



School as a determinant for health outcomes – a structural equation model analysis

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Abstract

Purpose – The purpose of this paper is to investigate whether students' perceptions of their school environment and their adjustment to school are associated with health outcomes across gender and age groups.

Design/methodology/approach – Data from the cross-sectional international Health Behavior in School-aged Children Survey of the year 2002 ($n = 162\ 306$) were analyzed. A structural equation model (LISREL) specified social school climate and school demands influencing, school adjustment (achievement and liking of school). The latter aspects were assumed to influence the health outcomes general health item, life satisfaction and multiple psychosomatic symptoms. Analyses were repeated across gender and age (11, 13 and 15 years).

Findings – The specified LISREL model fitted the data well on the entire sample as well as for age and gender subgroups (RMSEA = 0.043-0.054). Overall, girls' general perceived health and life satisfaction seemed to be more strongly affected by the school environment than boys'. Age affected the goodness of fit of the model and reduced the strength of the relationship between school pressure and school adjustment. In all subgroups, the relationship between better school perceptions and better subjective health and life satisfaction were supported by the analyses.

Research limitations/implications – Reported findings are limited to the cross-sectional study design which precludes causal inferences. Further research using longitudinal data is warranted to confirm the findings.

Practical implications – Relationships between school environment and school adjustment and health-related outcomes revealed the relative importance of school social climate and demands for school adjustment and through the latter in determining subjective health and life satisfaction. School social climate is a target for promoting health and well-being of children and adolescents.

Originality/value – Complex statistical analyses employing structural equation modelling confirmed findings on the importance of school aspects for child and adolescents in a huge data set.

Keywords Adolescents, Personal health, Customer satisfaction, Schools, Europe, North America

Paper type Research paper



Introduction

Early adolescence is a crucial developmental period. At this time, individuals must cope with the biological challenges associated with puberty, the psychological challenges of increased identity differentiation (Erikson, 1998; Schickedanz *et al.*, 2001), and the scholastic challenges arising from transitions across school types (Roeser *et al.*, 1996; Roeser *et al.*, 2000). Adolescents greet these challenges in a variety of different ways, so that, while some adolescents have great difficulty coping, many others experience relatively little destabilization (Steinberg and Morris, 2001; Kuperminc *et al.*, 2001; Berk and Levin, 2003). Unsuccessful coping, however, can lead to the emergence of depressive symptoms and psychosomatic complaints (Murray and Greenberg, 2000).

During this period, school becomes a crucial socio-psychological context for development (Kuperminc *et al.*, 2001; Hoge *et al.*, 1990; Samdal *et al.*, 1998). Not only do adolescents spend a considerable portion of their waking hours in school (Kasen *et al.*, 1990), school is also prominent in their out of school time, for example through homework, clubs, sports, and the developing relationships and friendships initially established in the school setting. The school environment is also a potential source of stress for early adolescents, through for example the pressures of schoolwork and social school climate shaped by teachers and peers. Young peoples' complaints regarding the school environment may reflect in part the problems in adapting to school demands such as achievement and schoolwork (Torsheim *et al.*, 2001; Torsheim and Wold, 2001a, b). In contrast, positive perceptions of school social climate of classrooms or of the school as a whole are associated with fewer emotional and behavioral problems (Kuperminc *et al.*, 1997).

Research to date has shown a consistent link between perceptions of school and emotional health (Natvig *et al.*, 1999). School environments that are perceived as positive (such as those that provide an inclusive social climate and supportive classmates) and good school adjustment (such as academic achievement and low school-related stress) can increase the sense of success and competence, which, in turn, lead to better well-being, lower levels of depression, and fewer subjective health complaints (Aro *et al.*, 1989). In contrast, lack of academic achievement and poor peer acceptance can decrease health-related variables and increase health-risk behaviors (Aro *et al.*, 1989; Seiffge-Krenke *et al.*, 2001). Thus, school related factors can determine physical, emotional, and social well-being (Roeser *et al.*, 1996; Lerner and Galambos, 1998).

Age and gender influence which school related factor will be the most influential over subjective health (Garnefski, 2000). Among older students, academic stress becomes significant, perhaps because of the focus and immediacy of future plans and orientations, while, among younger students, peer rejection can have a robust effect on health (Wagner and Compas, 1990). In terms of gender differences, females seem to rely more on their social network when experiencing stress across their life-spans (Taylor *et al.*, 2000), so perceived lack of this support for females could result in poorer subjective health and less life satisfaction during adolescence (Wagner and Compas, 1990). Additional major determinants of girls' self-esteem during adolescence are perceived physical attractiveness and social acceptance. "Failures" in either domain can have negative effects on overall health as well (Cole and Cole, 1996; Taylor *et al.*, 2000). Furthermore, girls are likely to be more vulnerable to emotional disorders than boys (Hankin and Ambranson, 2001). This association is also valid in the context of

reporting somatic symptoms (Kolip and Schmidt, 1999; Scheidt *et al.*, 2000). Apparently, these gender differences are observable at an early age (Hankin *et al.*, 1998).

The school context seems to be both a risk factor and a resource during this developmental period (King, 1998), and as a consequence, over the last decade, health promoting school programs have been implemented in many countries. The main elements of such programs are for example, the health education curriculum, the school ethos and environment and interaction with the wider community. (Mukoma and Flisher, 2004)

In the present study, we examined the relationship between school and life satisfaction, as partially mediated by emotional health, following a model originated by Samdal and Dür, 2000. This model postulates that perceptions of school, namely, support by classmates and school demands, can influence students' school adjustment, as measured by satisfaction with school and academic achievement. School adjustment, in turn, contributes to better life satisfaction, both directly and indirectly, as mediated by emotional health (see Figure 1).

