time activity

No significant differences were found for TV viewing and computer use, but a significant difference was found for homework for both boys and girls, with a higher reporting of time spent doing homework by PC respondents ($PP_{boys} = 38$ minutes/day, $PC_{boys} = 48$, $p < .001$; $PP_{girls} = 61$, $PC_{girls} = 66$, $p = .027$).

Substance use

For all but two items (drunkenness and hashish), reports of substance use did not vary for both boys and girls across administration conditions. However, among girls, PC respondents reported a higher frequency of drunkenness than PP respondents ($p = .014$) (Figure 1a). Among boys, PP respondents reported a higher frequency of hashish use during the last month than PC respondents ($p = .025$) (Figure 1b), although this difference was no longer significant when we compared those who used hashish over the last month with those who did not use it.

Sexual behavior

No significant differences were found for the items measuring sexual behavior.

Other lifestyle behaviors

For tooth brushing, a significant difference was found for boys, with PC respondents reporting lower tooth brushing ($p = .031$) (Figure 1c). No difference was found among girls, but most girls brush their teeth daily.

There was no significant mode of administration effect for seat belt use, carrying a weapon, or truancy.

Psychosomatic health (Table 2)

No significant differences between PC and PP were found for general health and well-being, somatic health complaints (headache, stomachache, backache, sleeping disturbances, and dizziness), use of six out of the seven medications, reported height and weight, or suicidal behavior.

Significant differences were found for both boys and girls for feeling safe at school, feeling left out, and feeling tired. Among boys, but not girls, significant differences

