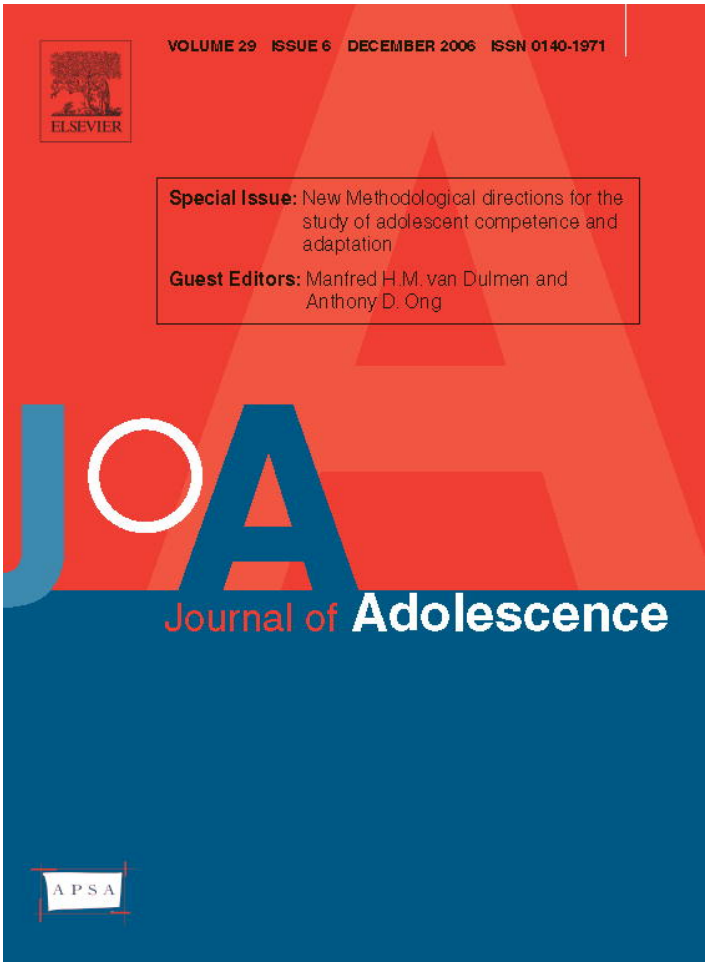

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Relationships at school and stage-environment fit as resources for adolescent engagement and achievement

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Abstract

Guided by Self-Determination and associated theories, we examined whether adolescent ($N = 324$, M age $= 15$, 52% female) competence (academic engagement and achievement) were supported by relationships at school and school fit. Aspects of relationships and school fit that were measured included adolescents' perceptions of each context as promoting autonomy, relatedness and competence. Within a latent-variable structural equation model, direct and indirect path estimates, standard errors and confidence intervals were produced using maximum likelihood and bootstrapping. Results supported the hypothesized model. As predicted, school fit partially mediated the association between teacher–student relationships and engagement, but fully mediated the association between peer relationships and engagement. Engagement fully mediated the path from school fit to achievement. The use of SEM and bootstrapping are encouraged as the combination of these techniques can increase power to detect direct and indirect effects, and can be a better choice for data that do not conform to normal theory assumptions. Overall, these techniques allowed for more firm conclusions about the importance of a hierarchy of multidimensional contextual experiences for adolescent competence.

Keywords: School engagement; Peer relationships; Teacher–student relationships; Achievement; Stage-environment fit

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Introduction

Low school achievement and school dropout rates are a concern for parents, teachers, communities and governments. In Queensland, Australia, about 25–30% of high school students leave school before completing Year 12 (Queensland Government, 2002). With this high rate of school dropout, there has been ongoing concern about how to engage students in the classroom and school environment, how to motivate students to continue their academic study until Year 12 and beyond, and how to promote optimal student outcomes. This rate of early school leaving also indicates that a substantial proportion of secondary school students may be feeling bored, disconnected and disaffected with their schooling.

Engagement and achievement at school are important components of competence during adolescence that can promote or undermine future competencies and developmental pathways. For example, adolescents who do not complete secondary school run a greater risk for unemployment, reduced psychosocial well-being, and other negative outcomes (Creed, Muller, & Patton, 2003). Competence and optimal functioning include, and can depend on, being interested and active in the environment (Larson, 2000). In addition, the identification of the correlates of engagement and initiative has the potential to assist schools and other environments in promoting adolescent competence and the best possible developmental trajectories.

In the current study, we tested a model of adolescents' perceptions of their relationships with teachers and peers at school, school fit, and student engagement and achievement at school and in the classroom (see Fig. 1). Engagement and achievement were the key competency outcomes in the model. Engagement included being more interested and self-reliant in learning activities, and

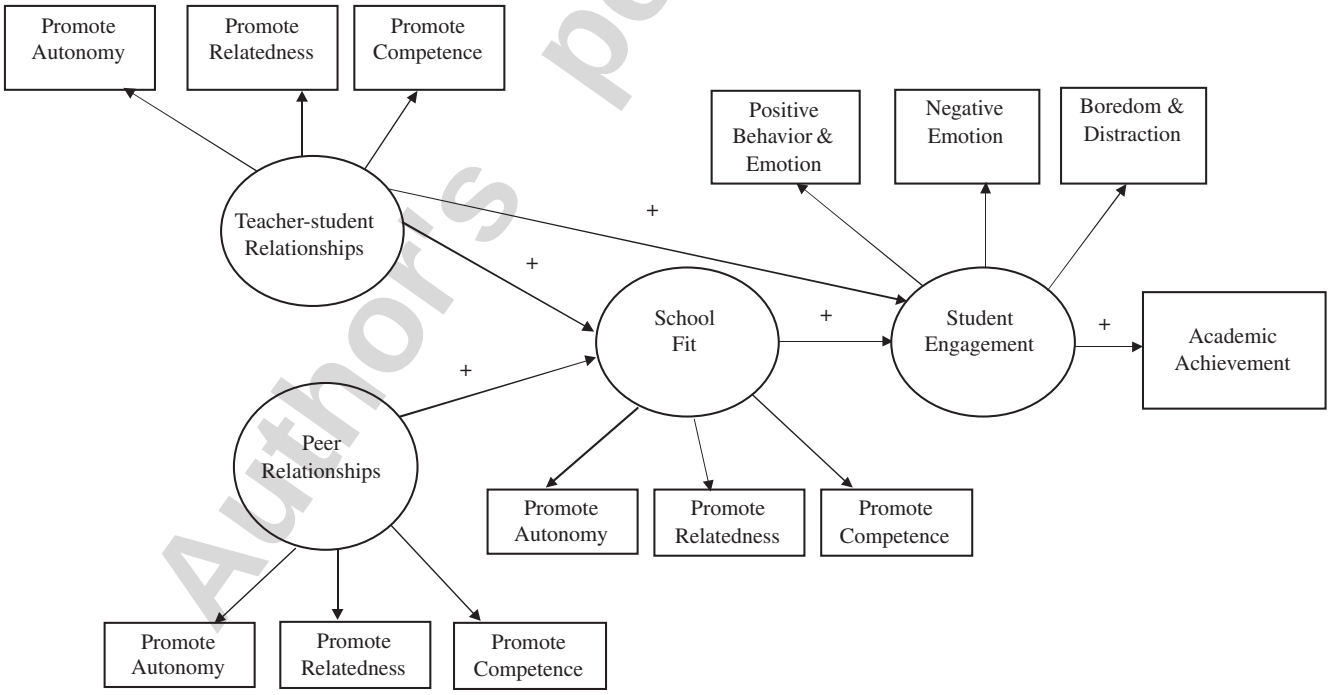

Fig. 1. The hypothesized mediational model of adolescents' relationships with teachers and peers, school fit, academic engagement, and school achievement.

more interested, and less anxious and bored when facing new and ongoing schoolwork. Engagement has been defined as observable demonstrations of motivation, including the intensity and extent of effort, and the emotional quality of involvement in actions (Reeve, 2002). Student engagement was expected to directly influence academic achievement and serve as a mediator of associations between relationships, school fit and achievement. In addition, school fit was expected to be a higher order system variable that would mediate associations between lower order relationships (i.e., relationships with teachers and peers) and engagement at school.

Adolescents at the transition to middle adolescence (age 15 and 16) were the participants in the current study. Most studies of academic engagement and perceptions of the school environment have focused on somewhat younger students in the middle school years (about age 12–14). Fewer studies of older adolescents makes it unclear whether relationships and school fit remain important for engagement and other academic competencies at this time of life. We expected that this would be an important time to test these associations because relationships outside the family become even more important in middle adolescence, when compared with earlier ages. For example, peer relationships become significant sources of support in middle adolescence as compared to earlier, and relationships with adults outside the family may be established and gain prominence (Furman & Buhrmester, 1992; Wigfield & Wagner, 2005).