However, it has to borne in mind that the direction of causality might be in both directions. Satisfaction with school and its social components may increase satisfaction with life and health, and satisfaction with life and good health may increase satisfaction with school and its environment. Indeed it is likely that there are dynamic interactions among the studied phenomena. For the sake of presenting a clear argument we considered school as the determinant and health as the outcome while acknowledging that the relationships are likely to be more complex and dynamic in reality.

Based on previous studies (cited above), we hypothesized that both age and gender would act to modify these relationships.

Methods

Study design

The data reported in this article stem from the collaborative cross-national survey "Health Behaviour in School Aged Children" (HBSC) of the year 2002. This survey was

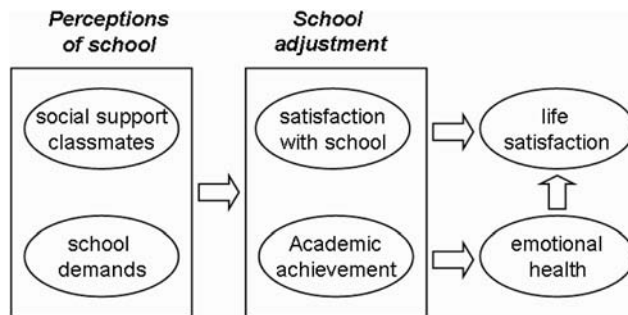


Figure 1.
The theoretical relationship between school and life satisfaction

Notes: Standardized coefficients of the first SEM. Latent variables are shown in ellipses and observed variables are shown in rectangles. All coefficients are significant. The correlation between social climate and demands (not shown) was part of the model and was $r = 0.21$
Source: Samdal and Duer (2001)

conducted in 35 countries and regions of Europe[1], North America[2], and Israel under the auspices of the World Health Organization (WHO) Europe. The HBSC survey is designed as a cross-sectional study, which aims at gaining new insights into and understanding of health and health behaviors of children and adolescents.

Each participating country was responsible for sampling and data collection, adhering to the HBSC Research Protocol (2001) thus ensuring consistency and guidance. Data were collected by means of standardized paper-and-pencil questionnaires administered in the classrooms at school during one lesson. The specific sample selected were students attending schools who were 11, 13, or 15 years old. Participation was completely voluntary and confidentiality was guaranteed at all stages of the survey. Further information about the HBSC survey can be obtained through WHO Europe International Report "Young People's Health in Context" (Currie *et al.*, 2004).

Subjects

The sample was selected through a complex multistage sampling procedure. The primary sampling unit was school-class, with self-selection of students. More detailed information about the sample and the sampling frame can be obtained elsewhere (Currie *et al.*, 2001, 2004). The multistage sampling makes it difficult to compute a single response rate. The available documentation suggest that for a majority of countries, the response rate at the level of school was above 80% with additional dropout at the student-level ranging from 2.4 per cent to 26.0 per cent. Combining all available information the weighted response rate was 75 per cent (authors calculation). Altogether $n = 162\ 306$ students (48.63 per cent females, 51.37 per cent males; age group 11 yrs = 34.20 per cent, 13 yrs = 34.49 per cent, and 15 yrs = 31.31 per cent) completed the questionnaire.

Variables

The questionnaire was developed and piloted by the interdisciplinary multi-national HBSC research team. Each country was responsible for translating the questionnaire into their native language.

Social school climate. Three items assessed school social climate: "The students in my class(es) enjoy being together.", "Most of the students in my class(es) are kind and helpful.", and "Other students accept me as I am.". The answer categories employed ranged from "strongly agree" (1) to "strongly disagree" (5). These three items form one latent construct called "social climate" which was used in the LISREL analysis.

Demands. Demands were measured using a single item that asked: "How pressured do you feel by the schoolwork you have to do?" The answer categories varied from "not at all" (1) to "a lot" (4).

School adjustment. The survey comprised two items to evaluate students' adjustment to school. The first one focused on academic achievement in school: "In your opinion what does your class teacher think about your school performance compared to your classmates?" The response choices were "very good", "good", "average", and "below average". The second item concerned the liking of school: "How do you feel about school at present?" Response choices were "I like it a lot", "I like it a bit"; "I don't like it very much", and "I don't like it at all".

Health. One general health question and eight items on psychosomatic complaints assessed health. The general health item was: "Would you say your health is...?" Response options were "excellent", "good", "fair", and "poor". The psychosomatic complaints were listed using the following instruction: "In the last six months: how often have you had the following...?" The symptoms asked were headache, stomach ache, backache, feeling low, irritability or bad temper, feeling nervous, sleeping difficulties and feeling dizzy. The answer categories ranged from "about every day" (1) to "rarely or never" (5). The item scores were summed.

Life satisfaction. The Cantril Ladder (Cantril, 1965) was used to assess life satisfaction. A picture of a ladder was shown to the students and they were told: "The top of the ladder '10' is the best possible life for you and the bottom '0' is the worst possible life for you. In general, where on the ladder do you feel you stand at the moment?" Thus, there were altogether 11 answer categories ranging from 0 to 10.

All variables were recoded beforehand that higher values indicate "better" states. The reliability and validity of the applied measures for school and health aspects was tested within former HBSC survey, indicating their usefulness (Torsheim *et al.*, 2000).