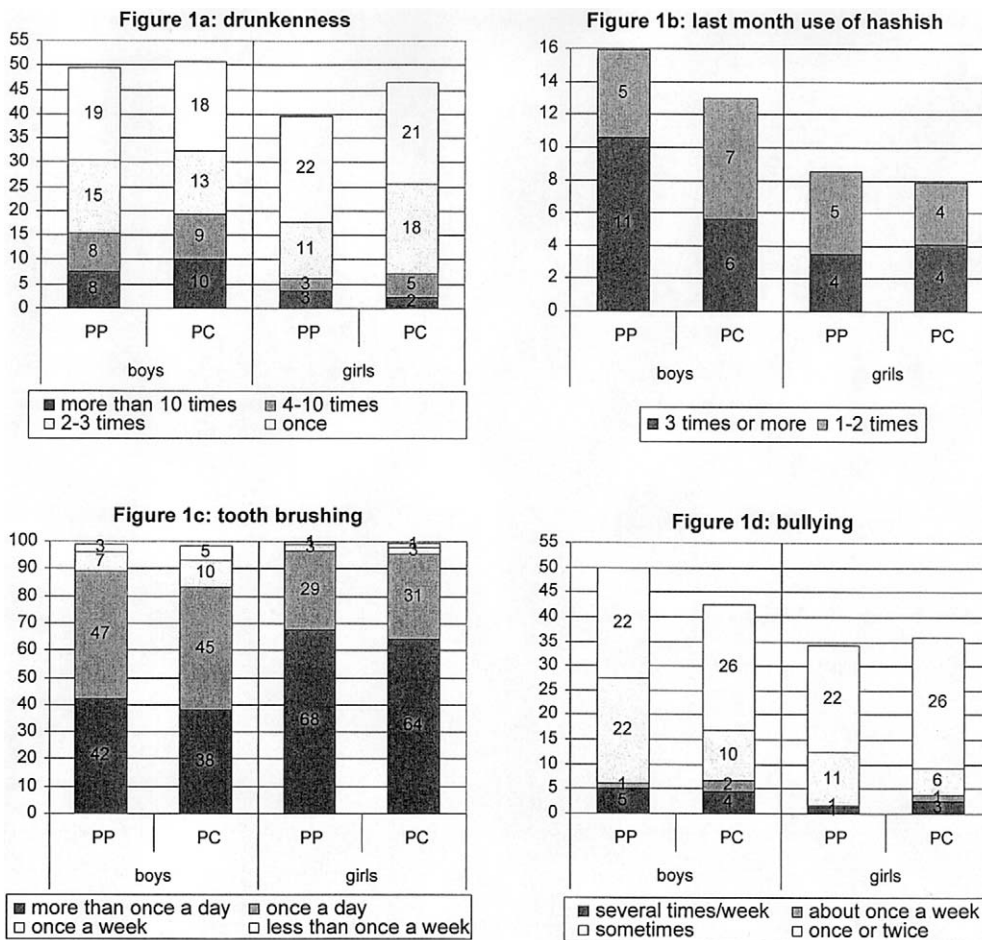


Figure 1. (a–d) Prevalences by gender and administration mode for (a) drunkenness, (b) last month use of hashish, (c) tooth brushing, and (d) bullying.

were found for ‘feeling self confident’, perceived weight, body image, and suicidal ideation. Borderline significance was found for feeling lonely. Among girls, but not boys, significant differences were found for irritability/bad temper, nervousness and the use of medication against cough. Borderline significance was found for feeling helpless. All significant differences in responses to the psychosomatic items indicated a higher reporting of more undesirable affective states and feelings by PC respondents.

Social relations

No differences were found in the questions about home or friends. Of the questions about school, only bullying differed by administration mode: boys reported a higher level of bullying in the PP format compared with the PC format ($p = .007$) (Figure 1d).

Discussion

In the present study, adolescents’ reports of a wide range of Belgium-Flanders HBSC 2000 questions obtained by PC are compared with those obtained by PP in a real-life survey situation.

For the majority of items, including sexual behavior and most items on substance use, topics that are presumed to be sensitive, we found that mode of administration had no significant effect on adolescents’ responses. A significant mode effect was found for both boys and girls for homework, feeling safe at school, feeling left out and feeling tired; a significant mode effect was found for girls, but not for boys, for drunkenness, medication use against cough, feeling irritable, feeling nervous and three food items; a significant mode effect was found for boys, but not for girls, for last month frequency of hashish use, feeling self-confident, self-perception of body weight, body image, suicidal ideation, bullying and two food items. For most items where we found a difference, more socially desirable responses were found in the PP format.

The items that showed a significant difference were mainly feelings and not lifestyle behaviors. Situational as well as cognitive factors might explain these differences. Within a school setting, people that pose a threat to the confidentiality of a survey are the teacher and the pupils who sit beside the respondent. As the teacher is instructed to respect the privacy of the pupils, and there is only one

Table 2

Overview of psychosomatic variables that differed significantly or borderline significantly by administration mode: mean of PP and PC and significance of the difference

	Boys			Girls		
	PP mean	PC mean	<i>p</i>	PP mean	PC mean	<i>p</i>
General health and psychological well-being						
Feeling safe at school (1 = always; 5 = never)	1.77	1.99	<.001	1.66	1.81	.016
Feeling lonely (1 = very often; 4 = never)	3.38	3.28	.056	3.15	3.14	.674
Feeling helpless (1 = always; 5 = never)	4.10	3.99	.080	3.89	3.76	.055
Feeling self confident (1 = always; 5 = never)	2.25	2.43	.005	2.66	2.74	.349
Feeling left out (1 = always; 5 = never)	4.22	4.02	<.001	4.07	3.82	<.001
Self-perception of body weight (1 = much too thin; 5 = much too fat)	3.05	3.17	.040	3.65	3.66	.478
Body image (1 = very good looking; 5 = not at all good looking)	2.81	2.90	.039	3.23	3.23	.930
Specific health complaints over the past 6 months (1 = almost every day; 5 = rarely or never)						
Feeling tired	4.14	3.79	<.001	3.80	3.40	<.001
Bad temper/irritable	4.17	4.04	.064	4.00	3.73	.004
Nervousness	4.00	3.94	.431	3.81	3.59	.025
Medication use over last month (0 = no; 1 = yes)						
Cough	0.21	0.21	0.933	0.19	0.26	0.011
Suicide						
Suicidal ideation (1 = never; 5 = very often)	1.55	1.68	0.032	1.75	1.81	0.409

teacher present in a classroom, the most likely threat to privacy comes from pupils seated close to the respondent. However, the effects due to the third party presence is linked to the third party's knowledge of the information requested and the degree of personal stake the third party may have in the respondent's answers [24]. As most adolescents know if their classmates smoke, drink alcohol, and use hashish, respondents may have no reason to bias their answer for these questions.