Latent-variable structural equation modelling (SEM; Kaplan, 2000) was used to test models. Latent constructs were indicated after constructing three subscale scores from items on each measure (i.e., referred to as *parcels*; see Little, Cunningham, Shahar, & Widaman, 2002). The use of SEM allowed simultaneous estimation of covariances between latent and/or measured constructs, while also estimating directional pathways between constructs. One purpose of model testing was to examine whether school fit mediated associations between students' relationships with teachers and peers, and engagement at school. Similarly and simultaneously, we wanted to test whether engagement would mediate associations between relationships and achievement, and between school fit and achievement. We could have relied on the following steps to test these hypotheses: (a) construct single scale scores for each construct, (b) examine zero-order correlations, (c) estimate more than one multiple regression model (e.g., the commonly used 4-step approach of Baron and Kenny, 1986), and (d) use Sobel's (1982) formula to test the significance of the indirect effects of independent variables (e.g., teacher–student relationships) on dependent variables (e.g., engagement) through mediating variables (e.g., school fit). Instead, we used a more efficient and powerful approach, bootstrapping, to examine mediational (i.e., indirect) pathways. This is a relatively new approach to the analysis of mediated effects that was summarized and extended by Shrout and Bolger (2002).

Bootstrapping is a resampling method that assists with making statistical inferences about a population from which a sample is drawn. The method involves taking repeated, random selections of cases from a study sample with replacement after each sampling (Good, 1999). For each selected subsample, parameter estimates or other test statistics are calculated. For example, data may have been collected from 400 participants. We might randomly select 200 participants, compute parameter estimates, put these 200 participants back into the pool, randomly select another 200 participants, compute parameter estimates, put them back into the pool, etc. Most often this process of random sampling, estimation, replacement, and resampling is repeated hundreds or thousands of times resulting in the calculation of hundreds or thousands of test

statistics. This allows an examination of the distribution of a test statistic, and the calculation of an average, median and/or standard error of a test statistic.

Bootstrapping techniques can be used in SEM and are especially helpful in cross-sectional mediational path models when the sample size is small to moderate ($N < 400$) and variables are not normally distributed. In simulation studies, the Baron and Kenny (1986) technique has been found to have low power to detect mediational effects (MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002) and bootstrapping has been found to increase power and accuracy by not depending on normal theory assumptions but, instead, drawing estimates from the data (Shrout & Bolger, 2002). SEM and bootstrapping are also ideal methods to use when there are complex model pathways, such as chains of mediational effects, which could not be tested within a single linear regression model. Bootstrapping methods were not widely available until fairly recently. Bootstrapping is now easy to implement using software packages such as AMOS (Byrne, 2001; SmallWaters Corporation, 1999), and, in most cases, it can be an efficient way to examine the importance of mediational linkages and indirect effects.

The use of latent-variable SEM to test a model with mediational pathways was expected to advance the study of adolescent competence by allowing the investigation of how environmental resources at lower levels of a hierarchy of systems impact on adolescent competence via perceptions of higher-level systems. For example, relationships at the level of the microsystem (e.g., a dyad or small group in the form of teacher–student relationships and peer relationships) were expected to influence perceptions of a higher order system, such as the school environment, but may or may not have direct influences on competence without this intervening perception of the higher order system. Further, testing latent-variable SEM models can make a test of theory more explicit. For example, in the current study, the use of SEM allowed the construction of a model with more explicit links among theoretical constructs that are multidimensional (e.g., the important aspects of interactions with others, and engagement as having components within the behavioural, emotional and cognitive domains). These multiple dimensions were used as measured indicators of latent constructs making the links between theory and the empirical study and analyses more explicit.

Theoretical background and construct development

Self-Determination Theory (Deci & Ryan, 1985; Ryan & Deci, 2000, 2002) and related developmental theories of motivation, agency and initiative (Connell & Wellborn, 1991; Eccles et al., 1993; Walls & Little, 2005) guided the development of the model. In these theories, multiple aspects of interpersonal relationships and environmental experiences have been identified that are expected to assist young people to be interested and positive about their school activities (Connell & Wellborn, 1991; Furrer & Skinner, 2003; Roeser, Midgley, & Urdan, 1996; Wentzel, 1999). In the current study, the focus was on how these environments can promote adolescents' behavioural and emotional engagement in academic activities.

Theories (Baumeister & Leary, 1995; Bowlby, 1969; Connell & Wellborn, 1991; Ryan & Deci, 2000, 2002; Eccles et al., 1993; Harter, 1978; Skinner, 1995; White, 1959) suggest that engagement will be greater when environments have features that meet individual needs. The needs identified as important include (a) autonomy (i.e., a feeling of agency and opportunities for, and/or control over, decisions), (b) relatedness to others, and (c) competence or an understanding of

contingencies, self-efficacy and control. Relationships and environments promote *autonomy*, *relatedness* and *competence* by being *autonomy supportive* (rather than coercive), *involved* and warm (rather than hostile), and *structured* and predictable (rather than chaotic and unpredictable; Connell & Wellborn, 1991; Ryan & Deci, 2000; Skinner, 1995; Skinner, Zimmer-Gembeck, & Connell, 1998). For example, providing autonomy support by allowing for joint decision-making and supported choice promotes feelings of agency and autonomy. Providing a structured and predictable environment where the contingencies for success and failure are clear can allow for experiences of competence and control by making it clearer how to set goals, manage tasks, and/or experience success. Evidence has shown that autonomy support, relatedness and structure do promote engagement in school (Brand, Felner, Shim, Seitsinger, & Dumas, 2003; Furrer & Skinner, 2003; Roeser, Eccles, & Sameroff, 2000; Sweetland & Hoy, 2000; Wentzel, 1999).

Adolescent relationships with teachers and peers, engagement, and achievement

We assessed adolescents' perceptions of autonomy support, involvement and structure within their teacher–student and peer relationships because these are the key relationships at school. They have been shown to play relatively independent roles in adolescents' lives, and have been found to have different effects on motivational and academic outcomes (Wentzel, 1998). In past studies, engagement, including working harder on tasks and showing more positive affect, has been found to be an outcome of positive perceptions of relationships with teachers and peers at school (Goodenow, 1993; Lynch & Cicchetti, 1997; Roeser et al., 1996; Wentzel, 1998, 1999). In one longitudinal study of children and early adolescents, students who had better relationships with teachers and peers at school were more likely to display greater emotional and behavioural engagement in school (Furrer & Skinner, 2003). In another study, students who were engaged in school were significantly more likely to report that their teacher cared about (Baker, 1999). Goodenow (1993) reported that early adolescents who were more engaged and had better school performance also perceived more support from teachers.

As has been found with teacher–student relationships, positive functioning at school has been associated with better peer relationships (Wentzel & Caldwell, 1997; Wentzel, McNamara Barry, & Caldwell, 2004). In a review of research, acceptance by peers predicted greater involvement in class discussions, regardless of the amount of perceived warmth and caring of teachers (Osterman, 2000). Evidence has shown that students who are less liked by peers are less involved at school and have poorer academic performance (Buhs & Ladd, 2001; Guay, Boivin & Hodges, 1999), and students who experience loneliness and isolation from peers are more likely to leave school early (Hymel, Comfort, Schonert-Reichl, & McDougall, 1996). On the other hand, there are some reports of no direct effect of peer relationships on interest in school and/or other academic outcomes after accounting for relationships with teachers and parents (Goodenow, 1993; Ryan, Stiller, & Lynch, 1994; Wentzel, 1998). This makes it important to examine peer relationships within a model that includes relationships with others. Peer relationships may only be associated with positive academic outcomes when these relationships increase school fit or connection. In some cases, students may perceive higher autonomy support, relatedness and competence within their peer relationships, but these relationships may promote disaffection from school rather than connection (Roeser et al., 2000; Sage & Kindermann, 1999). In one study, children who affiliated

with others who were more disengaged and disaffected from academic activities became more disaffected themselves (Sage & Kindermann, 1999).

School fit, engagement, and achievement

Adolescents' perceptions of autonomy support, involvement and structure within the school context (''school fit'') was also a component of the model. Theory and empirical evidence have pointed to the importance of the school as an environmental context that should meet the developmental needs of adolescents. For example, with their concept of ''stage-environment fit'', Eccles and colleagues (Eccles et al., 1993; Roeser et al., 2000) highlighted autonomy support, involvement and structure as the aspects of the school environment that are needed to meet adolescents' needs for autonomy, relatedness and competence. When there is better stage-environment fit, engagement, achievement motivation and performance are expected to improve.

Most past studies have emphasized relatedness, school connection, and a sense of belonging at school rather than stage-environment or school fit. For example, community at school has been defined as a feeling of belongingness common to many (Solomon, Watson, Battisch, Schaps, & Delucchi, 1996) and has included the provision of an environment where students feel personally accepted, respected and supported (Ma, 2003), and where members know, care about, and support one another (Solomon et al., 1996). A general feeling of being cared for and supported at school has been found to promote competence (see Roeser et al., 2000 for a review). In one study, students who reported a greater sense of school community were higher in achievement motivation (Solomon et al., 1996). In a review of the literature on communal school environments, Osterman (2000) described a consistent link between students' sense of school community and factors related to students' motivation and behaviour within their school. In contrast to these previous studies, we assessed multiple dimensions of the school environment to determine adolescents' perceptions of school connection, autonomy support vs. coercion in the school, and the structured vs. chaotic environment of the school. Measuring these three aspects of the school environment provided a measure of school fit.