Statistical analysis

Structural equation modeling (SEM) using the software LISREL 8.5 (Jöreskog and Sörbom, 2001) were applied to specify and test models of the relationship between the above described concepts. The measurement model consisted of 1 to 3 indicators per latent construct. The identifiability of the parameters of the measurement was ensured by each observed variable loading on only one latent construct (McDonald and Ho, 2002). For exogenous constructs the variance was fixed to one, for endogenous constructs the loading coefficients of one indicator was fixed to 0.80 during parameter estimation and the latent construct being re-scaled afterwards to enable identifiability and rescaling of the latent variables. In case of constructs measured by only one indicator, the residual variance of the measured indicators were fixed to 0.36. The succeeding complete standardization of the model enabled correct parameter estimates (McDonald and Ho, 2002). Data-base for the maximum likelihood estimation of the model parameters was the correlation matrix of the observed indicators. As the maximum likelihood estimation procedure requires multivariate normal distribution of the data, the variables were a priori normalized-transformed using the software PRELIS 2.5 (Jöreskog and Sörbom, 2002).

The global Goodness of Fit (GoF) of the models was assessed with the root mean square error of approximation (RMSEA) (Browne and Cudeck, 1993) and the comparative fit index (CFI) (Bentler, 1999). A CFI larger than 0.95 and a RMSEA lower than 0.06 indicate an excellent fit between the specified model and the data, whereas values of CFI > 0.90 and RMSEA < 0.08 hint at an adequate fit (Hu and Bentler, 1999). The adjusted goodness of fit index (AGFI) describes the proportion of variance and covariance in the manifest variables which can be described by the model, taking into account the number of model-parameter respective the degrees of freedom. The statistical significance as well as the algebraic sign of the estimated path coefficients were used to evaluate the model validity. Statistical significance of the χ^2 -statistic was not used to evaluate the GoF because the large samples lead to an overwhelming statistical power to detect even smallest and practical irrelevant deviations.

The analyses were repeated for boys and girls as well as for the three age groups and the results were compared with each other.

Results

Table I shows the means and standard deviation of the variables to be analyzed. Figure 2 shows the first model specified and tested. The GoF statistics for this model were RMSEA = 0.046 and CFI = 0.980 – both values indicating an excellent GoF. The AGFI was 0.981 and thus also satisfying; $\chi^2(12, n = 154\ 762) = 3649.44; p < 0.001$. The theoretical model was specified taking into account the model of Samdal and Dür (2000) as well as the above-mentioned review of the literature. The final shape of the model was derived a priori from a discussion between the authors. The model consisted of the exogenous constructs social climate (measured by three indicators) and demands (measured by one indicator) which were correlated with each other ($r = 0.21$).

Measures (possible values)	Boys		Girls		11 year olds		13 year olds		15 year olds	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Students enjoy being together (1-5)	2.95	0.95	2.82	0.98	3.04	0.94	2.88	0.97	2.72	0.97
Students are kind and helpful (1-5)	2.69	1.05	2.71	1.04	2.88	1.02	2.64	1.05	2.56	1.03
Students accept me as I am (1-5)	3.00	0.99	2.96	0.98	3.04	1.00	2.95	0.99	2.93	0.95
Pressured by schoolwork (0-4)	2.77	0.91	2.72	0.88	2.95	0.86	2.72	0.87	2.56	0.91
School performance (1-4)	2.67	0.84	2.78	0.81	2.88	0.80	2.71	0.82	2.59	0.83
Feel about school (1-4)	2.74	0.92	2.92	0.86	3.06	0.87	2.76	0.88	2.67	0.88
Cantril ladder (0-10)	7.70	1.70	7.51	1.79	8.01	1.75	7.57	1.71	7.21	1.68
Would you say your health is... (1-4)	3.21	0.71	3.01	0.74	3.21	0.72	3.11	0.73	3.00	0.74
Psychosomatic complaints (1-5)	4.17	0.72	3.90	0.79	4.14	0.75	4.03	0.76	3.92	0.78

Table I.
Means and standard deviations of central measures

Notes: Boys – $n = 75,318$; Girls – $n = 79,444$; 11 year olds – $n = 52,835$; 13 year olds – $n = 53,132$; 15 year olds – $n = 48,795$

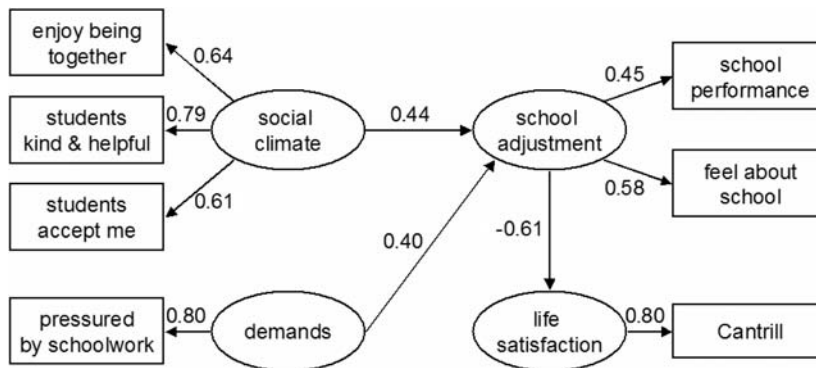


Figure 2.
Structural equation model according to the theoretical model of Samdal and Dür. Standardized coefficient of the Lisrel analysis

Notes: Standardized coefficients of the second SEM. Latent variables are shown in ellipses and observed variables are shown in rectangles. All coefficients are significant. The correlation between social climate and demands (not shown) was part of the model and was $r = 0.21$

Source: Samdal and Dür (2000)

The estimated standardized path coefficient for the causal relationship of social climate to the endogenous construct school adjustment (measured with two indicators) was 0.44. A similar causal effect (0.40) was estimated for the relation of demands on school adjustment. The path coefficient for the causal relationship of the latter construct on the second endogenous construct life satisfaction (measured by 1 indicator) was 0.61. All coefficients were statistically significant. The estimated loadings in the measurement model ranged between 0.45 and 0.79. About 35.4 per cent of the variation in school adjustment and 37.1 per cent of the variance in life satisfaction could be explained with the specified model. See Table II for the raw-correlation coefficients.

