

## The role of interpersonal relationships with peers and with teachers in students' academic achievement

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The purpose of this study was to examine the relation between social and academic variables in different school periods and to investigate, whether affective and motivational factors can be regarded as mediating variables in the relation between social and academic variables in school. 1159 students from three different periods of schooling, covering the age range from late childhood through early to middle adolescence, participated in the study. Different models of relations between social and academic variables were tested using structural equation modeling. The results show that the included mediating variables (well-being in school and academic engagement) do not explain the relation between social relations and academic achievement. In younger students, peer relations are related to students' academic achievement, which does not hold true for both older age groups. Relations to teachers are related to students' academic outcomes in all periods of schooling. The results also suggest that the method of data assessment is a very important factor in establishing the relations between variables.

*Key words:* peer relations, teacher-student relations, academic achievement, psychological assessment, structural equation modeling

### *Social and academic variables in educational research*

In the past, academic and social variables were regarded as two completely separated aspects of motivation. Recently, these beliefs have been changed radically; namely, academic and social variables can be intertwined in a number of ways, as for example (Weiner, 1996):

- (1) Feelings of rejection, the lack of social support and dissatisfaction of social needs influence academic motivation and performance in school; students feeling lonely in the classroom are more likely to give up in learning situations and have a higher rate of school drop-out.
- (2) Students' academic achievement and their choice of peer groups are related; students having similar achievement strivings tend to form friendships and peer groups.
- (3) Peers also act as models of appropriate academic, as well as social behavior.

Recently, the researchers in the field of academic motivation started to be increasingly oriented to the investigation of the effect of social and emotional factors on academic motivation and achievement. Numerous authors (e.g. Dweck, 1996; Weiner, 1996; Wentzel, 1996a) stress that in the past, academic achievement and social motivation were studied separately and that the reciprocal interaction between the two constructs was not taken into consideration. This also holds true for the research in school context where the relation between academic and social factors in students has been investigated only recently.

Two most frequent and important forms of social relations that students form and maintain in school are relations to teachers and to peers. In the next part of the article, the importance of the two forms of social relations is discussed in detail.

### *The role of teacher support and involvement*

Contemporary studies (e.g. Kindermann, 1993; Ryan, Stiller, & Linch, 1994; Wentzel, 1998) mostly investigate the influence of relations to peers and to teachers on students' academic motivation, and consequently on their academic achievement. Studies examining the role of relations to teachers in students' academic achievement variables originate mainly from the self-determination theory (Connell & Wellborn, 1991; Deci & Ryan, 2000-2001) which stresses the need for relatedness as one of the basic psychological needs. According to this theory, teachers' involve-

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ment is crucial for the satisfying the need for relatedness. This refers to the quality of interpersonal relations with students and is manifested through teachers having time for students, expressing positive feelings towards them, being flexible to their needs, etc. Teacher's involvement seems to be the strongest predictor of students' academic motivation, amongst all of the other presumably important dimensions of teachers' behavior. The students of highly involved teachers perceive their teachers not only as involved, but also as giving more structure and support to student's autonomy, independently of the teacher's actual behavior on these two dimensions (Furrer & Skinner, 2003; Skinner & Belmont, 1993). The sense of relatedness tapped by the measures of school climate and the quality of teacher-student relations, as well as the feelings of belonging, acceptance, importance, and interpersonal support, are related to important academic outcomes, including self-efficacy, expectations of success, achievement values, positive affect, effort, engagement, interest in school, task goal orientation, and grades (see Furrer & Skinner, 2003). Feeling related in the school context gives students a sense of importance and thereby enhances their activity (Furrer & Skinner, 2003).

Wentzel (1993) reported that teachers' liking of students is positively related to students' academic achievement. Students forming positive relations to their teachers have more positive attitudes towards school and like school more (Skinner & Belmont, 1993). In classrooms where teachers report that they respond to students' academic, as well as social needs, students report that they ask for help more frequently (Ryan, Gheen, & Midgley, 1998). Also, the relation to teachers plays an important role in some inappropriate behaviors in school such as cheating at tests; students that report to have a good relation with their teacher also report less cheating (Murdock, Hale, & Weber, 2001; Murdock, Miller, & Kohlhardt, 2004). Similarly, Ryan, & Patrick (2001) found that 8<sup>th</sup> grade students that perceiving teachers' support also report about having more self-regulative learning and less misbehavior compared to their behavior in the 7<sup>th</sup> grade.

#### *The relation between peer relations and students' school performance*

The second research direction in the investigation of the effect of social factors on academic variables is represented by studies of the relation between peer relations and academic achievement. The results of these studies (e.g. Hatzuchtistou & Hopf, 1996; Ollendick, Weist, Burden, & Greene, 1992; Wentzel, 1991; Wentzel & Asher, 1995; Wentzel & Caldwell, 1997) indicate positive relation between peer relations and students academic performance. The results (e.g. Chen, Chang, & He, 2003; Guay, Boivin, & Hodges, 1999; Wentzel, 1993; Wentzel & Caldwell, 1997) mostly indicate that students feeling more accepted by their peers also achieve more. It is likely that this relation is mediated by emotional

and motivational factors (Kupersmidt, Buchele, Voegler, & Sedikides, 1996; Wentzel, 1996b, 1998). However, the nature of the relation between social and academic variables in students still remains unclear.

#### *Students' social acceptance in relation to their academic outcomes*

Peer relations have already been studied in relation to various academic outcomes. The results of such studies consistently show that popular students are those usually achieving better outcomes and that rejected students are frequently those having learning difficulties (e.g. Wentzel, 1991). These findings were most consistent when academic outcomes were measured by students' grades (Hatzuchtistou & Hopf, 1996; Wentzel, 1991; Wentzel & Caldwell, 1997), although peer acceptance was also found to be related to standardized test achievements (Austin & Draper, 1984), as well as to students' intelligence (Wentzel, 1991). Students of lower sociometric in-class status, especially rejected students, represent a group of higher risk for learning difficulties and school drop-out (Hatzuchtistou & Hopf, 1996; Ollendick et al., 1992). This holds especially true for aggressive rejected students (Wentzel & Asher, 1995).

#### *Students' friendships in relation to their academic outcomes*

Wentzel and Caldwell (1997) conducted a longitudinal study of the relation between students' friendships and their academic achievement. The results of this study showed that the relation between having a friend and academic outcomes held stable in the period of two years. In another longitudinal study, Wentzel, McNamara Barry and Caldwell (2004) investigated the influence of friendships on motivation and school adjustment of early adolescents. Students without reciprocal friendships were less prosocial, had lower academic outcomes and reported more emotional distress compared to their peers with reciprocal friendships.

#### *Perceived peer support and students' academic variables*

The perception of peer and teacher support is regarded as an especially important factor in the students' achievement of learning goals. The students believing their peers support and care for them are usually more engaged in positive classroom behaviors compared to the students which do not perceive such a support (Wentzel, 1994, 1997). The latter group of students represents a group having a higher risk to develop learning difficulties (Goodenow, 1993).

*Relations to teachers versus relations to peers*

In younger students, Birch and Ladd (1997) found a positive relation between students' peer relations and their relations to teachers. Teachers provide unpopular students with more corrective feedback and popular students with more positive reinforcement (White, Sherman, & Jones, 1996). Teacher's behavior towards students exerts an especially strong influence on other students' perceptions of this student in preschoolers and younger school children. At this age, students form more positive relations with peers who also have more supportive and less conflictive relations with teachers (Ladd, Birch, & Buhs, 1999; Taylor, 1989). Birch and Ladd (1996) argue that relations to peers and relations to teachers probably predict different aspects of school adjustment. In some situations, the relation between these two forms of relations can also be compensatory. The results of the study investigating the characteristics of early adolescents without friends (Wentzel & Asher, 1995) show that teachers' liking of students can soften the negative effects of peer rejection on students' school adjustment. In any case, the (in)congruity of student's popularity by peers and by teachers represents an important piece of information about the student's position in the classroom.

As indicated by Wentzel (2003), the strength of peer influence in relation to the influence of adults is one of the crucial research questions in the field of school adjustment. However, both social factors of students' academic achievement – i.e. relations to teachers and to peers – were rarely examined simultaneously. Likewise, when taking into account the social development in late childhood and adolescence, it is reasonable to expect that the relative importance of both forms of relationships for students' academic achievement change during different periods of schooling. Wentzel (2003) emphasized that school adjustment and factors which influence it should be investigated from a developmental perspective – taking into account students developmental abilities and tasks. Nevertheless, the studies in this field mostly focus on one single period of schooling and less on the possible changes in relations between social, emotional, and motivational factors and academic achievement, which might result due to developmental changes.