Conversely, students usually brush their teeth at home, and it might be embarrassing to admit not brushing regularly. Concerning homework, adolescents tend to brag to each other about how little time they spend on it. Following the traditional gender role pattern, drunkenness might be socially acceptable for boys, but not for girls [20,21], resulting in the lower reporting of drunkenness among girls using the PP format. So, these three items indicate more socially desirable answers in the PP format. The use of hashish and bullying, on the other hand, were reported more frequently in the PP format among boys; it might be that boys consider these behaviors as tough, and therefore desirable.

Finally, significant differences were found for other milk products and sweets for boys and for diet soft drinks, cereals, and white bread for girls, although the differences for boys were small and it is not unlikely that the higher consumption of cereals and the lower consumption of white bread among PP girls reflect a real difference, as both items can be considered as interchangeable food items.

In contrast to most lifestyle behaviors, feelings are much less public. It might be threatening for respondents to reveal their private feelings, especially if they believe that their

peers may see and eventually confront them with their responses. Moreover, as the answer on a paper is never really gone and as responses on a paper might be experienced as more confronting, PP respondents might think twice, refine and modify their response before marking what they perceive to be an 'appropriate' answer, leading to more socially desirable responses.

In addition, it might be that questions about feelings are cognitively more demanding than questions about behavior. If this is the case, higher engagement with the task is likely to provide more accurate responses. Given previous research suggesting that PC respondents are more enthusiastic [5], we presume that PC-respondents might be more motivated to proceed more carefully through the necessary cognitive processes to give an optimal answer.

Finally, we hypothesized that administration mode could influence the validity of the reports of boys and girls differently. In general, our results reveal the same pattern—no effect or a more "socially desirable" answer in the PP format—for boys and girls. Nevertheless, as indicated for drunkenness and hashish use, what is perceived as desirable by boys is not necessarily the same for girls and vice versa.

In conclusion, our findings suggest that both the PC and PP formats yield similar estimates in self-report data for most health behaviors but yield different estimates for feelings/psychological states. However, owing to the study design, it might be that, although we were able to individually match on five key variables, other variables we were not able to match on have played an important role as well. Future studies with a stronger design might give more insight.

The current data were, however, gathered from the Flem-

ish HBSC 2000 survey, and therefore the study design was subject to a number of limitations due to practical considerations. For example, in order not to discourage schools from participating in the study, they were offered the choice of PP or PC format rather than being randomly assigned to an administration mode group. As the PP format can easily be completed when the pupils have an unexpected study hour, whereas for the PC format the computer laboratory needs to be available/reserved, it was not surprising that more schools elected to use the PP format. In addition, although teachers are given standard instructions for administration of the HBSC survey, it was not possible to check the distances between desks or computer workstations. Thus, the actual degree of privacy experienced by PP vs. PC respondents may have been variable. A more ideal study design with random assignment of schools/pupils to PC or PP format and more control over the level of privacy within classrooms would be preferable and should be considered for future studies.

Before transition of the HBSC survey, currently completed using PP, to the more efficient PC survey, the potential mode effects on questions about feelings and affective states should be explored further. Future studies might also consider evaluation of potential mode effects in different age groups and educational levels; it might be that administration mode has a different effect for older vs. younger adolescents as well as for the more theoretically oriented pupils from general education level vs. the more practically oriented pupils from vocational education. Finally, little is known about the impact of different cultures on the different administration modes; hence, further evaluation in other countries is advised.

Acknowledgments

The study made use of the Health Behavior in School-aged Children (HBSC) Research Protocol for the 1997–1998 survey. This is a World Health Organization cross-national study. The international coordinator for the 1997–1998 survey was Candace Currie. The Flemish Government, Department of Welfare, Public Health and Culture, provided funding for this study. Finally, we thank Joanna Inchley for her suggestions, comments and the editing of the final draft.

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