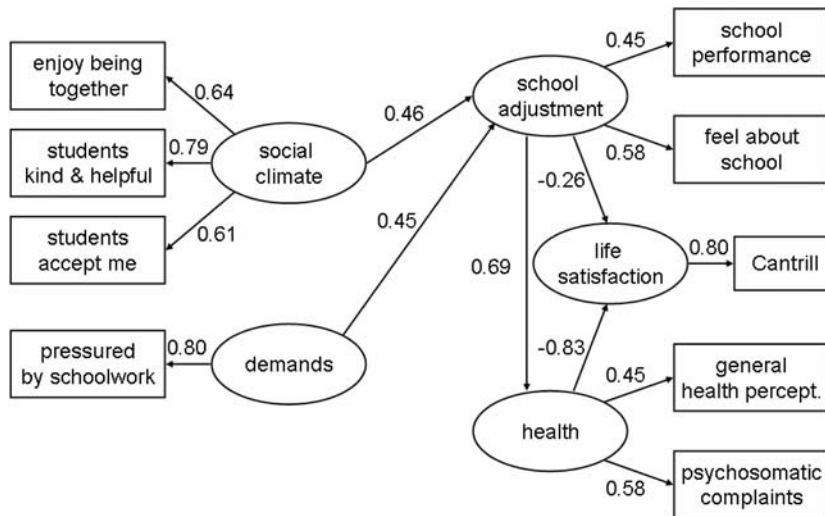
Although displaying an excellent GoF, the model displayed in Figure 2 lacks the important aspect of health. A second SEM was thus specified containing in addition the endogenous construct health (measured with two indicators). Figure 3 shows the structure and the results of the analysis of this model. The GoF of this model was RMSEA = 0.048 and CFI = 0.974 indicating an excellent GoF again; $\chi^2(24, n = 154\ 762) = 7285.05; p < 0.001$. The AGFI was 0.977. The exogenous constructs social climate and demands were correlated with $r = 0.22$. The direct effect of social climate on school adjustment was 0.46 and similar to the direct effect of demands on this construct (0.45). The estimated direct effect of school adjustment on life satisfaction was 0.26. Additionally there was an effect modeled from school adjustment to health (0.69) and from health to life satisfaction (0.83). Thus the indirect effect of school adjustment on life satisfaction was 0.57. This time 41.1 per cent of the variation in school adjustment and 39.6 per cent of the variance in life satisfaction could be explained by the influencing variables. Overall 47.6 per cent of the variance in health was attributable to the school variables. All estimated path coefficients and loadings were statistically significant. The factor loadings in the measurement model ranged from 0.44 to 0.79.

In order to test for gender differences, the above described second model was tested separately for boys and girls data. In summary, the model displayed similar GoF for both girls and boys with slightly better results for the latter; RMSEA = 0.046, CFI = 0.973, and AGFI = 0.979 for boys ($\chi^2(24, n = 75\ 318) = 3260.38; p < 0.001$); RMSEA = 0.048, CFI = 0.977, and AGFI = 0.977 for girls ($\chi^2(24, n = 79\ 444) = 3799.63; p < 0.001$). Statistical significant differences between the estimated

Table II.
Intercorrelation (Pearson correlation coefficient without a priori normalization) of central measures for boys and girls (11-15 years)

	Pearson correlation coefficient							
	v2	v3	v4	v5	v6	v7	v8	v9
Students enjoy being together (v1)	0.50	0.36	0.09	0.11	0.18	0.18	0.17	0.12
Students are kind and helpful (v2)		0.47	0.13	0.13	0.25	0.21	0.17	0.16
Students accept me as I am (v3)			0.13	0.12	0.17	0.22	0.18	0.17
Pressured by schoolwork (v4)				0.14	0.24	0.20	0.16	0.26
School performance (v5)					0.30	0.24	0.22	0.14
Feel about school (v6)						0.23	0.16	0.19
Cantril Ladder (v7)							0.37	0.33
Would you say your health is... (v8)								0.33
Psychosomatic complaints (v9)								

Note: $n=154,762$



Notes: Standardized coefficients of the second SEM separately for girls and boys. All coefficients are significant; all differences between girls and boys are significant. The correlation between social climate and demands (not shown) was part of the model and was $r = 0.25$ for girls and $r = 0.19$ for boys.
Source: Samdal and Dür (2000)