School fit as a mediator

A key hypothesis of the current study was that school fit would mediate associations between relationships with teachers and peers, and school engagement (see Fig. 1). Few past studies have had the opportunity to test this hypothesis. We expected a mediational role of school fit, because most interactions with teachers and peers exist at school. Therefore, teacher–student and peer relationships may influence students' perceptions of schools. A school may be perceived more positively because of teacher–student or peer relationships, or both. For example, peer support has been found to contribute to a greater sense of school membership (Isakson & Jarvis, 1999) and supportive teacher relationships have positively influenced students' experience of belonging in school (Sanders & Jordan, 2000; Solomon et al., 1996). Osterman (2000) argued that relationships with both peers and teachers play an important role in students' perceptions of school community. Hence, we hypothesized that school fit would be a direct outcome of teacher and peer relationship characteristics, and would mediate associations between relationships at school and student engagement.

Specific direct and indirect associations were expected. Peer relationships were predicted to influence engagement via school fit only (i.e., school fit would be a full mediator; Holmbeck, 1997). It was anticipated that peer relationships would promote school fit or undermine school fit depending on the peer group. Therefore, engagement was only expected to follow from positive peer relationships when a relatively greater perception of school fit was the outcome of peer relationships. In contrast, we expected that teacher–student relationships would have a direct effect on engagement in addition to an indirect effect on engagement via school fit (i.e., school fit would be a partial mediator; Holmbeck, 1997). This was hypothesized because of the potent links between teacher–student relationships and engagement that have been found in previous studies (Skinner et al., 1998; Wentzel, 1998).

Engagement as a mediator

There have been investigations to determine whether engagement has an influence on students' achievement at school. This positive link between engagement and achievement has been found in multiple studies (Dweck, 1999; Eccles & Wigfield, 2002; Skinner et al., 1998). For example, students performed better on achievement tests when they reported higher levels of engagement (Brand et al., 2003). In a study of early adolescents, students with higher grades also had higher levels of engagement (Wentzel, 1998).

Additionally, student engagement has been the mediator that forms the bridge between relationships at school or school connection and academic achievement (Connell & Wellborn, 1991; Osterman, 2000; Solomon et al., 1996; Wentzel, 1998). Supportive relationships, especially with parents and teachers, have been related to student achievement (e.g., grade point average) indirectly by way of school and class interest and engagement (Furrer & Skinner, 2003; Isakson & Jarvis, 1999; Skinner et al., 1998; Verkuyten & Thijs, 2002; Wentzel, 1998). In the current study, we expected that engagement would be a full mediator of associations between social environmental factors and academic achievement.

Study purpose and analytical strategy

In sum, a mediational model of adolescents' relationships, school fit, and competence at school (academic engagement and achievement) was tested. This model and associated hypotheses are shown in Fig. 1. Following the typical presentation style for SEM diagrams, circles indicate latent constructs and squares indicate measured variables. Plus signs on directional pathways between latent constructs identify the positive and significant associations that were expected. A lack of directional arrows between latent constructs illustrate where no significant associations are expected.

Method

Participants

Participants were 324 students (52% female) enrolled in Grades 10 and 11 at two high schools in southeast Queensland, Australia. Data were collected in the middle of the school year. In

Queensland, students in a grade are generally 1 year younger than in many Western countries. Students had a mean age of 15.3 years ($SD = .74$) and most (79%) were age 15 or 16.

An additional 10 students were excluded because they did not provide achievement information. Although missing data estimation techniques, such as maximum likelihood or single/multiple imputation, could have been used and should be encouraged (Schafer & Graham, 2002), we did not use these techniques because the proportion of students missing data was quite small (3%) and listwise deletion has been found to have a modest influence on results when only a very small proportion of participants are excluded (Roth, Switzer III, & Switzer, 1999). In rare instances, a student failed to answer a single item on a measure and missing scores were replaced with the mean of the other items on the scale for that individual. In one simulation study using Monte Carlo analysis to vary the number of items on measures, the correlation between items, and the pattern of missing data (Roth et al., 1999), replacement of missing data with the mean of items on the scale (''mean substitution across individuals'', p. 219) returned the most accurate estimates of covariation (correlations and regression parameters) followed by regression imputation and a hot-deck technique that relied on Euclidian distance.

Of the sample, 42% reported that they were currently employed with an average working week of 12 h. Fifty-six percent of fathers and 48% of mothers had attended university. This is slightly higher than average in Australia, indicating that the participants may have been from families with somewhat higher than average education. Race/ethnicity and income information could not be collected, but schools reported that slightly more than 80% of their student populations were Caucasian and Australian citizens. About 10% were not Australian citizens. Most students were from low-middle to upper-middle income.

Measures

The parcelling strategy for SEM: There are many debates about how to make decisions about the measured indicators to use for SEM latent constructs. For example, there are differing opinions about whether it is best to maintain individual items or whether it is best to identify groups of items (''parcels'') that are combined prior to their use as measured indicators. Methodologists have also considered how to parcel data under different conditions (Hall, Snell, & Foust, 1999; Landis, Beal, & Tesluk, 2000; Little et al., 2002). Given the modest sample size and the multidimensionality of measured constructs, parcelling was used in the current study.

All measures used, except achievement, were multidimensional with two or three subscales. It has been recommended that latent variables in SEM have at least three measured indicators to ensure that models are not underidentified or overidentified (Little et al., 2002). When measures included three subscales, we parcelled items based on the original multidimensional structure. This parcelling involved forming three subscale scores to use as indicators of SEM latent constructs. The measure of engagement had two subscales. Hence, we used factor analysis to explore whether this measure had this two-dimensional structure or whether more than two parcels of items could be identified.

Academic engagement vs. disaffection: Behavioural and emotional aspects of engagement were measured with an 18-item scale (Skinner et al., 1998). This measure assessed students' perception of their effort, attention, and persistence while initiating and sustaining learning activities, and their emotions when undertaking learning activities (e.g., ''I try very hard in school'', ''In class,

I just act like I'm working'', ''When I'm in school, I feel unhappy'', ''When we start something new in school, I feel interested''). Responses range from 1 (*not at all true*) to 5 (*very true*). This scale is designed to have two subscales with 10 items that assess behavioural engagement and eight items that reflect emotional engagement in school.

To investigate the multidimensionality of this measure, factors were extracted with principal axis factoring using the criteria of an eigenvalue above one. Three interpretable factors with all but two loadings above .40 were found after an oblique rotation. Also, these factors were supported by theory and empirical research on motivations that are distinguished by approach vs. avoidance (Elliott, 2005). The first factor had high loadings for the nine items that assessed positive and active behaviour in the classroom and positive emotion. This factor was labelled *positive behaviour and emotion*, Cronbach's $\alpha = .80$. A second factor included the four negative emotion items and was labelled *negative emotion*, $\alpha = .91$. The final factor included five items that assessed boredom, daydreaming and simply going through the motions at school, $\alpha = .74$. This factor was labelled *boredom*. Items were reversed when appropriate and averaged to form three indicators for use in SEM. All items were averaged to form a measure of engagement for use in descriptive and correlational analyses. This measure of engagement had a high interitem correlation, $\alpha = .86$.

Teacher–student relationships: A shortened version of the Students' Assessment of Teacher Context (Belmont, Skinner, Wellborn, & Connell, 1992) assessed adolescents' perceptions of teacher autonomy support (e.g., ''Teachers want to know what I think about how we should do things''), involvement (e.g., ''Teachers let me know they like me''), and structure (e.g., ''My teachers explain the reasons for our classroom rules''). This measure included 12 items, with four items per subscale. Item response options ranged from 1 (*not at all true*) to 5 (*very true*).

Scores were computed by averaging items within each subscale after reversing appropriate items. Higher scores indicated more positive teacher–student relationships. Total scores were also computed and used for descriptive statistics. In SEM, latent variables were estimated using subscale scores of autonomy, relatedness and competence. Scale reliabilities were Cronbach's $\alpha = .63$ for autonomy support, $\alpha = .63$ for involvement, and $\alpha = .65$ for structure. The interitem correlation of all 12 items was higher, $\alpha = .82$.

Peer relationships and school fit: The Basic Need Satisfaction in Relationship Scale (La Guardia, Ryan, Couchman, & Deci, 2000) was used to assess adolescents' perceptions of peer relationships at school and fit with the general school environment. Each scale consisted of nine items responded to on a 5-point scale ranging from 1 (*not at all true*) to 5 (*very true*). The items were preceded by the sentence, ''When I am with my friends…'' (peer relationships), or ''When I am at school…'' (school fit). Each measure had three subscales: autonomy/autonomy support (e.g., ''I have a say in what happens and I can voice my opinion''), relatedness/involvement (e.g., ''I feel a lot of closeness and intimacy''), and competence/structure (e.g., ''I feel like a competent person''). Peer relationship and school fit scores were computed by averaging the items within each subscale after reversing appropriate items. Higher scores indicated more school fit and better peer relationships. Total scores were computed to use for descriptive statistics. In SEM, latent variables were estimated using subscale scores of autonomy, relatedness and competence. Reliabilities of the subscales ranged from $\alpha = .62$ to .71. The total scale interitem correlations were $\alpha = .76$ for peer relationships and $\alpha = .82$ for school fit.