*Some developmental changes in transition to adolescence*

In late childhood and adolescence, peer relations become increasingly important. During the childhood, peer groups enlarge and become less supervised by adults (Gifford-Smith & Brownell, 2003). In early adolescence, the role of peers as a source of emotional and instrumental support becomes even more important than it was in the childhood. Peers also become an important factor in organizing spare time and act as a factor of sexual satisfaction and identity formation. Also, early adolescence is an espe-

cially critical period for students' learning beliefs and behaviors (Eccles & Midgley, 1989). For some early adolescents, the increase in self-reflection, autonomy and identity exploration leads to new academic interests, an increase in self-regulative learning and commitment to education (Goodenow, 1993). But for many adolescents this is also a period of doubts in their abilities to succeed in academic activities, questioning the value and meaning of school work and consequently the decline of academic effort. The social environment in the classroom that includes perceived teacher, as well as perceived peer support, is therefore crucial for this period. Thus, early adolescence represents an especially sensitive period. For many adolescents, this is a period of decrease in their academic achievement (Ryan & Patrick, 2001).

In transition to adolescence the conflict between social and academic goals is also more frequent than in childhood. Such incongruities occur when students try to simultaneously satisfy the expectations of teachers and of peers which can sometimes collide. Also, the incongruities between students' academic values and those of their friends can appear. As emphasized by Juvonen (1996), such situations have still not been sufficiently investigated and deserve more research attention.

*Mediating variables in relation between measures of students' interpersonal relationships and their academic achievement*

Mediating processes between social relations in school and students academic outcomes represent another research area that has not been explained sufficiently. With the reference to the relation between social acceptance and academic variables, Wentzel (1991; also Wentzel & Asher, 1995) hypothesized four possible explanations of this connection:

- Positive peer relations influence students' sense of relatedness which has a positive effect on students' learning motivation, as predicted by the self-determination theory. Consequently, students having a better accepted of their peers also achieve more.
- The relation between social and academic variables can be explained by students' self-regulatory skills. More mature and independent students are more self-confident, having a better impulse control, and probably out of this reason are more successful in school, as well as better accepted by their peers.
- Students accepted by their peers are usually also more accepted by their teachers, as well. In contrast to this, teachers are more critical towards rejected students and offer them less help, which can lead to lower academic outcomes of these students.
- It is also possible that students' academic reputation is directly related to their social acceptance; the students achieving more are also more liked by their peers.

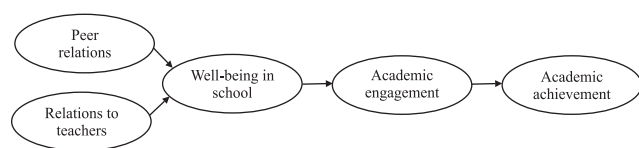


Figure 1. The presumed model of relations between social, emotional, motivational, and academic variables

Wentzel (2003) hypothesized that the relation between students' interpersonal relations and their academic behavior is mediated by some affective variables. The students that do not perceive teacher and peer support can experience psychological discomfort or distress which in turn increases their orientation towards themselves and reduces the possibility of their positive orientation towards learning and social interactions. Author also stresses the need for the development and testing of theoretical models explaining the relation between social motivation and academic variables. Likewise, Covington (2000) emphasizes the importance of multivariate studies that longitudinally track the joint effect of cognitive, motivational, social, and emotional factors on academic achievement. The nature of the relation between social and academic variables is still quite unclear, but the results of some studies show that the assumption of affective mediating variables could be correct (see e.g. Wentzel, 1998; Wentzel & Caldwell, 1997).

The main purpose of the study is to establish the predictive value of the quality of peer relations and relations with teachers for students' academic achievement in different school periods. It is hypothesized that the relations with peers and with teachers independently influence students' academic achievement, and that this influence is mediated by students' well-being in school and academic engagement. The causal model based on the models of Connell and Wellborn (1991) and Wentzel (1998) is presented in Figure 1.

In this model, it is hypothesized that students with more positive relations to peers and to teachers experience school as more pleasant and are therefore more engaged in school work. Higher school engagement results in better academic achievement. The relation between separate constructs in the model was already established in various studies (Furrer & Skinner, 2003; Hatzuchtistou & Hopf, 1996; Ollendick et al., 1992; Wentzel, 1991, 1994; Wentzel & Caldwell, 1997; Wentzel et al., 2004).

In addition, we wanted to establish the relation between the quality of relationships with teachers and with peer in different school periods and to evaluate different methods for assessing these variables.

## METHOD

### Participants

All together 1159 students from 49 classrooms of Slovenian elementary and secondary schools participated in the study. This includes 424 4<sup>th</sup> grade elementary school students (mean age 9.80 years; 51% male), 404 7<sup>th</sup> grade elementary school students (mean age 12.93 years; 54% male), and 331 2<sup>nd</sup> year high school students (mean age 15.98 years; 48% male). From the developmental point of view, participants covered the age range from late childhood to early and middle adolescence. Also 49 teachers assessed their students on different measures.

In the sample of secondary school students all forms of secondary school education were represented. Sampling was proportional, considering the data of the Ministry of Education and Sport about the enrolment structure of the secondary school programs.

### Variables and instruments

The model tested in the study consists of the following variables: peer relations, relations to teachers, well-being in school, academic engagement, and academic achievement. The data was gathered using three different sources: students' self-report, teacher assessment, and peer nominations. For each variable included in the model at least two sources were used.

### Measures of peer relations

*Social preference.* Social preference was assessed by sociometric nominations (*like most* and *like least*). It was defined as a difference between standardized positive and negative nominations and is a measure of student's relative likableness (Coie, Dodge, & Coppotelli, 1982). Students were asked to name three schoolmates they liked most and three they liked least.

*Peer perceived popularity.* Students were asked to name three most popular classmates in their classroom. The number of nominations for each student was standardized within classrooms. These standardized values were used as a measure of perceived peer popularity.

*Number of friendships.* Students were asked to name three members of their classroom that were their best friends. The standardized number of nominations each student received was used as a measure of student's friendships.

*Number of reciprocal friendships.* The number of reciprocal friendships was determined for each student. After that, this variable was standardized within classrooms.

*Peer academic and personal support.* Two subscales from the *Classroom Life Instrument* (Johnson, Johnson, &

Anderson, 1983) were used to assess the perceived academic (e.g. *Other students care about how much I learn*) and personal peer support (e.g. *Other students like me the way I am*). These two scales were translated into Slovene and adapted for the purposes of this study. The Peer Academic Support Scale consists of four items; alpha coefficient was .68. The Peer Personal Support Scale consists of five items, alpha coefficient was .78. Students rated the items using a 5-point scale (1- never true for me; 5 – always true for me).

#### *Measures of relations to teachers*

*Teacher's liking of the students.* Teachers received the following instruction: "With regard to the numerous differences between the students, it is normal and human that the teacher does not like all students in the same way, although he/she behaves equally fair to all of them. For all of the students in the class please indicate how much you like would to have the particular student in your class next year". The rating scale was a 5-point scale (1- not at all; 5 – very much).

*Peer perceived relation with teachers.* Students were asked to name three or less classmates that have the best relations with teachers. The within classrooms standardized number of nominations that each student received was used as a measure of peer perceived relation with teachers.

*Teacher academic and teacher personal support.* Teacher academic support and Teacher personal support scales which form a part of the already mentioned *Classroom Life Instrument* were used to assess students' perceptions of both, teacher academic (e.g. *My teacher likes to help me learn*) and personal support (e.g. *My teacher really cares about me*). Both scales consisted of four items. The rating scale is the same as for peer support scales. Students were instructed bear in mind the majority of teachers. Alpha coefficient of internal consistency is .70 for Teacher Academic Support Scale and .74 for Teacher Personal Support.

#### *Measures of students' well-being in school*

*Teacher report of students well-being in school.* Teachers assessed the degree to which every single student felt well/was satisfied in school using a 5-point rating scale (1 – very unsatisfied/feels very bad; 5 – very satisfied/feels very well).