Figure 3. Structural equation model according to the theoretical model of Samdal and Dür enhanced with health. Standardized coefficient of the Lisrel analysis

standardized path coefficient of boys and girls were approximately tested using the formula for the comparison of the correlation coefficients between the same variables but in different samples ($z = [Z_1 - Z_2] / \sqrt{[1 / (n_1 - 3)] + [1 / (n_2 - 3)]}$)^{0.5} where Z_1 and Z_2 are the Fisher Z transformed standardized estimates and n_1 and n_2 are the number of boys and girls (McNemar, 1968). Figure 3 shows that for boys social climate has a stronger influence (0.47) on school adjustment than for girls (0.44) whereas demands stronger influences school adjustment for girls (0.45) than for boys (0.43). According to the work of Cohen (1988) The effect size of these differences ($Z_1 - Z_2$) could be classified as marginal for the former ($Z_1 - Z_2 = 0.038$) and the latter path ($Z_1 - Z_2 = 0.025$). The correlation between social climate and demands was lower for boys ($r = 0.19$) than for girls ($r = 0.25$). The effect size of that difference ($Z_1 - Z_2 = 0.063$) indicated a marginal effect. The influence of school adjustment on life satisfaction was more pronounced for girls (0.23) than for boys (0.20) as well as the influence of school adjustment on health which was 0.69 for boys and 0.75 for girls. The effect of the difference could be classified as marginal for the former ($Z_1 - Z_2 = 0.031$) and small for the latter ($Z_1 - Z_2 = 0.125$). For girls health has a slightly stronger influence on life satisfaction (0.87) than for boys (0.84). The difference in the path coefficients resembled a small effect ($Z_1 - Z_2 = 0.112$).

To test for age differences the analyses were separately repeated for the 11, 13 and 15 year olds. Global GoF was best for the 11 year olds (RMSEA = 0.043; CFI = 0.978; AGFI = 0.981; $\chi^2(24, n = 52\ 835) = 1997.32, p < 0.001$), second best for the 13 year olds (RMSEA = 0.052; CFI = 0.964; AGFI = 0.973; $\chi^2(24, n = 53\ 132) = 3036.83, p < 0.001$), and slightly further decreased for the 15 year olds (RMSEA = 0.054; CFI = 0.962; AGFI = 0.971; $\chi^2(24, n = 48\ 795) = 3004.07, p < 0.001$). Although path

coefficients significantly differed across the age groups (Figure 4) with the effect size of the differences up to small effects ($Z_1 - Z_2 = < 0.304$) only two monotone trends across age groups could be identified: The estimated path coefficient influence of demands on school adjustment was 0.47 for the 11 year olds, 0.43 for the 13 year olds, and decreased to 0.36 for the 15 year olds. The effect size $Z_{11} - Z_{15}$ of the difference was 0.133 which could be classified as small. The influence of school adjustment on health decreased from 0.68 for the 11 year olds to 0.65 for the 13 year olds and to 0.64 for the 15 year olds. The effect size $Z_{11} - Z_{15}$ of the difference was 0.071 which indicates a marginal effect. The correlation between social climate and demands decreased from $r = 0.24$ for the 11 year old to $r = 0.12$ for the 15 year old ($Z_{11} - Z_{15} = 0.124$ (small effect) (see Figure 5)).

Discussion

Two conceptual models about the causal relationship between school environment, school adjustment and health outcomes were specified and tested using means of SEM. The first sparse model containing life satisfaction as final outcome fitted the data in a similar way to a more complex model including health as additional final outcome. However the investigation and interpretations were focused on the latter model as the primary research interest was to highlight the relationship between school variables and health outcomes and not only life satisfaction.

The derived hypotheses were simultaneously tested using means of SEM. The results did not contradict the a priori assumptions: The strong relationship demonstrated between the school environment and school adjustment and the health-related outcomes suggest that school is an important factor influencing the health of students.

The specified SEM could explain the association between the observed variables and the variation in the latent health outcomes well. This finding is noteworthy with

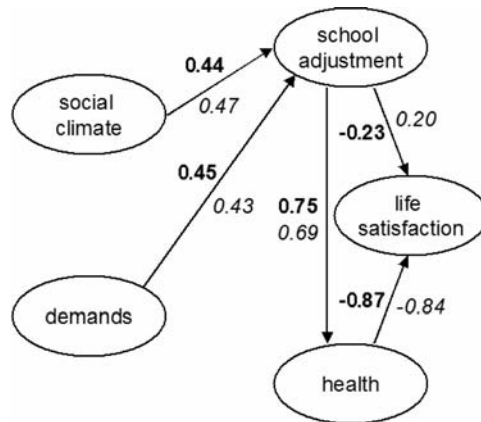
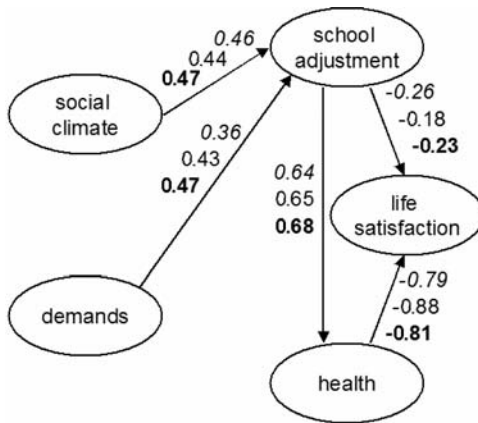


Figure 4. Structural equation model according to the theoretical model of Samdal and Dür (2000) enhanced with health

Note: Standardized coefficients of the second SEM separately for 11 year olds (bold), 13 year olds (normal) and 15 year olds (italics). All coefficients are significant; all differences between age groups are significant. The correlation between social climate and demands (not shown) was part of the model and was $r = 0.24$ (11 year olds), 0.19 (13 year olds) and $r = 0.12$ (15 year olds)

Source: Samdal and Dür (2000)



Note: Standardized coefficient of Lisrel analysis for 11-year olds (**bold**), 13-year olds (normal) and 15-year olds (*italic*) separately
Source: Samdal and Dür (2000)

Figure 5.
Structural equation model
according to the
theoretical model of
Samdal and Dür enhanced
with health

respect to the case that the specified model does not contain “classical” health determinants such as medical diagnoses but is focused solely on school variables.