Achievement: Participants reported their grades in school as a measure of achievement by answering "what marks do you usually receive at school?". Response options were *usually A's*, *usually B's*, *usually C's*, or *Usually D's and F's*. Overall, 24% of students reported that they usually received A's, 52% B's, 24% C's, and 1% D's or F's. Research has shown that high school students are very accurate reporters of their own performance (Wigfield & Wagner, 2005).

Procedure

Ethics approval was obtained for this study. Research project members distributed parental consent forms and information sheets to all students in Grades 10 and 11. The parental consent rate was 76%. Surveys were administered within students' schools by researchers and/or teachers. Surveys took about 30 min to complete. Surveys and consent forms were collected by researchers and placed in separate, sealed envelopes to ensure confidentiality and anonymity.

Overview of the analytic strategy

SEM was completed using maximum likelihood estimation available within AMOS software (SmallWaters Corporation, 1999). Model fit was assessed with commonly available fit indices, including the χ^2 test statistic and the Comparative Fit Index (CFI) (Bentler & Bonett, 1980). The χ^2 test statistic is sensitive to sample size; therefore, other statistics, such as the CFI, are often used to judge model fit. These χ^2 and CFI fit indices both compared the specified model to a model with complete independence. The CFI is more acceptable as it approaches values of 1 and values over .9 to .95 are considered indicative of good model fit (Hu & Bentler, 1999). The root mean square error of approximation (RMSEA) (Browne & Cudeck, 1993) was used also to judge model fit. The RMSEA is an estimate of error due to the approximate fit of the model. Less error is more desirable, so RMSEA values below .06 are considered an indication of good model fit, between .06 and .08 is fair fit, and between .08 and .10 is mediocre fit (Hu & Bentler, 1999; Kaplan, 2000).

In the first model, factor loadings were estimated and all covariances between latent variables were freed to examine measurement (McDonald & Ho, 2002). Next, we tested structural models, including all variables in this first model, but replaced covariances with hypothesized directional paths. To draw conclusions about mediational pathways, we used procedures recommended by Holmbeck (1997) and Shrout and Bolger (2002), which included fitting multiple structural models that tested a number of direct and indirect paths between a predictor (X), a mediator (M), and an outcome variable (Y). Additionally, bootstrapping was used to estimate the standard errors (*SE*s) and 95% bias-corrected confidence intervals (*CI*s) for all model estimates (Shrout & Bolger, 2002). *SE*s and *CI*s were estimated for direct and indirect effects in the models. Direct effects were paths drawn in Fig. 1. Indirect effects were those between X and Y via M. In this case, an indirect effect is calculated as the path coefficient, a, of X→M multiplied by the path coefficient, b, of M→Y ($a * b$). Full mediation can be concluded when (1) M is associated with both X and Y, (2) the direct effect of X→Y is not different from zero, and (3) the 95% confidence interval of the indirect effect of X→Y through M does not include zero. Partial mediation can be concluded when all of the previous criteria hold, except the direct effect of X→Y is significantly different from zero and in the same direction as the X→M and M→Y associations.

The bootstrapped *SE*s and 95% *CI*s were used to make conclusions about full, partial or no mediational roles of school fit and engagement. In particular, we examined the lower *CI* of the path coefficient linking each X→Y when M was not included. We wanted the lower *CI* to be significantly larger than 0 to infer that the association between X and Y was significant when M was not included in the model. We set this criterion because all associations are proximal in this cross-sectional model. It has recently been argued that this criterion can be relaxed in longitudinal models with more distal X→Y effects (MacKinnon et al., 2002; Shrout & Bolger, 2002). In addition, we needed to examine the upper *CI*s of the X→Y direct effect when M was included in the model. If an upper *CI* was not significantly larger than 0, we could conclude with more certainty that there was no association between X and Y when M was playing a mediational role in the model. We also examined whether the 95% *CI*s of the indirect effect of X→Y through M did not include zero to provide more clarity about the strength of mediation. If these patterns of path estimates and *CI*s were met, all criteria of full mediation were met (Holmbeck, 1997; Shrout & Bolger, 2002).

Comparison of alternative models was completed by calculating the χ^2-difference statistic. This statistic can be used to compare models only when models are nested. Nested models are models that have the same variables, but differ because of adding a constraint or freeing a constraint. For example, fixing a directional path to 0 is an example of adding a constraint. The χ^2-difference is calculated by subtracting the χ^2 fit statistic of one model from the same fit statistic in a second model. The associated value of the degrees of freedom is calculated by subtracting the degrees of freedom in one model from the degrees of freedom in the other model. The next step is to determine whether the value of the χ^2-difference statistic (with the associated degrees of freedom) is significantly larger than 0 by using a χ^2 table (available in most introductory statistics textbooks). If the χ^2-difference is not significant, it is concluded that the two models have a similar fit to the data, and the most parsimonious model is maintained.

Results

Descriptive statistics and zero-order correlations

Table 1 summarizes means, standard deviations, and zero-order correlations between all measured variables, and correlations between latent constructs in the measurement model. Zero-order correlations are shown below the diagonal. Correlations between relationships with teachers, relationships with peers, school fit, engagement and achievement were all positive and significant, *r*s ranged from .18 to .61, all $p<.01$.

Measurement model with covariances: relationships, school fit and engagement

The measurement model with covariances among all constructs had a fair fit to the data, $\chi^2(53, N = 342) = 133.4$, $p<.01$, CFI = .95, RMSEA = .069 (90% *CI* .054–.083). All factor loadings were above an absolute value of .60, with two exceptions; the loading for peer relatedness was .59 and the loading for boredom was −.54. Similar to the zero-order correlations, all correlations between latent constructs were positive and significant, correlations ranged from .23 to .78, all $p<.01$ (see Table 1, above the diagonal). Comparing each zero-order correlation to the

Table 1
Means, standard deviations, and zero-order correlations between all constructs

Measured variable	1	2	3	4	5
1. Teacher relationships	–	.41	.52	.78	.39
2. Peer relationships	.31	–	.71	.51	.23
3. School fit	.42	.61	–	.72	.25
4. Engagement	.59	.34	.52	–	.45
5. Achievement	.35	.18	.20	.37	–
Mean (*SD*)	2.94 (.45)	3.96 (.54)	3.28 (.45)	3.14 (.31)	2.01 (.72)

All $p < .01$.

corresponding correlation between latent constructs provides information about the degree of correction for measurement error in the latent constructs. Given the adequate fit of this model and support for predicted associations, we next tested the structural models.

School fit as a mediator

Two models were estimated to determine if school fit mediated the association between relationships and students' engagement. In one model, only the direct paths (X's→Y) between teacher–student relationships and engagement, and peer relationships and engagement were tested. The second model included hypothesized direct and indirect paths between teacher–student relationships, peer relationships, school fit and engagement (see Fig. 1).

Table 2 summarizes maximum likelihood and bootstrapped estimates of paths, *SE*s and *CI*s. The first model (Model 1) included only the direct paths from teacher–student and peer relationships to student engagement; school fit and achievement were not in the model. Direct effects were positive and significant, standardized path coefficients = .69 and .23, respectively, both $p < .01$, and the model had a good fit to the data, $\chi^2(24, N = 342) = 35.6$, $p = .06$, CFI = .99, RMSEA = .039 (90% *CI* .000–.064). These findings confirmed the condition of mediation that the X→Y (teacher–student relationships→engagement, peer relationship→engagement) effect is significantly different from zero when M (i.e., school fit) was not included in the model (Holmbeck, 1997). The lower *CI* of the direct effect of teacher–student relationships on engagement, .55, indicated this criterion was met. However, the lower *CI* of the peer relationships→engagement effect was small, .08, making us more cautious about concluding that the criteria of an association between peer relationships and engagement was met.

As can be seen in Table 2 (Model 2) and Fig. 2, we next fit the data to a model with school fit as the mediator and direct associations between teacher and peer relationships, and engagement. This model had a good fit to the data, $\chi^2(45, N = 342) = 93.5$, $p < .01$, CFI = .97, RMSEA = .058 (90% *CI* .041–.074), with a significant effect of school fit on engagement, standardized coefficient = .48, $p < .01$. As expected, the direct effects of teacher and peer relationships on school fit were both positive and significant, standardized coefficient = .28 and .60, respectively, both $p < .01$. There was a direct effect of teacher–student relationships on engagement, standardized coefficient = .56, $p < .01$. Also as expected, there was no significant, direct effect of peer relationships on engagement. Overall, the model accounted for 57% of the variance in school fit and 75% of the variance in engagement. Bootstrapped estimates were quite similar to those reported in Table 2 and Fig. 2.