*Self-reported well-being in school.* Students' well-being in school was assessed using the *Scale of Well-Being in School* (Keller, Moser, & Rhyn, 1996), a shorter version of the Scale of Subjective Well-Being (Moser, Bless, & Haerberlin, 1989). Students with a high score on this scale feel good in school and like going to school (Moser, Bless, & Haerberlin, 1989). The shorter version consists of five items with a 5-point rating scale (1- never true for me; 5 – always true for me). The scale consists of items like *I like going to*

*school*. The scale was translated into Slovene and adapted for the purpose of the study. The internal consistency coefficient was .90.

#### *Measures of academic engagement*

*Self-reported academic engagement.* The behavioral and cognitive engagement in schoolwork scale (Assor, Kaplan, & Roth, 2002) was used to assess students' perceptions of their academic engagement. The scale was translated into Slovene and adjusted for this study. The scale consists of six items (e.g. *I do more than what I am required*). Students rated the items on a 5-point scale. The internal consistency coefficient was .74.

*Teacher report of students' academic engagement.* The scale described above was adjusted for the teachers, as well. This version consisted of five items. The item *In classes I try to look busy, but I really do not pay attention* was missed out. Teachers rated the items for every single student using a 5-point scale (1 – never; 5 – always). The alpha coefficient for this scale was .91.

*Peer perceived academic engagement.* Students named three or fewer classmates that were most engaged in lessons. The within classrooms standardized number of nominations for each student was used as a measure of peer perceived academic engagement.

#### *Measures of academic achievement*

##### *GPA in the previous school year.*

*Peer perceived academic achievement.* Students were instructed to name three or less best students in their class. The within classroom standardized number of nominations for each students was regarded as a measure of peer perceived academic achievement.

#### *Procedure*

The data was collected at the beginning of the school year. The questionnaires for students were administered collectively in the classrooms. Students were told they should report about their relations with other students and teachers, the characteristics of their classroom, their well-being in school and about how they engage in schoolwork. Students first answered the peer nomination procedures and then the self-report scales. During the classroom testing teachers were asked to complete the items in which they assessed students in their class.

## RESULTS

Descriptive statistics and the correlations between manifest variables are presented in Table 1. Evidently, the source of assessing the variable is an important factor of the size of

Table 1  
Descriptive statistics and correlations between variables included in the model for all pupils together and in different school periods

|   | M                     | SD   | 1    | 2   | 3   | 4   | 5   | 6    | 7    | 8   | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |  |
|---|-----------------------|------|------|-----|-----|-----|-----|------|------|-----|---|----|----|----|----|----|----|----|----|--|
| 1. Social preference                                | 4 <sup>th</sup> grade | 0.00 | 1.63 |     |     |     |     |      |      |     |   |    |    |    |    |    |    |    |    |  |
|   | 7 <sup>th</sup> grade | 0.00 | 1.61 | -   |     |     |     |      |      |     |   |    |    |    |    |    |    |    |    |  |
|   | 2 <sup>nd</sup> grade | 0.00 | 1.60 |     |     |     |     |      |      |     |   |    |    |    |    |    |    |    |    |  |
|   | Together              | 0.00 | 1.59 |     |     |     |     |      |      |     |   |    |    |    |    |    |    |    |    |  |
| 2. Popularity <sup>a</sup>                          | 4 <sup>th</sup> grade | 1.80 | 2.66 | .49 |     |     |     |      |      |     |   |    |    |    |    |    |    |    |    |  |
|   | 7 <sup>th</sup> grade | 2.00 | 3.03 | .41 | -   |     |     |      |      |     |   |    |    |    |    |    |    |    |    |  |
|   | 2 <sup>nd</sup> grade | 2.02 | 3.23 | .28 |     |     |     |      |      |     |   |    |    |    |    |    |    |    |    |  |
|   | Together              | 1.92 | 2.95 | .40 |     |     |     |      |      |     |   |    |    |    |    |    |    |    |    |  |
| 3. Friendship                                       | 4 <sup>th</sup> grade | 2.55 | 1.85 | .70 | .39 |     |     |      |      |     |   |    |    |    |    |    |    |    |    |  |
|   | 7 <sup>th</sup> grade | 2.52 | 1.84 | .73 | .47 | -   |     |      |      |     |   |    |    |    |    |    |    |    |    |  |
|   | 2 <sup>nd</sup> grade | 2.30 | 1.51 | .60 | .31 |     |     |      |      |     |   |    |    |    |    |    |    |    |    |  |
|   | Together              | 2.47 | 1.76 | .68 | .39 |     |     |      |      |     |   |    |    |    |    |    |    |    |    |  |
| 4. Reciprocal friendship                            | 4 <sup>th</sup> grade | 1.12 | 1.00 | .42 | .29 | .54 |     |      |      |     |   |    |    |    |    |    |    |    |    |  |
|   | 7 <sup>th</sup> grade | 1.27 | 1.06 | .50 | .37 | .64 | -   |      |      |     |   |    |    |    |    |    |    |    |    |  |
|   | 2 <sup>nd</sup> grade | 1.60 | 1.02 | .35 | .22 | .57 |     |      |      |     |   |    |    |    |    |    |    |    |    |  |
|   | Together              | 1.18 | 1.02 | .43 | .30 | .58 |     |      |      |     |   |    |    |    |    |    |    |    |    |  |
| 5. Student academic support                         | 4 <sup>th</sup> grade | 3.55 | 0.86 | .14 | .12 | .06 | .08 |      |      |     |   |    |    |    |    |    |    |    |    |  |
|   | 7 <sup>th</sup> grade | 3.16 | 0.71 | .22 | .11 | .14 | .10 | -    |      |     |   |    |    |    |    |    |    |    |    |  |
|   | 2 <sup>nd</sup> grade | 3.28 | 0.69 | .17 | .03 | .10 | .12 |      |      |     |   |    |    |    |    |    |    |    |    |  |
|   | Together              | 3.34 | 0.78 | .18 | .09 | .10 | .10 |      |      |     |   |    |    |    |    |    |    |    |    |  |
| 6. Student personal support                         | 4 <sup>th</sup> grade | 3.78 | 0.80 | .13 | .11 | .03 | .06 | .73  |      |     |   |    |    |    |    |    |    |    |    |  |
|   | 7 <sup>th</sup> grade | 3.40 | 0.74 | .28 | .18 | .26 | .17 | .65  | -    |     |   |    |    |    |    |    |    |    |    |  |
|   | 2 <sup>nd</sup> grade | 3.49 | 0.65 | .18 | .09 | .12 | .16 | .70  |      |     |   |    |    |    |    |    |    |    |    |  |
|   | Together              | 3.56 | 0.75 | .19 | .12 | .13 | .12 | .71  |      |     |   |    |    |    |    |    |    |    |    |  |
| 7. Teacher's liking                                 | 4 <sup>th</sup> grade | 4.48 | 0.89 | .30 | .16 | .14 | .11 | -.01 | .00  |     |   |    |    |    |    |    |    |    |    |  |
|   | 7 <sup>th</sup> grade | 4.12 | 1.06 | .22 | .02 | .16 | .13 | .04  | -.01 | -   |   |    |    |    |    |    |    |    |    |  |
|   | 2 <sup>nd</sup> grade | 4.28 | 0.89 | .15 | .06 | .03 | .07 | .02  | .00  |     |   |    |    |    |    |    |    |    |    |  |
|   | Together              | 4.30 | 0.96 | .23 | .08 | .11 | .11 | .04  | .02  |     |   |    |    |    |    |    |    |    |    |  |
| 8. Relations to teachers (peer report) <sup>b</sup> | 4 <sup>th</sup> grade | 2.14 | 3.28 | .33 | .46 | .24 | .24 | .06  | .07  | .18 |   |    |    |    |    |    |    |    |    |  |
|   | 7 <sup>th</sup> grade | 2.35 | 4.22 | .11 | .21 | .13 | .14 | .01  | -.01 | .33 | - |    |    |    |    |    |    |    |    |  |
|   | 2 <sup>nd</sup> grade | 2.35 | 4.78 | .06 | .29 | .03 | .15 | .09  | .15  | .26 |   |    |    |    |    |    |    |    |    |  |
|   | Together              | 2.27 | 4.08 | .20 | .34 | .15 | .18 | .04  | .05  | .23 |   |    |    |    |    |    |    |    |    |  |