Overall social climate and school demands displayed similar impacts on school adjustment. Adolescents who reported being less pressured by schoolwork and experiencing a positive social climate at school performed better at school and felt better about school. This positive school adjustment was strongly associated with better health perception, fewer psychosomatic complaints, and a higher life satisfaction. Assuming that the model holds true, the direct effects of school adjustment on life satisfaction was smaller (0.26) than the indirect effect mediated by the health perception (0.57 [0.69*0.83]). The school variables accounted for a large amount of the variance in life satisfaction and health, emphasizing the enormous relevance of the school on adolescents’ lives.

Within a multi group analysis, the question of whether the parameter estimates differ across the subgroups by comparing the GoF of a constraint and an unconstrained modeling was not specifically tested. According to Jonsson (1998) such investigations can only serve as an initial check of statistical interactions. Instead the single parameter estimates were compared across the groups (DeGoede *et al.*, 1999). Examining the path coefficients for boys and girls separately showed that social climate and demands are equally important for girls’ school adjustment whereas school climate was the slightly more important factor for boys’ school adjustment than school demands. Overall girls’ general health, psychosomatic complaints, and life satisfaction seem to be more strongly affected by school environment than boys’. The specified model fitted that data slightly better among the 11-year olds than among their older peers. This decrease might be attributable to the fact that for older children school demands play a less important role for school adjustment, whereas the impact of social school climate remains stable across the surveyed age groups. This finding is surprising as it could have been expected that increasing school demands in higher grades lead to enlarging the influence of this factor on adolescents’ life.

In adolescence, the social support of classmates influences students' health and the well being. Social relationships and support may be seen as crucial components to human life, giving a global sense of belonging or providing situational or task specific support. Social resources could help to cope with stressors and thereby are even protective for health (Berkman and Glass, 2000). Schoolwork and school-related demands should be adjusted to children's developmental level and functioning. On the other hand effective support from teachers, parents and mentors could help to better cope with school demands and consequently to avoid health problems such as subjective health complaints and dissatisfaction with life among students. Academic achievement also has an immediate effect on self-esteem and general well-being. Students who succeed academically tend to enjoy school, while those who fail tend to feel alienated from school (Samdal, 1998). We argue that perceived social support and achievement influence the development of students' self-esteem, self-perception and health behaviors, and these issues eventually affect students' present and future health and life satisfaction. Students disliking school are most likely also failing academically and to be at higher risk for unhealthy behaviors, suffering from psychosomatic complaints and experiencing reduced well-being (Samdal, 1998, Maes and Lievens, 2003). The planning of any health or school intervention program requires the analysis of the complex interaction of these factors and the involvement of significant others.

Limitations of the study

The direction of causality is unclear and the cross-sectional data does not permit to test causal relationship. Assuming that the specified model holds true, there appear to be strong effects of school environment via school adjustment on health and life satisfaction. Yet as mentioned in the introduction the vice versa relationship could be considered as well: a high level of perceived health might predict positive perception of school outcomes.

The limited number of variables used in this study is of concern. Potential confounders which could have been used from the survey are, e.g. experiences of bullying, parental support in school or the socio-economic status of the family. It is suggested that further analyses incorporating these variables are conducted. Such sensitivity analyses reveals if the coefficients found remain stable and if the additional aspects have a unique relevance. Such analyses could for example reveal the extent to which the associations found between the constructs under study are attributable to the socio-economic status influencing all of these constructs – causing the observed associations between them – rather than the influence between these aspects. For example pupils with a higher socio-economic background might be less pressured by schoolwork, experience a more positive school climate, feel and perform better at school, have a better health perception, fewer psychosomatic complaints and higher life satisfaction (Currie *et al.*, 2008; Richter *et al.*, 2008).

Additional limitations of this study comes from the fact that all information were gathered from students, making the results susceptible to same source rather bias. Another important concern is about a potentially overlap in the constructs under study: For example the construct underpinning how a pupils feel about school (school adjustment) might overlap with the construct addressed by whether or not he/she feels accepted by others (social school climate). Feelings about school could also overlap with life satisfaction. Such overlap could result in stronger associations between

constructs and models with a high goodness of fit. However the latter demands that the within construct correlations of indicators are still stronger than the correlation across constructs. Furthermore it has to be taken into account that it might be difficult to measure complex social constructs like school climate, demands or school adjustment with only few items. Measuring school adjustment with the performance in relation to other classmates for example is of limited value in selective classes with overall high performance but a pupil with slight lower performance. Pupils who are unable to perform well at all would be a priori classified as not well adjusted.

Notes

1. Austria, Croatia, the Czech Republic, Denmark, England, Estonia, Finland, Belgium (Flanders and Walloon), France, Germany (Hessen, North Rhine-Westphalia, Berlin, and Saxony), Greece, Greenland, Hungary, Ireland, Italy, Latvia, Lithuania, The former Yugoslav Republic of Macedonia, Malta, The Netherlands, Norway, Poland, Portugal, the Russian Federation, Scotland, Slovenia, Spain, Sweden, Switzerland, Ukraine, and Wales.
2. Canada and the USA.