Table 2
Path estimates, SEs and 95% CIs for models predicting engagement with and without school fit as a mediator ($N = 324$)

Model paths	Unstandardized				Standardized			
	Estimate[a]	B-estimate (*SE*)	B-lower 95% *CI*	B-upper 95% *CI*	Estimate[a]	B-estimate (*SE*)	B-lower 95% *CI*	B-upper 95% *CI*
Model 1: Direct effects model								
Covariance/correlation								
Teacher, peer*	.14	.14 (.03)	.09	.20	.41	.42 (.07)	.27	.55
Direct effects								
Teacher → Engagement*	.42	.43 (.05)	.33	.53	.69	.69 (.06)	.55	.80
Peer → Engagement*	.20	.20 (.07)	.07	.35	.23	.23 (.08)	.08	.38
Model 2: School fit as a mediator (see Fig. 2)[b]								
Direct effects								
Teacher → School fit*	.26	.26 (.06)	.13	.38	.28	.28 (.07)	.14	.41
Teacher → Engagement*	.34	.34 (.06)	.24	.47	.56	.55 (.08)	.38	.70
Peer → School fit*	.73	.73 (.09)	.55	.92	.60	.60 (.07)	.45	.72
Peer → Engagement	−.04	−.05 (.09)	−.22	.15	−.04	−.06 (.11)	-.26	.18
School fit → Engagement*	.31	.32 (.09)	.16	.50	.47	.48 (.13)	.23	.73
Indirect effect via school fit								
Teacher → Engagement*	.08	.08 (.03)	.04	.15	.13	.13 (.05)	.06	.25
Peer → Engagement*	.23	.23 (.07)	.12	.40	.28	.28 (.09)	.14	.49

Note: B = bootstrapped; *CI* = confidence interval. Model 1 fit statistics: $\chi^2(24, N = 342) = 35.6$, $p = .06$, CFI = .99, RMSEA = .039 (90% *CI* .000–.064). Model 2 fit statistics: $\chi^2(45, N = 342) = 93.5$, $p < .01$, CFI = .97, RMSEA = .058 (90% *CI* .041–.074).

*$p < .01$.

[a]Maximum likelihood estimates (also shown in Fig. 2).

[b]Covariance between teacher and peer relationships was the same as in Model 1.

Summary: Considering the confidence intervals of indirect and direct effect estimates, school fit partially mediated the link between teacher–student relationships and engagement, and fully mediated the association between peer relationships and engagement. The indirect effect of teacher–student relationships on engagement via school fit was only 19% of the full association between teacher–student relationships and engagement (.13/.69; see Shrout & Bolger, 2002 for a discussion about this statistic). Hence, students' relationships with their teachers had direct and indirect effects on engagement, but the direct effect was more substantial.

Engagement as a mediator

Additional models were fit to examine engagement as a mediator (see Fig. 1). The condition of a significant X → Y link (i.e., school fit → achievement) was supported, correlation = .25, $p < .01$ (see Table 1), so we next fit the hypothesized model. Following this, a model was estimated to test

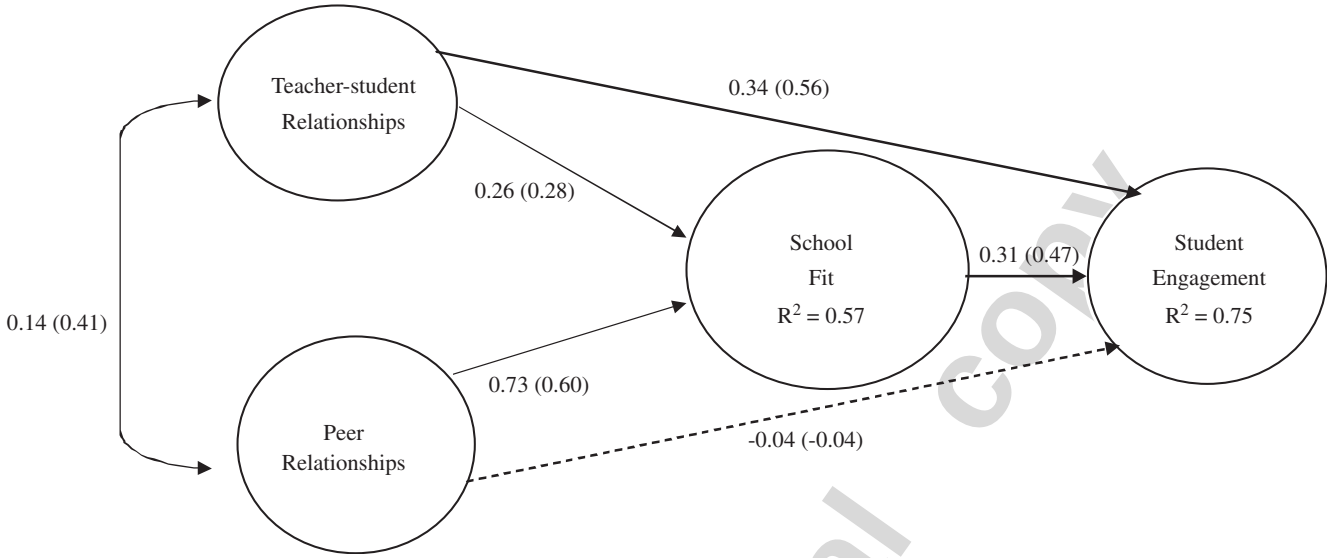

Fig. 2. Standardized SEM maximum likelihood estimates from testing the mediational role of school fit. *Note*: Standardized results are shown here (also see Table 2, Model 2). Fit statistics: $\chi^2(45, N = 342) = 93.5$, $p < .01$, CFI = .97, RMSEA = .058 (90% *CI* .041–.074).

other potential indirect and direct associations between teacher–student and peer relationships, school fit, engagement, and academic achievement.

The hypothesized model had a good fit to the data, $\chi^2(57, N = 342) = 138.3$, $p < .01$, CFI = .95, RMSEA = .066 (90% *CI* .052–.081). All hypothesized paths were supported, all $p < .01$ (see Table 3 and Fig. 3). There was a direct and significant effect of engagement on achievement, standardized coefficient = .45, $p < .01$. The indirect effect of school fit on achievement via engagement was moderate, standardized estimate = .18 (.04), 95% *CI* = .10−.26. The standardized indirect effect of teacher–student relationships on achievement through school fit and engagement was .31 (.05), 95% *CI* = .21−.41, and there was a modest positive and indirect effect of peer relationships on achievement that occurred via school fit and engagement, standardized coefficient = .11 (.03), 95% *CI* = .06−.17. Overall, the model accounted for 57% of the variance in school fit, 74% of engagement, and 20% of achievement.

Finally, direct paths from (1) school fit to achievement, (2) teacher–student relationships to achievement, and (3) peer relationships to achievement were tested by fitting an additional model after freeing these three paths. This model had a good fit to the data, $\chi^2(54, N = 342) = 136.4$, $p < .01$, CFI = .95, RMSEA = .068 (90% *CI* = .054−.082), but these freed paths were not significantly different from 0, school fit → achievement standardized coefficient = −.18 (.13), $p = .09$, 95% *CI* = −.46−.04; teacher–student relationships → achievement standardized coefficient = .16 (.14), 95% *CI* = −.10−.45; peer relationships → achievement standardized coefficient = .01 (.08), 95% *CI* = −.15−.16. Supporting the hypothesized model, the χ^2-difference test showed that the fit of this model did not significantly improve upon the fit of the hypothesized model, χ^2-difference(3) = 1.9, $p > .05$ (see Table 4).

Summary: The confidence intervals of indirect effects (see Table 3) in combination with direct effects in the hypothesized model (see Fig. 3), and the findings when additional direct effects were freed, showed that engagement fully mediated the association between school fit and achievement.

Table 3
Path estimates, SEs and 95% CIs of the final model of engagement and achievement ($N = 324$, see Fig. 3)

Model paths[a]	Unstandardized				Standardized			
	Estimate[b]	B-estimate (*SE*)	B-lower 95% *CI*	B-upper 95% *CI*	Estimate[b]	B-estimate (*SE*)	B-lower 95% *CI*	B-upper 95% *CI*
Direct effects								
Teacher → School fit*	.26	.26 (.06)	.13	.38	.28	.28 (.07)	.14	.41
Peer → School fit*	.72	.72 (.09)	.55	.91	.59	.59 (.07)	.45	.72
Teacher → Engagement*	.37	.37 (.06)	.26	.48	.58	.58 (.08)	.42	.72
School fit → Engagement*	.27	.28 (.06)	.16	.42	.40	.40 (.08)	.23	.55
Engagement → Achievement*	.74	.74 (.11)	.54	.97	.45	.45 (.06)	.34	.55
Indirect effects via school fit								
Teacher → Engagement*	.07	.07 (.02)	.04	.13	.11	.11 (.04)	.06	.91
Peer → Engagement*	.19	.20 (.05)	.11	.31	.24	.24 (.06)	.13	.35
Indirect effects via engagement								
Teacher → Achievement*	.33	.33 (.06)	.22	.44	.31	.31 (.05)	.21	.41
Peer → Achievement*	.14	.15 (.04)	.08	.24	.11	.11 (.03)	.06	.17
School fit → Achievement*	.20	.20 (.05)	.12	.31	.18	.18 (.04)	.10	.26

Note: B = bootstrapped; *CI* = confidence interval. Model fit statistics: $\chi^2(57, N = 342) = 138.3$, $p < .01$, CFI = .95, RMSEA = .066 (90% *CI* .052–.081).