|   | M    | SD   | 1          | 2          | 3            | 4          | 5          | 6          | 7          | 8          | 9          | 10         | 11         | 12         | 13         | 14         | 15         | 16         | 17 |
|---|------|------|------------|------------|--------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|----|
| 9. Teacher academic support                         | 4.35 | 0.62 | -0.05      | .00        | -0.04        | .02        | <b>.41</b> | <b>.34</b> | .01        | .01        |            |            |            |            |            |            |            |            |    |
| 7 <sup>th</sup> grade                               | 3.69 | 0.68 | -0.08      | -0.05      | <b>-0.11</b> | -0.08      | <b>.40</b> | <b>.11</b> | .00        | <b>.12</b> | -          |            |            |            |            |            |            |            |    |
| 2 <sup>nd</sup> grade                               | 3.54 | 0.68 | .09        | -0.04      | .00          | -0.02      | <b>.36</b> | <b>.24</b> | .10        | .08        |            |            |            |            |            |            |            |            |    |
| Together  | 3.89 | 0.74 | -0.01      | -0.04      | -0.04        | -0.02      | <b>.43</b> | <b>.29</b> | <b>.08</b> | .02        |            |            |            |            |            |            |            |            |    |
| 10. Teacher personal support                        | 4.12 | 0.82 | .00        | .08        | -0.04        | -0.08      | <b>.41</b> | <b>.40</b> | .12        | .01        | <b>.56</b> | -          |            |            |            |            |            |            |    |
| 4 <sup>th</sup> grade                               | 3.22 | 0.80 | -0.06      | -0.12      | -0.10        | -0.07      | <b>.37</b> | <b>.21</b> | <b>.13</b> | <b>.22</b> | <b>.63</b> | -          |            |            |            |            |            |            |    |
| 7 <sup>th</sup> grade                               | 3.14 | 0.67 | .00        | -0.03      | -0.05        | -0.06      | <b>.37</b> | <b>.30</b> | .08        | <b>.16</b> | <b>.61</b> |            |            |            |            |            |            |            |    |
| 2 <sup>nd</sup> grade                               | 3.53 | 0.90 | -0.01      | -0.02      | -0.06        | -0.06      | <b>.43</b> | <b>.37</b> | <b>.16</b> | <b>.09</b> | <b>.69</b> |            |            |            |            |            |            |            |    |
| Together  | 4.24 | 0.87 | <b>.36</b> | <b>.34</b> | <b>.19</b>   | <b>.18</b> | .06        | .07        | <b>.53</b> | <b>.32</b> | -0.07      | .09        |            |            |            |            |            |            |    |
| 11. Well-being in school (teacher report)           | 3.79 | 0.96 | <b>.27</b> | <b>.19</b> | <b>.25</b>   | <b>.16</b> | .08        | <b>.11</b> | <b>.50</b> | <b>.28</b> | -0.05      | -0.01      |            |            |            |            |            |            |    |
| 4 <sup>th</sup> grade                               | 3.95 | 0.82 | <b>.25</b> | <b>.12</b> | .02          | .06        | .05        | .08        | <b>.53</b> | <b>.28</b> | .11        | <b>.16</b> | -          |            |            |            |            |            |    |
| 7 <sup>th</sup> grade                               | 4.00 | 0.91 | <b>.27</b> | <b>.22</b> | <b>.17</b>   | <b>.14</b> | <b>.11</b> | <b>.13</b> | <b>.53</b> | <b>.27</b> | <b>.08</b> | <b>.16</b> |            |            |            |            |            |            |    |
| Together  | 3.94 | 0.96 | <b>.11</b> | .06        | .08          | .05        | <b>.39</b> | <b>.39</b> | <b>.16</b> | <b>.15</b> | <b>.37</b> | <b>.37</b> | <b>.15</b> |            |            |            |            |            |    |
| 12. Well-being in school (self-report)              | 2.93 | 0.99 | .07        | .03        | .02          | .00        | <b>.31</b> | <b>.20</b> | <b>.13</b> | <b>.15</b> | <b>.32</b> | <b>.34</b> | .06        | -          |            |            |            |            |    |
| 4 <sup>th</sup> grade                               | 3.16 | 0.84 | .09        | .11        | .08          | <b>.12</b> | <b>.25</b> | <b>.28</b> | .08        | <b>.20</b> | <b>.28</b> | <b>.29</b> | <b>.14</b> |            |            |            |            |            |    |
| 7 <sup>th</sup> grade                               | 3.37 | 1.04 | <b>.10</b> | .05        | .05          | .04        | <b>.38</b> | <b>.35</b> | <b>.17</b> | <b>.12</b> | <b>.45</b> | <b>.47</b> | <b>.19</b> |            |            |            |            |            |    |
| Together  | 3.92 | 0.88 | <b>.37</b> | <b>.34</b> | <b>.18</b>   | <b>.15</b> | .01        | .06        | <b>.53</b> | <b>.45</b> | -0.08      | <b>.13</b> | <b>.64</b> | <b>.11</b> |            |            |            |            |    |
| 13. Engagement (teacher report)                     | 3.54 | 0.99 | <b>.21</b> | .05        | <b>.17</b>   | <b>.11</b> | -0.02      | .01        | <b>.54</b> | <b>.49</b> | .03        | <b>.13</b> | <b>.44</b> | <b>.14</b> | -          |            |            |            |    |
| 4 <sup>th</sup> grade                               | 3.44 | 0.83 | <b>.07</b> | .06        | .04          | .10        | .09        | .04        | <b>.60</b> | <b>.41</b> | .09        | <b>.15</b> | <b>.49</b> | <b>.19</b> |            |            |            |            |    |
| 7 <sup>th</sup> grade                               | 3.65 | 0.93 | <b>.27</b> | <b>.15</b> | <b>.14</b>   | <b>.12</b> | <b>.07</b> | <b>.08</b> | <b>.56</b> | <b>.41</b> | <b>.12</b> | <b>.23</b> | <b>.54</b> | <b>.22</b> |            |            |            |            |    |
| Together  | 4.22 | 0.62 | <b>.15</b> | <b>.13</b> | .02          | .02        | <b>.22</b> | <b>.31</b> | <b>.22</b> | <b>.21</b> | <b>.28</b> | <b>.29</b> | <b>.24</b> | <b>.38</b> | <b>.29</b> |            |            |            |    |
| 14. Engagement (self-report)                        | 3.59 | 0.65 | -0.05      | -0.09      | -0.11        | -0.12      | <b>.20</b> | <b>.03</b> | <b>.22</b> | <b>.28</b> | <b>.44</b> | <b>.41</b> | <b>.08</b> | <b>.49</b> | <b>.30</b> | -          |            |            |    |
| 4 <sup>th</sup> grade                               | 3.43 | 0.55 | -0.05      | .03        | -0.05        | .01        | .05        | .00        | <b>.16</b> | <b>.31</b> | <b>.40</b> | <b>.36</b> | <b>.20</b> | <b>.33</b> | <b>.27</b> |            |            |            |    |
| 7 <sup>th</sup> grade                               | 3.78 | 0.70 | .03        | .01        | -0.04        | -0.03      | <b>.24</b> | <b>.21</b> | <b>.23</b> | <b>.18</b> | <b>.52</b> | <b>.51</b> | <b>.23</b> | <b>.52</b> | <b>.36</b> |            |            |            |    |
| Together  | 2.42 | 3.71 | <b>.37</b> | <b>.43</b> | <b>.27</b>   | <b>.21</b> | .01        | .04        | <b>.16</b> | <b>.67</b> | -0.02      | .06        | <b>.29</b> | <b>.09</b> | <b>.45</b> | <b>.20</b> |            |            |    |
| 15. Engagement <sup>a</sup> (peer-report)           | 2.40 | 4.25 | .09        | <b>.16</b> | <b>.10</b>   | <b>.12</b> | .01        | .01        | <b>.31</b> | <b>.77</b> | <b>.12</b> | <b>.20</b> | <b>.39</b> | <b>.12</b> | <b>.50</b> | <b>.29</b> | -          |            |    |
| 4 <sup>th</sup> grade                               | 2.42 | 4.66 | .08        | <b>.26</b> | <b>.06</b>   | <b>.13</b> | -0.04      | -0.02      | <b>.33</b> | <b>.66</b> | .06        | <b>.14</b> | <b>.32</b> | <b>.17</b> | <b>.45</b> | <b>.35</b> |            |            |    |
| 7 <sup>th</sup> grade                               | 2.42 | 1.18 | <b>.21</b> | <b>.30</b> | <b>.16</b>   | <b>.16</b> | -0.01      | 0.00       | <b>.24</b> | <b>.70</b> | .00        | <b>.07</b> | <b>.28</b> | <b>.08</b> | <b>.43</b> | <b>.19</b> |            |            |    |
| Together  | 4.41 | 0.79 | <b>.37</b> | <b>.33</b> | <b>.20</b>   | <b>.18</b> | -0.04      | .01        | <b>.41</b> | <b>.42</b> | -0.11      | .09        | <b>.44</b> | .03        | <b>.62</b> | <b>.25</b> | <b>.44</b> |            |    |
| 16. Academic achievement                            | 4.14 | 0.90 | <b>.24</b> | <b>.11</b> | <b>.21</b>   | <b>.14</b> | -0.05      | .03        | <b>.51</b> | <b>.50</b> | -0.06      | .08        | <b>.45</b> | .05        | <b>.71</b> | <b>.26</b> | <b>.53</b> | -          |    |
| 4 <sup>th</sup> grade                               | 3.27 | 0.76 | <b>.13</b> | <b>.12</b> | <b>.14</b>   | <b>.20</b> | .09        | .08        | <b>.43</b> | <b>.42</b> | <b>.19</b> | <b>.21</b> | <b>.27</b> | <b>.14</b> | <b>.56</b> | <b>.27</b> | <b>.45</b> |            |    |
| 7 <sup>th</sup> grade                               | 3.97 | 0.95 | <b>.23</b> | <b>.16</b> | <b>.17</b>   | <b>.16</b> | .03        | <b>.08</b> | <b>.42</b> | <b>.35</b> | <b>.18</b> | <b>.27</b> | <b>.38</b> | <b>.16</b> | <b>.64</b> | <b>.40</b> | <b>.37</b> |            |    |
| Together  | 2.41 | 4.15 | <b>.36</b> | <b>.47</b> | <b>.31</b>   | <b>.19</b> | .04        | .02        | <b>.20</b> | <b>.64</b> | -0.04      | .08        | <b>.36</b> | .05        | <b>.46</b> | <b>.12</b> | <b>.68</b> | <b>.44</b> |    |
| 17. Academic achievement (peer report) <sup>a</sup> | 2.47 | 4.92 | <b>.14</b> | <b>.20</b> | <b>.14</b>   | <b>.12</b> | -0.02      | .00        | <b>.27</b> | <b>.74</b> | <b>.11</b> | <b>.20</b> | <b>.28</b> | .07        | <b>.53</b> | <b>.21</b> | <b>.73</b> | <b>.53</b> | -  |
| 4 <sup>th</sup> grade                               | 2.43 | 5.46 | <b>.16</b> | <b>.21</b> | <b>.08</b>   | <b>.14</b> | .06        | .02        | <b>.34</b> | <b>.64</b> | <b>.19</b> | <b>.17</b> | <b>.24</b> | <b>.21</b> | <b>.39</b> | <b>.32</b> | <b>.69</b> | <b>.52</b> |    |
| 7 <sup>th</sup> grade                               | 2.44 | 4.82 | <b>.24</b> | <b>.32</b> | <b>.20</b>   | <b>.15</b> | .02        | -0.02      | <b>.23</b> | <b>.67</b> | -0.01      | .05        | <b>.26</b> | .03        | <b>.41</b> | <b>.10</b> | <b>.70</b> | <b>.35</b> |    |
| Together  |      |      |            |            |              |            |            |            |            |            |            |            |            |            |            |            |            |            |    |