References

- Aro, H., Hanninen, V. and Paronen, O. (1989), "Social support, life events and psychosomatic symptoms among 14-16-year-old adolescents", *Social Science and Medicine*, Vol. 29, pp. 1051-6.
- Bentler, P.M. (1999), "Comparative fit indexes in structural models", *Psychological Bulletin*, Vol. 107, pp. 238-46.
- Berk, L. and Levin, E.A. (Eds) (2003), *Child Development: A Canadian Perspective*, Pearson, Toronto.
- Berkman, L.F. and Glass, T. (2000), "Social integration, social networks, social support, and health", in Berkman, L.F. and Kawachi, I. (Eds), *Social Epidemiology*, Oxford University Press, Oxford, pp. 137-73.
- Browne, M.W. and Cudeck, R. (1993), "Alternative ways of assessing model fit", in Bollen, K.A. and Long, J.S. (Eds), *Testing Structural Equation Models*, Sage, Thousand Oaks, CA, pp. 136-62.
- Cantril, H. (1965), *The Pattern of Human Concerns*, Rutgers University Press, New Brunswick, NJ.
- Cohen, J. (1988), *Statistical Power Analysis for the Behavioural Sciences*, Erlbaum, New York, NY.
- Cole, M. and Cole, S.R. (Eds) (1996), *The Development of Children*, W.H. Freeman and Company, New York, NY.
- Currie, C., Gabhainn, S.N., Godeau, E., Roberts, C., Smith, R. and Currie, D. (2008), *WHO Regional Office for Europe (Health Policy for Children and Adolescents, No. 5)*, Copenhagen, Inequalities in Young Peoples Health, HBSC International Report from the 2005/2006 Survey.
- Currie, C., Samdal, O., Boyce, W. and Smith, R. (Eds) (2001), "Health behaviour in school-aged children: a World Health Organization cross-national study (HBSC). Research protocol for the 2001/2002 survey", University of Edinburgh, Edinburgh.
- Currie, C., Roberts, C., Morgan, A., Smith, R., Settertobulte, W., Samdal, O. and Barnekow Rasmussen, V. (2004), "Young people's health in context. Health behaviour in school-aged children (HBSC) study: international report from the 2001/2002 survey", WHO Policy Series, *Health Policy for Children and Adolescence*, Issue 4.

- DeGoede, M., Spruijt, E., Iedema, J. and Meeus, W. (1999), "How do vocational and relationship stressors and identity formation affect adolescent mental health?", *Journal of Adolescent Health*, Vol. 25, pp. 14-20.
- Erikson, E.H. (Ed.) (1998), *Life Cycle: Completed Extended Version with New Chapters on the Ninth Stage of Development by Joan M. Erikson*, Norton and Company, New York, NY.
- Garnefski, N. (2000), "Age differences in depressive symptoms, antisocial behaviour, and the negative perceptions of family, schools, and peers among adolescents", *Journal of the American Academy of Child and Adolescent Psychiatry*, Vol. 39, pp. 1175-81.
- Hankin, B.L. and Ambranson, L.Y. (2001), "Development of gender differences in depression: an elaborated cognitive vulnerability-transactional stress theory", *Psychological Bulletin*, Vol. 127, pp. 773-96.
- Hankin, B.L., Abramson, L.Y., Moffitt, T.E., Silva, P.A., Mcgee, R. and Angell, K.E. (1998), "Development of depression from preadolescence to young adulthood: emerging gender differences in a 10 year longitudinal study", *Journal of Abnormal Psychology*, Vol. 107, pp. 128-40.
- Hoge, D.R., Smit, E.K. and Hanson, S.L. (1990), "School experiences predicting changes in self-esteem of sixth- and seventh-grade students", *Journal of Educational Psychology*, Vol. 82, pp. 117-27.
- Hu, L. and Bentler, P.M. (1999), "Cutoff criteria for fit indexes in covariance structure analysis. Conventional criteria versus new alternatives", *Structural Equation Modeling*, Vol. 6, pp. 1-55.
- Jonsson, F.Y. (1998), "Modeling interactions and nonlinear effects: a step-by-step LISREL example", in Schumacker, R.E. and Marcoulides, G.A. (Eds), *Interaction and Nonlinear Effects in Structural Equation Modeling*, Lawrence Erlbaum Associates, London, pp. 43-61.
- Jöreskog, K.G. and Sörbom, D. (Eds) (2001), *LISREL 8: Users's Reference Guide*, Scientific Software International, Lincolnwood, IL.
- Jöreskog, K.G. and Sörbom, D. (Eds) (2002), *PRELIS 2: Users's Reference Guide*, Scientific Software International, Lincolnwood, IL.
- Kasen, S., Johnson, S. and Cohen, P. (1990), "The impact of school emotional climate on student psychopathology", *Journal of Abnormal Child Psychology*, Vol. 18, pp. 165-77.
- King, A. (1998), "School as a healthy environment", in Currie, C. et al. (Eds), *Health-Behaviour in School-aged Children: a WHO Cross-national Study (HBSC). Research Protocol for the 1997/98 Survey*, Research Unit in Health and Behavioural Change, University of Edinburgh, Edinburgh, pp. 60-3.
- Kolip, P. and Schmidt, B. (Eds) (1999), *Gender and Health in Adolescence*, World Health Organisation, Copenhagen.
- Kuperminc, G.P., Leadbeater, B.J. and Blatt, S.J. (2001), "School social climate and individual differences in vulnerability to psychopathology among middle school students", *Journal of School Psychology*, Vol. 39, pp. 141-59.
- Kuperminc, G.P., Leadbeater, B.J., Emmons, C. and Blatt, S.J. (1997), "Perceived school climate and difficulties in the social adjustment of middle school students", *Applied Developmental Sciences*, Vol. 1, pp. 76-88.
- Lerner, R.M. and Galambos, N.L. (1998), "Adolescent development: challenges and opportunities for research, programs, and policies", *Annual Review of Psychology*, Vol. 49, pp. 413-46.
- McDonald, R.P. and Ho, M.H.R. (2002), "Principals and practice in reporting structural equation analyses", *Psychological Methods*, Vol. 7, pp. 64-82.
- McNemar, Q. (Ed.) (1968), *Psychological Statistics*, Wiley, New York, NY.