*$p < .01$.

[a]Covariance between teacher and peer relationships was the same as in Table 2, Model 1.

[b]Maximum likelihood estimates (also shown in Fig. 3).

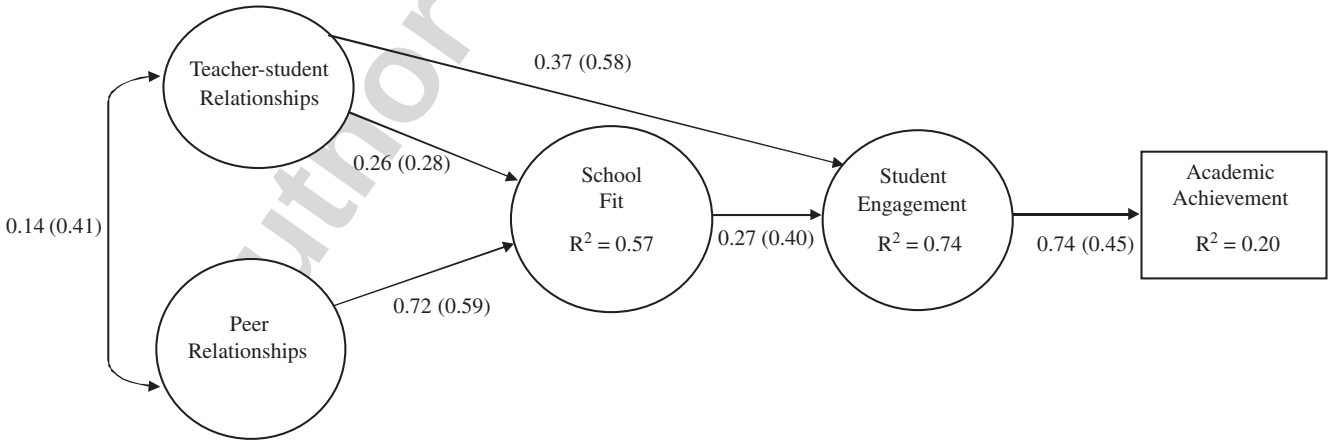

Fig. 3. Standardized SEM maximum likelihood estimates from testing the full hypothesized model (also see Table 3). *Note*: Fit statistics: $\chi^2(57, N = 342) = 138.3$, $p < .01$, CFI = .95, RMSEA = .066 (90% *CI* .052–.081).

Table 4
Summary of model fit indices and comparison of models ($N = 342$)

Model	χ^2	*df*	*p*	CFI	RMSEA	RMSEA lower 90% *CI*	RMSEA Upper 90% *CI*	χ^2-difference
Measurement model	133.4	53	<.01	.95	.069	.054	.083	–
Model 1: direct effects from relationship measures to student engagement only	35.6	24	.06	.99	.039	.000	.064	Model 1 vs. measurement model: 97.8*
Model 2: see Fig. 2	93.5	45	<.01	.97	.058	.041	.074	Model 2 vs. 1: 57.9*
Model 3: see Fig. 3	138.3	57	<.01	.95	.066	.052	.081	Model 3 vs. 2: 44.8*
Model 4: freeing additional direct paths to achievement	136.4	54	<.01	.95	.068	.054	.082	Model 4 vs. 3: 1.9

CI = Confidence interval.
*Significant improvement in model fit, $p<.01$.

Also, engagement mediated the association between teacher–student relationships and achievement, and there were indirect associations of peer relationships with both engagement and achievement that were mediated by adolescents' perceptions of school fit. Table 4 provides a summary of the fit of each model tested and provides comparisons of the fit of each successive model to the previously tested model.

Discussion

In the current study, pathways to engagement and achievement were found that operated via students' relationships with their teachers and their peers, and the capacity of the school environment as a whole to meet students' psychological needs for autonomy, relatedness and competence. More specifically, this study contributed to the study of adolescent competence at school in at least four ways. First, stage-environment fit was examined as a mechanism linking relationships with teachers and peers to academic outcomes. In this model, engagement in learning was also a mediator between stage-environment fit and achievement. These findings build on and support the findings of previous research on the influence of relationships with others on assisting students to be motivated, engaged, and have higher levels of achievement at school (Furrer & Skinner, 2003; Roeser et al., 1996). These previous studies have also shown the importance of the joint contributions of individual psychological needs and relationships at school, as well as pathways to academic competence.

Second, engagement was measured with items that assessed behaviour, cognition and emotion in the classroom and at school. In previous research, behaviour and cognition have been emphasized, somewhat neglecting the emotional components of engagement and motivation (Wentzel, 1998; Weiner, 1990). Recently, Altermatt and Pomerantz (2003) concluded that future

studies should assess both cognitions and emotions in the academic domain, and should examine the joint contributions of multiple interpersonal relationships to academic engagement. This study has helped to accomplish this task.

Third, most previous research on this topic has had younger adolescent and/or child participants. Hence, in the current study, all models were tested with adolescent participants in the middle years of high school in order to fill some gaps in our understanding of these processes among older adolescents. Fourth, latent-variable SEM has rarely been used to simultaneously examine different levels of school-related relationships, fit within the school environment, and academic competence. The use of latent variables with multiple indicators reduced measurement error and increased the accuracy of parameter estimates (Cole & Maxwell, 2003). In addition, there was an illustration of bootstrapping of model estimates, standard errors, and confidence intervals. This technique was ideal for this study and is ideal for the skewed distributions of variables and modest sample sizes that can be found in psychological and educational research.

Overall, the current study findings show that engaging students in learning in order to promote academic competence partly depends on adolescents' representations of school as meeting needs for autonomy, relatedness and competence—having a better fit between students' needs and the environmental structure. In addition, this perception of school fit partly depends on positive interactions within microsystems embedded within the school environment. In this study, these interactions were more positive relationships with teachers and peers at school. Overall, school fit and engagement are mediators linking relationships with teacher and peers at school to students' academic achievement.

We assessed competence as having two components—engagement and achievement. Engagement was the mechanism through which school fit was linked to students' academic achievement. That is, when students' needs are better met at school, they are more engaged in the classroom and school environment—being more attentive and interested in class, doing more than just acting like they are doing the work, and being more positive, happier and less anxious at school. This engagement is directly associated with better achievement. This finding supports previous research in which children's engagement in the classroom is one important pathway between children's feelings of relatedness, competence, control and school fit, and academic achievement (Furrer & Skinner, 2003; Skinner et al., 1998). Previous studies have primarily focused on these processes among younger adolescents. The present study has shown that these associations remain among older adolescents.

Unlike previous research that has stressed feelings of relatedness to particular individuals as important for achievement, we examined relatedness as only one component of relationships with teachers and peers, and also as one component of a more global individual–school environmental fit. Measures of relationships with others at school and school fit assessed students' perceptions that their relationships and school met their needs for autonomy, relatedness, and competence, and these relational factors were labelled autonomy support, involvement, and structure. An additional feature of the current study was the modelling of latent constructs that were directly indicated by these multiple dimensions.

Although it is expected that positive teacher–students relationships would promote engagement and achievement at school, relationships with peers may or may not be important to school fit and school success depending on the content of peer interactions and interests. As would be expected by these differences in relationships with teachers and peers, the mediational role of school fit

differed when teacher–student relationships vs. peer relationships were examined. School fit fully mediated the link between peer relationships and students' engagement. In contrast, and as predicted, school fit was a partial mediator of the association between teacher–student relationships and student engagement, with teacher–student relationships continuing to have a direct effect on engagement.

In past studies, peer relationships have not had consistent effects on academic outcomes. Although associations between peer support and higher levels of academic achievement have been found (Furrer & Skinner, 2003), some previous studies have found no independent effect of peer relationships on academic motivation and achievement (Goodenow, 1993; Ryan et al., 1994; Wentzel, 1998). Yet, other pathways have been found with peer relationships having indirect influences on academic outcomes via loneliness (Guay et al., 1999) or psychological distress (Wentzel, 1998). The current study findings of indirect associations between peer relationships, engagement and achievement add to the handful of studies that have helped to resolve these inconsistencies. Future research should expand the model tested in the current study to include additional mediators. In addition, engagement vs. disaffection from school may depend on characteristics of the peer affiliates, such as their own levels of engagement vs. disaffection and achievement in school (Sage & Kindermann, 1999). The current study findings, coupled with the findings of previous research, suggest that school fit is one mechanism that explains when relationships with peers promote engagement and achievement.