Note. Variables are arranged with regard to belonging latent variables; for measures of interpersonal peer assessment the standardized values are used in correlational analysis; correlations significant at  $p \leq .01$  are marked with bold;  $N$  for 4<sup>th</sup> grade is 428, for 7<sup>th</sup> grade 404, for 2<sup>nd</sup> grade 333, and for all students together 1165; <sup>a</sup> - normalized variable.

the correlations. The correlations between measures gathered from the same source (self-report, teacher report, peer report) are higher than the correlations between measures gathered from different sources, although they might measure the same construct.

*Testing the models about the relations between social and academic variables*

The originally presumed model described above and some alternative models were tested using structural equation modeling. Therefore, the program Lisrel 8.50 was used.

*Model 1: Originally presumed model with mediating variables*

First the model in which relations to peers and teachers effect academic outcomes via students' well-being in school and their school engagement was tested. This model consists of five latent and seventeen manifest variables and is presented in Figure 2.

For variables that do not distribute normally the normalized values were used. These variables are some of the peer interpersonal assessment measures: (1) peer perceived popularity; (2) peer perceived relations with teachers; (3) peer perceived academic engagement and (4) peer perceived academic achievement.

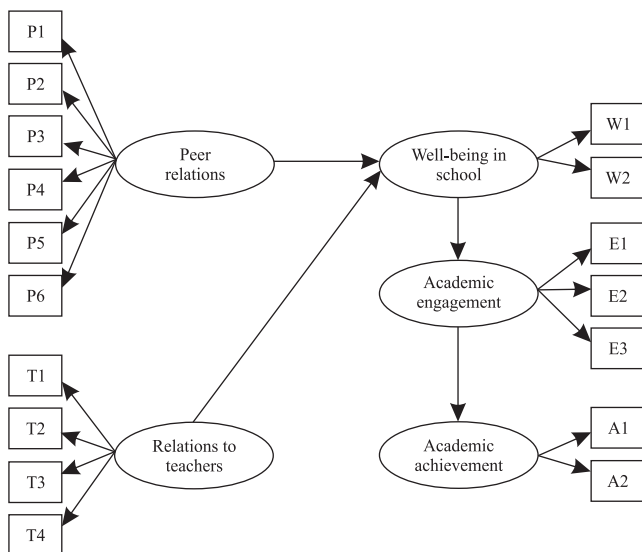


Figure 2. Model 1: model of relations between social and academic variables with mediating variables  
 Note. Definitions of manifest variables are given in Method section. The manifest variables assessed by the same source (self-report, peer nominations, teacher report) are correlated (separately for dependent and for independent variables).

Table 2

Fit indices for the originally presumed model with mediating variables

| Model                                   | df | $\chi^2$  | GFI | AGFI | RMSEA                   |
|---|----|-----------|-----|------|-------------------------|
|   |    |           |     |      | 90% confidence interval |
| Model 1: model with mediating variables |    |           |     |      |                         |
| together                                | 95 | 1071.33** | .89 | .82  | .103 (.097; .110)       |
| 4 <sup>th</sup> grade                   | 95 | 339.99**  | .90 | .83  | .087 (.077; .097)       |
| 7 <sup>th</sup> grade                   | 95 | 457.97**  | .86 | .78  | .106 (.096; .120)       |
| 2 <sup>nd</sup> grade                   | 95 | 369.27**  | .88 | .80  | .099 (.085; .110)       |

Note. The maximum likelihood method was used; GFI – goodness-of-fit-index; AGFI – adjusted goodness-of-fit-index; RMSEA – root mean square error of approximation.

\* $p \leq .05$ ; \*\* $p \leq .01$ .

Also, the factor of the method of data assessment was taken into consideration in the model. The correlations between the manifest variables, gathered from the same source (self-report, peer nominations, teacher report) were set as free parameters.

In Table 2 some fit indices for this originally presumed model tested on all students together and separately for each age group are presented. As suggested by Raykov and Marcoulides (2000) the value of RMSEA or the lower value of the RMSEA confidence interval of less than .05 is indicative of the model being a reasonable approximation of the data.

The originally presumed model did not provide a good fit to the data. The fit for this model is somewhat better when testing it separately for different school periods; it fits best for the students of the 4<sup>th</sup> grade. Because of the inappropriateness of the fit for this model, the model coefficients are not presented.

The adequacy of the parts of the model was established for independent, as well as for dependent variables using confirmatory factor analysis. The fit for the model with relations to peers and to teachers is appropriate (RMSEA= .021). The same is also true for the part of the model with dependent variables (RMSEA= .037). However, if directed relations between dependent variables are predicted (i.e. the influence of well-being in school on academic engagement and academic achievement) the fit is very poor (RMSEA= .246).

*Testing the influence of each kind of relations separately*

In addition, the fit of the models with each independent variable separately was tested, i.e. how the relations to peers and to teachers can independently predict academic outcomes, considering the presumed mediating variables. The fit indices for these two versions of the originally presumed model are presented in Table 3.