- Maes, L. and Lievens, J. (2003), "Can school make a difference? A multilevel analysis of adolescents risk and health behaviour", *Social Science and Medicine*, Vol. 56, pp. 517-29.
- Mukoma, W. and Flisher, A.J. (2004), "Evaluations of health promoting schools: a review of nine studies", *Health Promotion International*, Vol. 19, pp. 357-68.
- Murray, C. and Greenberg, M.T. (2000), "Children's relationship with teachers and bonds with school: an investigation of patterns and correlates in middle childhood", *Journal of School Psychology*, Vol. 38, pp. 423-55.
- Natvig, G.K., Albrektsen, A., Anderssen, N. and Qvarnström, U. (1999), "School-related stress and psychosomatic symptoms among school adolescents", *Journal of School Health*, Vol. 69, pp. 362-8.
- Richter, M., Hurrelmann, K., Klocke, A., Melzer, W. and Ravens-Sieberer, U. (2008), *Gesundheit, Ungleichheit und jugendliche Lebenswelten: Ergebnisse der zweiten internationalen Vergleichsstudie im Auftrag der Weltgesundheitsorganisation WHO*, Juventa, Weinheim.
- Roeser, R., Eccles, J.S. and Sameroff, A.J. (2000), "School as a context of early adolescents' academic and social-emotional development: a summary of research findings", *Elementary School Journal*, Vol. 100, pp. 443-71.
- Roeser, R., Midgley, C. and Urdan, T.C. (1996), "Perceptions of the school psychological environment and early adolescents' psychological and behavioural functioning in school: the mediating role of goals and belonging", *Journal of Educational Psychology*, Vol. 88, pp. 408-22.
- Samdal, O. (1998), "Achieving health and educational goals through schools: a study of the importance of school climate and students' satisfaction with school", *Health Education Research*, Vol. 13, pp. 383-97.
- Samdal, O. and Dür, W. (2000), "The school environment and the health of adolescents", in Currie, C., Hurrelmann, K., Settertobulte, W., Smith, R. and Todd, J. (Eds), *Health and Health Behaviour Among Young People WHO Policy Series, Health Policy for Children and Adolescence*, Issue 1, pp. 49-65.
- Samdal, O., Nutbeam, D., Wold, B. and Kannas, L. (1998), "Achieving health and educational goals through schools – a study of the importance of the school climate and the student's satisfaction with school", *Health Education Research*, Vol. 13, pp. 383-97.
- Scheidt, P., Overpeck, M.D., Wyatt, W. and Aszmann, A. (2000), "Adolescents' general health and wellbeing", in Currie, C., Hurrelmann, K., Settertobulte, W., Smith, R. and Todd, J. (Eds), *Health and Health Behaviour Among Young People, WHO Policy Series, Health Policy for Children and Adolescence*, Issue 1, pp. 24-39.
- Schickedanz, J.A., Schickedanz, D.I., Forsyth, P.D. and Forsyth, G.A. (Eds) (2001), *Understanding Children and Adolescents*, Allyn and Bacon, Toronto.
- Seiffge-Krenke, I., Weidemann, S., Fentner, S., Aegenheister, N. and Poebblau, M. (2001), "Coping with school-related stress in healthy and clinically referred adolescents", *European Psychologist*, Vol. 6, pp. 123-32.
- Steinberg, L. and Morris, A.S. (2001), "Adolescent development", *Annual Review of Psychology*, Vol. 52, pp. 83-110.
- Taylor, S.E., Klein, L.C., Lewis, B.P., Gruenewald, T.L., Gurung, R.A.R. and Updegraff, J.A. (2000), "Biobehavioral responses to stress in females: tend-and-befriend, not fight-flight", *Psychological Review*, Vol. 107, pp. 411-29.
- Torsheim, T. and Wold, B. (2001a), "School-related stress, school support, and somatic complaints: a general population study", *Journal of Adolescent Research*, Vol. 16, pp. 293-303.

- Torsheim, T. and Wold, B. (2001b), "School-related stress, support, and subjective health complaints among early adolescents: a multilevel approach", *Journal of Adolescence*, Vol. 24, pp. 701-13.
- Torsheim, T., Aaroe, L.E. and Wold, B. (2001), "Sense of coherence and school-related stress as predictors of subjective health complaints in early adolescence: interactive, indirect or direct relationships?", *Social Science and Medicine*, Vol. 53, pp. 603-14.
- Torsheim, T., Wold, B. and Samdal, O. (2000), "The teacher and classmate support scale: factor structure, test-retest reliability and validity in samples of 13- and 15-year-old adolescents", *School Psychology International*, Vol. 21, pp. 195-212.
- Wagner, B.M. and Compas, B.E. (1990), "Gender, instrumentality and expressivity: moderators of adjustment to stress during adolescence", *American Journal of Community Psychology*, Vol. 18, pp. 383-406.

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