During adolescence, young people develop social relationships with nonfamilial adults and peers, and seek greater autonomy and self-determination (Zimmer-Gembeck, 2002; Zimmer-Gembeck & Collins, 2003). Therefore, it is not surprising that perceptions of social relationships as providing support for autonomy, relatedness and competence are important for older adolescents' engagement and achievement at school. Eccles et al. (1993), Eccles and Midgley (1989) and Roeser et al. (2000) argued that the failure of schools to meet the developmental needs of early adolescents may be partly responsible for the increase in academic failure and school dropout that occurs when young people move through their teen years. Our findings support this by showing that, even by age 15–16, the more students reported their needs being met by their school the higher their engagement with school. Yet, we must note that the current study examined school fit as a predictor of engagement. It is possible that engagement is an antecedent of school fit and the qualities of relationships at school (Guay et al., 1999; Roeser et al., 2000; Skinner & Belmont, 1993). Students who are more involved in their school activities and studies, and feel happier when at school, may feel they are contributing more to their school, thus increasing their sense of fit within the school environment and being active in seeking out opportunities that meet their needs for autonomy, relatedness and competence.

The importance of positive teacher–student relationships on youths' engagement and academic success has been demonstrated in other studies. For example, perceptions of teacher support have been associated with academic engagement, performance, and motivation (Goodenow, 1993; Murdock, 1999; Skinner et al., 1998; Wentzel, 1998), as well as academic achievement and success (see Osterman, 2000 for a review). Further, the fact that the association between teacher–student relationships and engagement was fairly direct with school fit only playing a weak, mediational role indicates that there may be other reasons that teacher–student relationships result in greater engagement at school. Students may be more engaged because they feel autonomous, connected and competent within particular classrooms, with certain teachers or because of certain subjects,

but this may not necessarily mean they feel autonomous and involved within their school as a whole. There is evidence that subject areas may differ in meeting the needs of adolescents, and engagement and achievement may differ for an individual student from subject to subject (McEvoy & Welker, 2000; Ntoumanis & Blaymires, 2003). Alternatively, teacher–students relationships may prompt engagement through other mechanisms such as reducing psychological distress (Wentzel, 1998) or promoting goal-setting and planning (Roeser et al., 1996). Future research should add to this model by including additional mechanisms that have been found to link teacher–student relationships to student engagement.

Study limitations

Study limitations to address include the use of a cross-sectional research design to test pathways and mediational relationships, the use of all self-report and the possibility of shared method variance, and measurement issues. First, the cross-sectional nature of the data leaves open the possibility of reversed or bidirectional pathways. For example, some researchers have reported that competence beliefs come before perceptions of the school importance and engagement in coursework (Wigfield & Wagner, 2005). Ideally, to be more certain of the direct and indirect effects tested here, longitudinal data with at least four waves are needed (see Cole & Maxwell, 2003 for a discussion). Yet, given the expense and time needed to collect this type of data, we believe this is a positive contribution to our understanding of the importance of relationships and individual–school environment fit for student engagement and achievement.

Second, all measures were based on self-report from adolescents. Hence, all information about relationships, school and achievement were from the adolescents' perspectives. Self-reports may be biased by each adolescent's perceptual frame and/or other biases, such as desires to present one's behaviour and emotion as more positive or negative. Related to the use of self-report for all constructs, findings may have been influenced by the problem of shared method variance. However, the use of SEM to model latent constructs and estimate covariances between error terms may reduce some concerns about biased path estimates.

Third, some interitem correlations for parcels used as measured variables in SEM were lower than ideal. Hence, firm conclusions about the magnitude of all model effects and the mediational roles of school fit and engagement should be interpreted along with previous studies, and tested with longitudinal designs with multiple reporters and additional measures.

Conclusion

In closing, we are cautious about making recommendations for interventions based on the current study findings (see Urdan & Turner, 2005 for a discussion). Yet, it is important to consider how to assist adolescents to improve their engagement and achievement at school. First, it may be possible to change school structure to better promote autonomy, connection and feelings of competence among students. Class size has been negatively correlated with students' perceptions of autonomy and relatedness (Filak & Sheldon, 2003) and having a system of homerooms has been linked to students feeling greater connection to school (Smerdon, 2002). Second, teachers who have more years of service have been found to be less supportive of student autonomy (Filak

& Sheldon, 2003). Supporting teachers, especially those that have longer histories in the school system, to maintain autonomy support and involvement with students could benefit student engagement and achievement. In fact, school level interventions that assist teachers and involve parents may have the added benefit of improving teacher–student and peer relationships, student engagement and academic achievement during both the early and later adolescent years. Additional intervention studies are needed to confirm the application of Self-Determination Theory, and the provision of autonomy support, involvement and structure to assist young people to maintain or increase their behavioural, cognitive, and emotional engagement at school.

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References

Altermatt, E. R., & Pomerantz, E. M. (2003). The development of competence-related and motivational beliefs: An investigation of similarity and influence among friends. *Journal of Educational Psychology*, *95*, 111–123.

Baker, J. A. (1999). Teacher–student interaction in urban at-risk classrooms: Differential behaviour, relationship quality, and student satisfaction with school. *The Elementary School Journal*, *100*, 57–70.

Baron, R. M., & Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, *51*, 1173–1182.

Baumeister, R. F., & Leary, M. R. (1995). The need to belong: Desire for interpersonal attachments as a fundamental human motivation. *Psychological Bulletin*, *117*, 497–529.

Belmont, M., Skinner, E. A., Wellborn, J., & Connell, J. P. (1992). *Teacher as social context* (*TASC*): *Two measures of teacher provision of involvement*, *structure*, *and autonomy support*: *Student report measure*. Technical Report, University of Rochester, Rochester, NY.

Bentler, P. M., & Bonett, D. G. (1980). Significance tests and goodness-of-fit in the analysis of covariance structures. *Psychological Bulletin*, *88*, 588–606.

Bowlby, J. (1969). *Attachment and loss* (Vol. 1). New York: Basic Books.

Brand, S., Felner, R., Shim, M., Seitsinger, A., & Dumas, T. (2003). Middle school improvement and reform: Development and validation of a school-level assessment of climate, cultural pluralism, and school safety. *Journal of Educational Psychology*, *95*, 570–588.

Browne, M. W., & Cudeck, R. (1993). Alternative ways of assessing model fit. In K. A. Bollen, & J. S. Long (Eds.), *Testing structural equation models* (pp. 136–162). Newbury Park, CA: Sage.

Buhs, E. S., & Ladd, G. W. (2001). Peer rejection as antecedent of young children's school adjustment: An examination of mediating processes. *Developmental Psychology*, *37*, 550–560.

Byrne, B. M. (2001). *Structural equation modelling with AMOS: Basic concepts, applications, and programming*. Mahwah, NJ: Erlbaum.

Cole, D. A., & Maxwell, S. E. (2003). Testing mediational models with longitudinal data: Questions and tips in the use of structural equation modelling. *Journal of Abnormal Psychology*, *112*, 558–577.

Connell, J. P., & Wellborn, J. G. (1991). Competence, autonomy, and relatedness: A motivational analysis of self-system processes. *Self processes and development*: *The Minnesota symposia on child development* (pp. 43–77). Hillsdale, NJ: Lawrence Erlbaum.

Creed, P. A., Muller, J., & Patton, W. (2003). Leaving high school: The influence and consequences for psychological well-being and career-related confidence. *Journal of Adolescence*, *26*, 295–311.

Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behaviour*. New York: Plenum.

Dweck, C. (1999). *Self-theories: Their role in motivation, personality, and development*. Philadelphia, PA: Psychology Press.

Eccles, J.S., Midgley, C. (1989). Stage-environment fit: Developmentally appropriate classrooms for early adolescents. In R. E. Ames, & C. Ames (Eds.), *Research on motivation in education*: *Goals and cognitions* (Vol. 3, pp. 13–14). New York: Academic Press.

Eccles, J. S., Midgley, C., Wigfield, A., Buchanan, C. M., Reuman, D., Flanagan, C., et al. (1993). The impact of stage-environment fit on young adolescents' experiences of school and in families. *American Psychologist*, *48*, 90–101.

Eccles, J. S., & Wigfield, A. (2002). Motivational beliefs, values and goals. *Annual Review of Psychology*, *53*, 109–132.

Elliot, A. J. (2005). A conceptual history of the achievement goal construct. In A. J. Elliot, & C. S. Dweck (Eds.), *Handbook of competence and motivation* (pp. 52–72). New York: Guilford.

Filak, V. F., & Sheldon, K. M. (2003). Student psychological need satisfaction and college teacher-course evaluations. *Educational Psychology*, *23*, 235–247.

Furman, W., & Buhrmester, D. (1992). Age and sex differences in perceptions of networks of personal relationships. *Child Development*, *63*, 103–115.

Furrer, C., & Skinner, E. A. (2003). Sense of relatedness as a factor in children's academic engagement and performance. *Journal of Educational Psychology*, *95*, 148–162.

Good, P. I. (1999). *Resampling methods: A practical guide to data analysis*. Boston, MA: Birkhäuser.

Goodenow, C. (1993). Classroom belonging among early adolescent students: Relationships to motivation and achievement. *Journal of Early Adolescence*, *13*, 21–43.

Guay, F., Boivin, M., & Hodges, E. V. E. (1999). Predicting change in academic achievement: A model of peer experiences and self-system processes. *Journal of Educational Psychology*, *91*, 105–115.