Testing the influence of each independent variable separately shows that relations to peers and relations to teach-



Table 3

The fit indices for the versions of the originally presumed model

| Model   | df | $\chi^2$ | GFI | AGFI | RMSEA<br>90% confidence interval |
|---|----|----------|-----|------|----------------------------------|
| Model 1a: model with mediating variables - peers    |    |          |     |      |                                  |
| together  | 52 | 314.13** | .95 | .92  | .071 (.063; .079)                |
| 4 <sup>th</sup> grade                               | 52 | 146.50** | .94 | .89  | .073 (.059; .087)                |
| 7 <sup>th</sup> grade                               | 52 | 113.82** | .95 | .91  | .059 (.044; .074)                |
| 2 <sup>nd</sup> grade                               | 52 | 97.92**  | .95 | .91  | .056 (.038; .072)                |
| Model 1b: model with mediating variables - teachers |    |          |     |      |                                  |
| together  | 37 | 893.70** | .86 | .75  | .153 (.144; .180)                |
| 4 <sup>th</sup> grade                               | 37 | 244.70** | .89 | .80  | .127 (.110; .140)                |
| 7 <sup>th</sup> grade                               | 37 | 346.83** | .84 | .72  | .156 (.140; .170)                |
| 2 <sup>nd</sup> grade                               | 37 | 176.06** | .90 | .82  | .114 (.097; .130)                |

Note. The maximum likelihood method was used; GFI – goodness-of-fit-index; AGFI – adjusted goodness-of-fit-index; RMSEA – root mean square error of approximation.

\* $p \leq .05$ ; \*\* $p \leq .01$ .

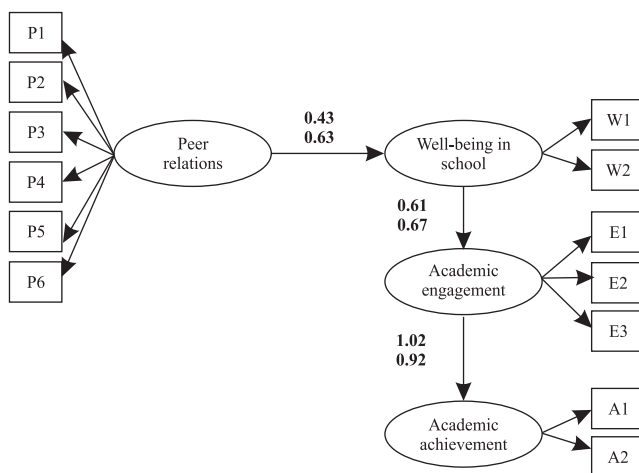


Figure 3. Parameter estimates for a variant of originally presumed model (Model 1a) for the students of the 7<sup>th</sup> grade and the 2<sup>nd</sup> grade of secondary school

Note. Coefficients in the first row refer to the students of the 7<sup>th</sup> grade and those in the second row to the students of the 2<sup>nd</sup> grade of secondary school. See also note to Figure 2.

ers differently relate to well-being, academic engagement and academic achievement. None of the models meets the criteria for fitting the model. However, the fit of the model with relations to peers as an independent variable is much better than the fit of the model with relations to teachers as an independent variable. When testing the models for different age groups, the model with relations to peers as an

independent variable fitted to the data for the students of the 7<sup>th</sup> grade and for the 2<sup>nd</sup> grade of secondary school. For these two older age groups, the model coefficients are presented in Figure 3. As is evident in Figure 3, the strongest relation appears between students' academic engagement and their academic achievement.

Model 2: Model without mediating variables

Because the originally presumed model did not prove to be appropriate, the model without mediating variables was tested, i.e. the model in which the direct influence of rela-

Table 4

Fit indices for the model without mediating variables

| Model                                      | df | $\chi^2$ | GFI | AGFI | RMSEA<br>90% confidence interval |
|--|----|----------|-----|------|----------------------------------|
| Model 2: model without mediating variables |    |          |     |      |                                  |
| together                                   | 35 | 245.56** | .96 | .91  | .078 (.069; .088)                |
| 4 <sup>th</sup> grade                      | 35 | 96.25**  | .96 | .90  | .071 (.054; .088)                |
| 7 <sup>th</sup> grade                      | 35 | 34.56    | .99 | .97  | .000 (.000; .038)                |
| 2 <sup>nd</sup> grade                      | 35 | 51.47*   | .97 | .94  | .041 (.011; .063)                |

Note. See note to Table 3.

\* $p \leq .05$ ; \*\* $p \leq .01$ .

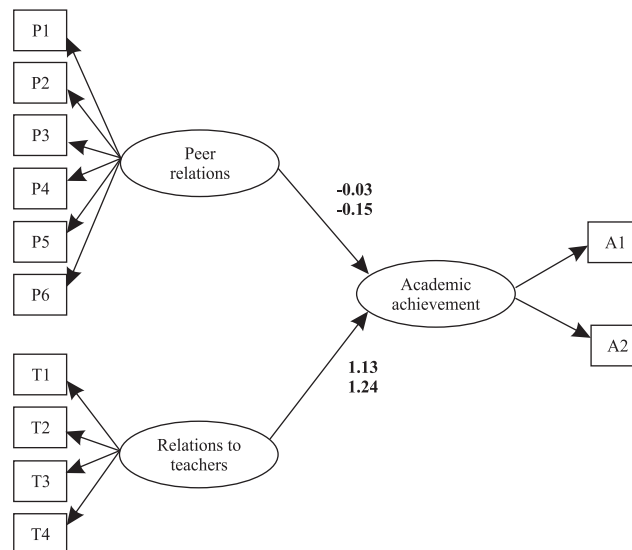


Figure 4. Parameter estimates for the model without mediating variables (Model 2) for students of the 7<sup>th</sup> grade and 2<sup>nd</sup> grade of secondary school

Note. Coefficients' in the first row refer to the students of the 7<sup>th</sup> grade and those in the second row to the students of the 2<sup>nd</sup> grade of secondary school. See also note to Figure 2.

tions to peers and to teachers on academic achievement is hypothesized.

The fit indices for the model without mediating variables are presented in Table 4.

The model without mediating variables fits better than the originally presumed model assuming that the relation between social and academic variables is mediated by well-being in school and academic engagement. However, the fit is only appropriate for the students of the 7<sup>th</sup> grade and the students of the 2<sup>nd</sup> grade of secondary school. The model coefficients for these two age groups can be observed in Figure 4.

As evident from Figure 4, the influence of relations to teachers on students' academic achievement is for both age groups much larger than the influence of peer relations which is close to zero and negative, respectively.

*Testing the influence of both kinds of relations separately*

As for the Model 1, two versions of the model with each independent variable separately were tested for the Model 2 as well. The fit indices of these two models are presented in Table 5.

The fit of the model without mediating variables with peer relations as an independent variable is appropriate for all age groups of students, as well as for all students together. The coefficients for this model are presented in Figure 5.

As presented in Figure 5, the influence of peer relations on students' academic achievement is the largest in 4<sup>th</sup> grade students, whereas in older students this influence is very low and zero, respectively. The model with relations to teachers

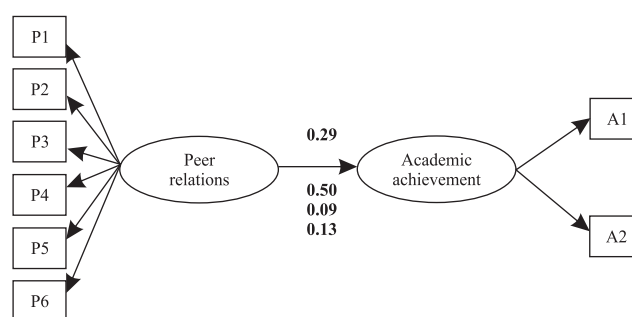


Figure 5. Parameter estimates for the model without mediating variables with peer relations as independent variables (Model 2a) for all students together and for the each age group  
 Note. Coefficients above the lines refer to all students together; coefficients below the lines refer to the students of the 4<sup>th</sup> grade (first row), the students of the 7<sup>th</sup> grade (second row), and the students of the 2<sup>nd</sup> grade of secondary school (third row). See also note to Figure 2.

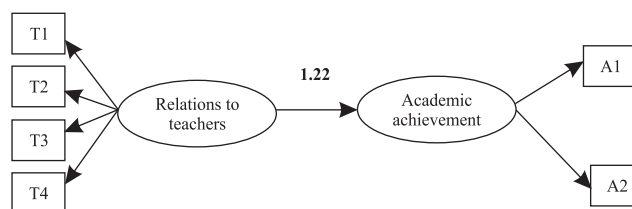


Figure 6. Parameter estimate for the model without mediating variables with relations to teachers as an independent variable (Model 2b) for the students of the 2<sup>nd</sup> grade of secondary school  
 Note. See note to Figure 2.

Table 5

Fit indices for the versions of the model without mediating variables

| Model  | df | $\chi^2$ | GFI | AGFI | RMSEA<br>90% confidence interval |
|--|----|----------|-----|------|----------------------------------|
| Model 2a: model without mediating variables – peers    |    |          |     |      |                                  |
| together   | 12 | 34.40**  | .99 | .97  | .044 (.027; .061)                |
| 4 <sup>th</sup> grade                                  | 12 | 26.30**  | .98 | .94  | .059 (.028; .089)                |
| 7 <sup>th</sup> grade                                  | 12 | 17.32    | .99 | .96  | .036 (.000; .071)                |
| 2 <sup>nd</sup> grade                                  | 12 | 12.66    | .99 | .97  | .014 (.000; .063)                |
| Model 2b: model without mediating variables – teachers |    |          |     |      |                                  |
| together   | 7  | 160.18** | .95 | .85  | .149 (.130; .170)                |
| 4 <sup>th</sup> grade                                  | 7  | 48.01**  | .96 | .87  | .129 (.096; .170)                |
| 7 <sup>th</sup> grade                                  | 7  | 58.74**  | .95 | .84  | .147 (.110; .180)                |
| 2 <sup>nd</sup> grade                                  | 7  | 17.42*   | .98 | .94  | .072 (.030; .110)                |

Note. See note to Table 3.

\* $p \leq .05$ ; \*\* $p \leq .01$ .

as an independent variable (Model 2b) fits the data only for the older group of students, i.e. students of the 2<sup>nd</sup> grade of secondary school. The model coefficients for this age group are presented in Figure 6.

*Model with latent variables with regard to the method of data assessment*

The analysis of the correlations between manifest variables indicated that variables assessed from the same source (self-report, peer nominations, teacher assessment) were more strongly correlated. Therefore, also the model in which latent variables are formed with regard to the method of data assessment was tested. In this model, the correlations with regard to the construct (i.e. peer relations, relations with teachers, well-being, academic engagement, and academic achievement) were set as free parameters. The fit indices for this model are presented in Table 6.

Table 6

Fit indices for the model with latent variables with regard to the method of data assessment

| Model   | df | $\chi^2$ | GFI  | AGFI | RMSEA<br>90% confidence interval |
|---|----|----------|------|------|----------------------------------|
| Model 3: model with latent variables with regard to the method of data assessment |    |          |      |      |                                  |
| together  | 90 | 521.76** | 0.94 | .90  | .070 (.064; .076)                |
| 4 <sup>th</sup> grade   | 90 | 326.23** | 0.93 | .87  | .069 (.058; .079)                |
| 7 <sup>th</sup> grade   | 90 | 251.57** | 0.92 | .87  | .072 (.061; .083)                |
| 2 <sup>nd</sup> grade   | 90 | 194.03** | 0.93 | .87  | .064 (.049; .076)                |

Note. See note to Table 3.

\* $p \leq .05$ ; \*\* $p \leq .01$ .

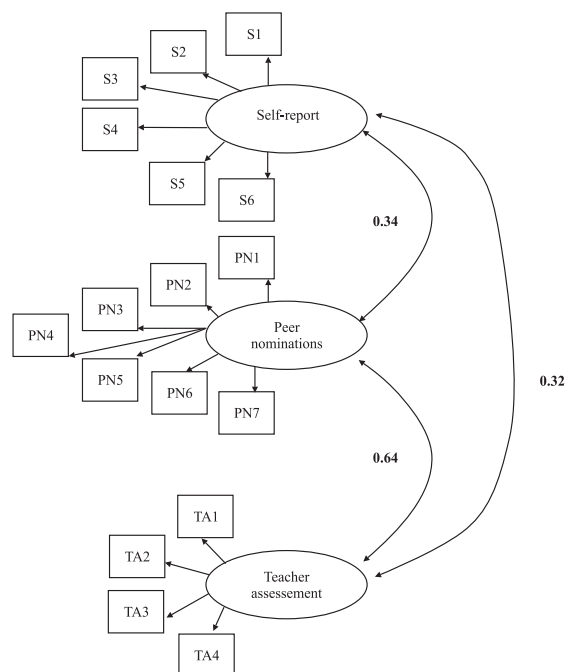


Figure 7. Parameter estimates for the model with latent variables with regard to the method of data assessment (Model 4) for the students of the 2<sup>nd</sup> grade of secondary school

Note. The manifest variables for the latent variable self-report are the following: S1 – teacher academic support; S2 – teacher personal support; S3 – peer academic support; S4 – peer personal support; S5 – self-reported well-being in school; S6 – self-reported academic engagement. Manifest variables of the latent variable peer nominations are: PN1 – social preference; PN2 – peer perceived popularity; PN3 – number of friendships; PN4 – number of reciprocal friendships; PN5 – peer perceived relations with teachers, PN6 – peer perceived academic engagement; PN7 – peer perceived academic achievement. The latent variable teacher assessment consists of the following variables: TA1 – teacher’s liking of the student; TA2 – teacher report of students’ well-being in school; TA3 – teacher report of students’ academic engagement; TA4 – GPA. Manifest variables that represent the measures of the same construct (peer relations, relations to teachers, well-being, academic engagement, academic achievement) are correlated.

For all students together, the model with latent variables with regard to the method of data assessment does not fit to the data. However, the RMSEA value is quite close to .05. The fit is appropriate for the students of the 2<sup>nd</sup> grade of secondary school. The model coefficients for this age group are shown in Figure 7. In any case, the fit for all age groups is better than for the originally presumed model with mediating variables. This is surprising considering the fact that the variables in the originally presumed model are formed with regard to their contents, whereas in this model all that variables within a specific latent variable have in common is the method of data assessment.

As can be observed in Figure 7, the relations between measures of peer nominations and teacher assessment are stronger compared to the measures of self-report that weakly correlate with other measures.

## DISCUSSION

The main purpose of the study was to test the model of relations between social and academic variables in school context. Therewith, we wanted to establish the relation between social and academic variables in different school periods and test whether affective and motivational factors act as mediating variables in the relation between social and academic variables in school.

The model that hypothesizes that the relation between social (i.e. peer and teacher relations) and academic variables is indirect via students’ well being in school and their academic engagement did not provide the appropriate fit to the data. Additional assumptions about the nature of the relations between social and academic variables were therefore made. The model without mediating variables that assumes the direct influence of peer and teacher relations on students’ academic achievement proved to be more adequate. The fit indices of this model were better than for the originally presumed model with mediating variables. However, the fit was appropriate only for the students of the 7<sup>th</sup> grade and the students of the 2<sup>nd</sup> grade of secondary school. In these two age groups, the influence of relations to teachers on students’ academic achievement is much larger compared to the influence of peer relations, which is close to zero and slightly negative, respectively.

### *The relation between social and academic variables in students*

The results indicate that the originally presumed model is not adequate because of the mediating variables. The model without mediating variables fits better than the model with mediating variables<sup>1</sup>. For the model that presumes only

<sup>1</sup> This can also be inferred from the following results that we do not refer here in detail because of the lack of space: (1) If the latent variables

peer relations as an independent variable, the fit is also better if mediating variables are not included in the model. The inclusion of mediating variables decreases the explanatory value of the model. This indicates that the presumed mediating variables are not adequate.