Hall, R. J., Snell, A. F., & Foust, M. S. (1999). Item parcelling strategies in SEM: Investigating the subtle effects of unmodeled secondary constructs. *Organizational Research Methods*, *2*, 233–256.

Harter, S. (1978). Effectance motivation reconsidered: Toward a developmental model. *Human Development*, *21*, 36–64.

Holmbeck, G. N. (1997). Toward terminological, conceptual, and statistical clarity in the study of mediators and moderators. Examples from the child clinical and pediatric psychology literatures. *Journal of Consulting and Clinical Psychology*, *65*, 599–610.

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*, *6*, 1–55.

Hymel, S., Comfort, C., Schonert-Reichl, K., & McDougall, P. (1996). Academic failure and school dropout: The influence of peers. In J. Juvonen, & K. R. Wentzel (Eds.), *Social motivation: Understanding children's school adjustment* (pp. 313–345). New York: Cambridge University Press.

Isakson, K., & Jarvis, P. (1999). The adjustment of adolescence during the transition to high school: A short term longitudinal study. *Journal of Youth and Adolescence*, *28*, 1–26.

Kaplan, D. (2000). *Structural equation modelling: Foundations and extensions*. Thousand Oaks, CA: Sage.

La Guardia, J. G., Ryan, R. M., Couchman, C. E., & Deci, E. L. (2000). Within-person variation in security of attachment: A self-determination theory perspective on attachment need fulfillment, and well-being. *Journal of Personality and Social Psychology*, *79*, 367–384.

Landis, R. S., Beal, D. J., & Tesluk, P. E. (2000). A comparison of approaches to forming composite measures in structural equation models. *Organizational Research Methods*, *3*, 186–207.

Larson, R. W. (2000). Toward a psychology of positive youth development. *American Psychologist*, *55*, 170–183.

Little, T. D., Cunningham, W. A., Shahar, G., & Widaman, K. F. (2002). To parcel or not to parcel: Exploring the question, weighing the merits. *Structural Equation Modeling*, *9*, 151–173.

Lynch, M., & Cicchetti, D. (1997). Children's relationships with adults and peers: An examination of elementary and junior high school students. *Journal of School Psychology*, *35*, 81–99.

Ma, X. (2003). Sense of belonging to school: Can schools make a difference? *The Journal of Educational Research*, *96*, 340–351.

MacKinnon, D. P., Lockwood, C. M., Hoffman, J. M., West, S. G., & Sheets, V. (2002). A comparison of methods to test mediation and other intervening variable effects. *Psychological Methods*, *7*, 83–104.

McDonald, R. P., & Ho, M. H. (2002). Principles and practice in reporting structural equation analyses. *Psychological Methods*, *7*, 64–82.

McEvoy, A., & Welker, R. (2000). Antisocial behaviour, academic failure, and school climate: A critical review. *Journal of Emotional and Behavioural Disorders*, *8*, 130–141.

Murdock, T. (1999). The social context of risk: Status and motivational predictors of alienation in middle school. *Journal of Educational Psychology*, *91*, 62–75.

Ntoumanis, N., & Blaymires, G. (2003). Contextual and situational motivation in education: A test of the specificity hypothesis. *European Physical Education Review*, *9*, 5–21.

Osterman, K. F. (2000). Students' need for belonging in the school community. *Review of Educational Research*, *70*, 323–368.

Queensland Government (2002). *Queensland and the smart state*: *Education and training reforms for the future. A white paper*. State of Queensland, ISBN 0734519591.

Reeve, J. (2002). Self-determination theory applied to educational settings. In E. L. Deci, & R. M. Ryan (Eds.), *Handbook of self-determination theory* (pp. 183–203). Suffolk: University of Rochester Press.

Roeser, R. W., Eccles, J. S., & Sameroff, A. J. (2000). School as a context of early adolescents' academic and social-emotional development: A summary of research findings. *The Elementary School Journal*, *100*, 443–446.

Roeser, R. W., Midgley, C., & 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*, *88*, 408–422.

Roth, P. L., Switzer, F. S., III, & Switzer, D. M. (1999). Missing data in multiple item scales: A Monte Carlo analysis of missing data techniques. *Organizational Research Methods*, *2*, 211–232.

Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist*, *55*, 68–78.

Ryan, R. M., & Deci, E. L. (2002). Overview of self-determination theory: An organismic dialectical perspective. In E. L. Deci, & R. M. Ryan (Eds.), *Handbook of self-determination theory* (pp. 3–33). Suffolk: University of Rochester Press.

Ryan, R. M., Stiller, J. D., & Lynch, J. H. (1994). Representations of relationships to teachers, parents, and friends as predictors of academic motivation and self-esteem. *Journal of Early Adolescence*, *14*, 226–249.

Sage, N. A., & Kindermann, T. A. (1999). Peer networks, behaviour contingencies, and children's engagement in the classroom. *Merrill-Palmer Quarterly*, *45*, 143–171.

Sanders, M. G., & Jordan, W. J. (2000). Student–teacher relations and academic achievement in high school. In M. G. Sanders (Ed.), *Schooling students placed at risk: Research policy, and practice in the education of poor and minority adolescents* (pp. 65–82). Mahwah, NJ: Lawrence Erlbaum Associates.

Schafer, J. L., & Graham, J. W. (2002). Missing data: Our view of the state of the art. *Psychological Methods*, *7*, 147–177.

Shrout, P. E., & Bolger, N. (2002). Mediation in experimental and nonexperimental studies: New procedures and recommendations. *Psychological Methods*, *7*, 422–445.

Skinner, E. A. (1995). *Perceived control motivation and coping*. Newbury Park, CA: Sage.

Skinner, E. A., & Belmont, M. J. (1993). Motivation in the classroom: Reciprocal effects of teacher behaviour and student engagement across the school year. *Journal of Educational Psychology*, *85*, 571–581.

Skinner, E. A., Zimmer-Gembeck, M. J., & Connell, J. P. (1998). Individual differences and the development of perceived control. *Monographs of the Society of Research in Child Development*, *63* (2–3, Whole No. 204).

SmallWaters Corporation. (1999). *AMOS 4.0 User's Guide*. Chicago, IL: SmallWaters Corporation.

Smerdon, B. A. (2002). Students' perceptions of membership in their high schools. *Sociology of Education*, *75*, 287–305.

Sobel, M. E. (1982). Asymptotic confidence intervals for indirect effects in structural equation models. In S. Leinhardt (Ed.), *Sociological methodology* (pp. 290–312). San Francisco: Jossey-Bass.

Solomon, D., Watson, M., Battisch, V., Schaps, E., & Delucchi, K. (1996). Creating classrooms that students experience as communities. *American Journal of Community Psychology*, *24*, 719–748.

Sweetland, S. R., & Hoy, W. K. (2000). School characteristics and educational outcomes: Toward an organizational model of student achievement in middle schools. *Educational Administration Quarterly*, *36*, 703–729.

Urdan, T., & Turner, J. C. (2005). Competence motivation in the classroom. In A. J. Elliot, & C. S. Dweck (Eds.), *Handbook of competence and motivation* (pp. 297–317). New York: Guilford.

Verkuyten, M., & Thijs, J. (2002). School satisfaction of elementary school children: The role of performance, peer relations, ethnicity and gender. *Social Indicators Research*, *59*, 203–227.

Walls, T. A., & Little, T. D. (2005). Relations among personal agency, motivation, and school adjustment in early adolescence. *Journal of Educational Psychology*, *97*, 23–31.

Weiner, B. (1990). History of motivational research in education. *Journal of Educational Psychology*, *82*, 616–622.

Wentzel, K. R. (1998). Social relationships and motivation in middle school: The role of parents, teachers, and peers. *Journal of Educational Psychology*, *90*, 202–209.

Wentzel, K. R. (1999). Social-motivational processes and interpersonal relationships: Implications for understanding motivation at school. *Journal of Educational Psychology*, *91*, 76–97.

Wentzel, K. R., & Caldwell, K. A. (1997). Friendships, peer acceptance, and group membership: Relations to academic achievement in middle school. *Child Development*, *68*, 1198–1209.

Wentzel, K. R., McNamara Barry, C., & Caldwell, K. A. (2004). Friendships in middle school: Influences on motivation and school adjustment. *Journal of Educational Psychology*, *96*, 195–203.

White, R. W. (1959). Motivation reconsidered: The concept of competence. *Psychological Review*, *66*, 97–333.

Wigfield, A., & Wagner, A. L. (2005). Competence, motivation, and identity development during adolescence. In A. J. Elliot, & C. S. Dweck (Eds.), *Handbook of competence and motivation* (pp. 222–239). New York: Guilford.

Zimmer-Gembeck, M. J. (2002). The development of romantic relationships and adaptations in the system of peer relationships. *Journal of Adolescent Health*, *31*, 216–225.

Zimmer-Gembeck, M. J., & Collins, W. A. (2003). Autonomy development during adolescence. In G. R. Adams, & M. Berzonsky (Eds.), *Blackwell handbook of adolescence* (pp. 175–204). Oxford: Blackwell Publishers.