The finding that emotional and motivational variables are not the factors mediating the influence of social relations students form in school on their academic outcomes is not congruent with the findings of some other studies. Some authors report motivational variables as those that mediate the relation between students' relations in school/family context and their academic achievement (e.g. Grolnick, Ryan, & Deci, 1991; Wentzel & Caldwell, 1997). Alternative assumptions about the relation between social and academic variables should thus be made. Some possible interpretations of this relation are mentioned below:

- (1) The relation between social and academic variables is direct.
- (2) Some third variable (e.g. self-regulatory skills or self-variables as self-concept or self-efficacy) is behind the relation between both groups of variables. The results of the Buhs' (2005) study speak in favor of this assumption. These results showed that the influence of peer relations on academic outcomes is mediated by students' perceptions of their own competence. Wentzel and Asher (1995) also suggest that students' self-regulatory skills are those influencing students' effective performance in social, as well as academic field.
- (3) The positive relation between students' peer relations and their academic achievement is due to the relations students form with their teachers. Teachers usually prefer students which perform better in school. It is possible that because of the teacher preference, these students could also be more accepted by their peers.
- (4) The relation between social and academic variables depends on developmentally specific norms which form among peers with regard to learning and learning behavior. Namely, the interpretations mentioned above can not explain the fact that in older students the correlations between peer relations and academic variables are much lower compared to younger students. For example, it is not very likely that a decrease in students' self-regulation skills occurs when entering adolescence (actually, the research shows the opposite; see e.g. Paris & Newman, 1990). Because of the age dependence on the strength of the connection between social

and academic variables, it is reasonable to assume that the relation between social and academic variables depends on the social norms that are formed in the peer group. These norms are developmentally specific and are especially prone to changes when students enter adolescence. In younger students, it is usually the teacher that influences the norms, rules, and values that are valid in the peer group. Consequently, students' norms regarding school work and learning are very similar to the expectations that teachers and other adults hold toward students. However, when entering adolescence the influence of the peer group becomes increasingly important. Adolescents often believe that two different sets of behavioral and academic attributes are needed to be popular with peers versus preferred by teachers (Hopmeyer Gorman, Kim, & Schimmelbusch; 2002). In adolescents, the peer group presents a very influential context for the development of academic beliefs and behaviors (Ryan, 2001). It is possible that the social norms that are formed in students' peer group are the reason for a stronger connection between peer relations and academic achievement in the period of late childhood as compared to adolescence.

Also, the possibility that the model does not fit the data because they are coming from different sources should be taken into consideration.

#### *The relation between social and academic variables in different school periods*

Considering the social development in late childhood and adolescence it is reasonable to assume that the importance of both kinds of relations (i.e. relations to peers and to teachers) for the academic achievement changes during the different school periods. For that reason, the relation of both kinds of relationships that students form in school to their academic achievement was investigated in students in different school periods. The comparison between the students of different ages is possible only in the model that assumes the direct influence of peer relations to students' academic achievement (Model 2a). This is namely the only model that fits the data in all of the three age groups. The model's coefficients between the peer relations and students' academic achievement are highest for the students of the 4<sup>th</sup> grade and lower in both of the older age groups. Thus, the crucial change in the influence of peer relations obviously occurs in the period between ten and thirteen years of age. Most likely, a decrease in the influence of peer relation on academic outcomes coincides with the transition to adolescence.

In adolescence, the influence of peer relations on students' academic achievement is low. The students that form more positive relations with peers are not those students that are also academically better (this holds true for the students of the 4<sup>th</sup> grade). Some models of relations between social and academic variables fit only to the two older age groups

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peer relations and relations to teachers are excluded from the model and only the relation between those variables that represent dependent variables in originally presumed model is tested, and directed links between those variables are presumed (i.e. well-being – engagement – academic achievement), the fit of such model is very poor (RMSEA=0.246). (2) If the influence of both independent variables is tested separately for each mediating variable (well-being and engagement), none of those models fits to the data.

of students. These models enable the comparison between the students of the 7<sup>th</sup> grade and the students of the 2<sup>nd</sup> grade of secondary school. There are no essential differences in the model's coefficients between different variables in the models of these two age groups. Apparently, there are no differences in the relation between measures of peer relations and academic variables between early and middle adolescents. Nevertheless, it should not be forgotten that we do not possess longitudinal data and is, therefore, impossible to draw conclusions about developmental changes.

*The relation between both kinds of social relations in different school periods*

For the most part, the correlations between the measures of peer relations and relations to teachers decrease with students' increasing age. This is true only for the measures that are assessed using peer and teacher report. The self-report measures relate very weakly to other measures.

In late childhood, students that form more positive relations with peers are also in better relations with their teachers. But in adolescence (i.e. students of the 7<sup>th</sup> grade and the 2<sup>nd</sup> grade of secondary school) the relations which students form with peers and with teachers become less related to each other. In this period, the correlations between both constructs are still positive, but low. Thus, the findings of some studies which show that students who form more positive relations with peers are also more liked by the teachers (e.g. Birch & Ladd, 1997; Donohue, Perry, & Weinstein, 2003; Taylor, 1989) can not be generalized to adolescents without some caution.

Also the differences in the importance of both kinds of relations for students' academic achievement were found. The results of the structural equation modeling indicate that the effect of peer relations on students' academic achievement depends on the students' age. For students in late childhood, peer relations are important factors of their academic achievement, whereas in older students the model's coefficients between peer relations and academic achievement are low. In contrast to this, the importance of relations to teachers for students' academic achievement is not age-dependent. The correlations between the measures of students' teacher relations and academic achievement are low to moderate in all periods of schooling. Peer relations to teachers are important for students in all periods of schooling. Furrer & Skinner (2003) explain this relation with the sense of relatedness that is crucial for students' active engagement in school activities, which leads to better academic outcomes. On the other hand, it is also possible that the direction of that relation is quite the opposite – in all periods of schooling teachers might prefer the students that are more engaged and achieve more.

However, irrespective of the original direction of the relation it is likely that the reciprocal link between both vari-

ables develops gradually – the teacher's liking positively influences students' academic achievement, which in turn strengthens the positive relation that these students form with their teachers.

*Evaluation of the methods for assessing the data about students' social and academic characteristics*

In this study at least two different measures of each construct were used to assess the latent variables included in the models. On the one hand, the purpose of such assessment was to validly assess each latent variable, but at the same time we were also interested in the relations between the different measures of the constructs with each other. The analysis of the correlations between all manifest variables already shows that the correlations between the measures of the same construct, assessed from the different sources, are mostly lower than the correlations between the measures of different constructs, assessed from the same source. Therefore, the model with latent variables taking into the account the method of data assessment was tested. Since latent variables in this model are designed only with regard to the method of data assessment and include manifest variables from different constructs it would be reasonable to expect that the model does not fit to the data. However, the results show a different picture. The fit indices are appropriate only for the oldest group of students, whereas for both of the younger age groups these indices are quite close to the recommended limit values. In any case, the fit is much better than for the originally presumed model with mediating variables that consists of latent variables designed with respect to the construct they are supposed to measure. Such results seem quite alarming and have some important implications for psychological research. Namely, especially for the research in the past it was common that only one source of data assessment was used in the study. According to the findings of our study the relations between variables, as found in such studies, can also be interpreted as an artifact of the method of data assessment and not as the actual (content) relation between variables. The possibility of such interpretation questions the findings of numerous psychological studies that are based upon one single source of data assessment.

The analysis of the correlations between all manifest variables indicates that the measures of self-report are especially weakly connected with other variables, whereas the peer and teacher report variables are more strongly correlated. This is true for all three age groups of students and, therefore, can not be attributed to the factors of students' cognitive development (e.g. insufficiently developed metacognitive skills in younger students).

Similar discrepancies between measures of self-report and other measures of data assessment were also reported in other studies (Bierman, 2004; Humphrey, 1984; Rohrbeck, Azar, & Wagner, 1991). Nevertheless, Meyers, Cohen, and

Schleser (1991) suggest that this lack of relationship among the raters should not be interpreted as an error variance. It simply reflects different conceptualizations of the student's everyday context. Therefore, on the basis of the inconsistency between measures of self-report on the one hand, and peer- and teacher-report measures on the other hand, it is not justified to make conclusions about which source of data is more accurate or more valid. Nevertheless, the mere use of self-report measures, which is quite frequent in psychological studies, seems quite controversial.

### CONCLUSIONS

Investigating the social factors of students' academic outcomes contributes to a better understanding of students' academic (under)achievement or failure and enables a more complete intervention in case of academic failure and especially preventive functioning. Relating social, emotional and motivational factors and academic achievement is a step towards a conceptualization of school adjustment as the most holistic educational goal. Such simultaneous investigation of different factors of school adjustment and relations between them can represent a basis for the formation of the school adjustment theory that is, as emphasized by Wentzel (2003), not well developed at the moment. The implications that arise from understanding the relations between social relations and students academic achievement in different school periods enable the adaptation of the interventions to students' developmental needs and qualification of teachers for such work.

From the methodological point of view, the findings of this study indicate the necessity of a methodological triangulation. Also, they emphasize the need for a critical evaluation of the existing studies that have investigated the relations between different variables and are based on one single method of data assessment.

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