

Predicting Change in Academic Achievement: A Model of Peer Experiences and Self-System Processes

Frédéric Guay, Michel Boivin and Ernest V. E. Hodges
Université Laval, Québec, Canada

Abstract

The purpose of this study was to test a model of peer experiences and academic achievement among elementary school children. This model postulates that the quality of children's social relations (e.g., social preference) in the peer group can foster or inhibit feelings of connectedness (e.g., loneliness), which in turn affects children's perceptions of academic competence. Finally, perceptions of academic competence are hypothesized to predict change in academic achievement. Participants were 397 school children (206 girls, 191 boys; mean age = 108 months, range = 88-157 months). Results from structural equation modeling provided support for the proposed model. Discussion centers on the mediational role of self-system processes between children's social relations and change in academic achievement.

Academic achievement problems appear to have lasting effects; problems in achievement that arise early in children's school careers predict school dropout (Barrington & Hendricks, 1989; Dryfoos, 1990; Ekstrom, Goertz, Pollack, & Rock, 1986; Ensminger & Slusarcick, 1992), delinquent behaviors (Tremblay et al., 1992), and mental health difficulties during adulthood (Caspi, Eider, & Bern, 1987; Kazdin, 1985). Given the pervasive effects of early school achievement difficulties, researchers have tried to identify factors that may impede or facilitate children's achievement. Much of this research has focused on psychological mechanisms (e.g., Fortier, Vallerand, & Guay, 1995; Gottfried, 1985, 1990; Normandeau & Guay, 1998), family factors (e.g., Ginsburg & Bronstein, 1993; Gottfried, Fleming, & Gottfried, 1994; Grolnick & Ryan, 1989; Grolnick, Ryan, & Deci, 1991; Grolnick & Slowiaczek, 1994; Guay & Vallerand, 1997; Patterson, Kupersmidt, & Vaden, 1990), and class-room climate variables (Boggiano, Flink, Shields, Seelbach, & Barrett, 1993; Ryan & Grolnick, 1986; Ryan & Stiller, 1991) that may contribute to academic achievement. For example, Ginsburg and Bronstein (1993) found that parental reactions to grades, such as negative control, low involvement, provision of extrinsic rewards, and over- and undercontrolling family styles, were related to lower academic performance. On the other hand, autonomy-supportive family styles (e.g., including children in decision making) have been found to be associated with higher academic performance. Recently, Guay and Vallerand (1997) provided evidence that, in addition to parents, the use of autonomy-supportive techniques by teachers and school administrators predicted school achievement through motivational processes (see also Grolnick et al., 1991; Ryan & Grolnick, 1986). In sum, the quality of children's interactions with parents and teachers seems to be associated with children's scholastic achievement.

However, peers may also contribute to children's achievement because they are one of the most potent influences on their day-to-day behaviors in school (Hymel, Comfort, Schonert-Reichl, & McDougall, 1996; Steinberg, Dombusch, & Brown, 1992). Indeed, research on peer relations reveals that the quality of children's relationships with their classmates is associated with school achievement (Bandura, Barbamelli, Caprara, & Pastorelli, 1996; Dishon, 1990; Epperson, 1963; Frentz, Gresham, & Elliot, 1991; Krappman, 1985; Vasudeva & Verma, 1974; Wentzel, 1991; Wentzel & Asher, 1995). For example, Frentz et al. (1991) and Wentzel (1991) showed that children who were rejected by their peers had lower academic achievement scores than more popular children. Longitudinal evidence has indicated that early peer rejection predicts decreases in academic performance, whereas making new friends in the classroom was associated with gains in school performance (Ladd, 1990). Thus, it seems that children who encounter problems with their peer relationships are likely to experience a school climate less conducive to learning than if they are well accepted by their classmates.

Although the link between the quality of children's peer relations and academic achievement has been established, theory delineating the processes by which this occurs is lacking. That is, how do peer relations come to be linked with academic achievement—through what psychological processes? One possible explanation is that peer relations may impede or foster the development of important self-components. Indeed, previous work has identified self-system processes or "inner resources" as important predictors of school success (Connell & Wellborn, 1990; Grolnick et al., 1991; Grolnick & Slowiaczek, 1994; Ryan & Powelson, 1991). More specifically, Connell and Wellborn (1990) proposed a theoretical framework that includes three self-system processes believed to be fundamental to learning: (a) relatedness, or perceiving oneself as being related to others in the school context; (b) competence, or perceiving oneself as being effective in one's interactions with school activities; and (c) autonomy, or perceiving oneself as experiencing choice in the initiation, maintenance, and regulation of school activities (see also Deci & Ryan, 1985, 1991; Ryan & Powelson, 1991, for similar perspectives). According to this model, individuals progressively develop their perceptions of competence, autonomy, and relatedness on the basis of their social interactions. Thus, the quality of social interactions should either enhance or inhibit perceptions of relatedness, competence, and autonomy. For example, home and school environments that are excessively controlling (e.g., punishment) interfere with these self-system processes, whereas autonomy-supportive environments (e.g., the child has the possibility to make decisions) foster them (Guay & Vallerand, 1997). Similarly, when perceived relatedness, autonomy, and competence are fostered by the school context, engagement is likely to be manifested in affect (e.g., curiosity vs. apathy), cognition (e.g., flexibility vs. rigidity in problem solving), and behavior (e.g., extracurricular academically oriented vs. extracurricular nonacademically oriented). Conversely, when these self-processes are hampered by the school context, disaffection will result, along with adverse effects on affect, cognition, and behavior. Finally, Connell and Wellborn's model postulates that affective, cognitive, and behavioral engagement in the school context influences school outcomes such as grades, skills, and adjustment. Thus, patterns of action (i.e., engagement vs. disaffection) are thought to mediate the relation between self-system processes and the acquisition of specific skills and adjustment within the school context.

In line with Connell and Wellborn's (1990) model and previous findings in the literature, we propose a social process model outlining the interpersonal and self-component mechanisms through which negative peer experiences are likely to be linked to decreases in academic

achievement. In the present study, two of Connell and Wellborn's self-system processes likely to be influenced by peer relationships were examined, namely perceptions of relatedness and competence. The autonomy dimension was not considered because peers are unlikely to promote a child's sense of autonomy in school. Encouraging autonomy is more concordant with the roles of parents and teachers in the school context, as they have the authority to provide a structure that encourages choices about school work (e.g., Grolnick & Ryan, 1989).

Three main hypotheses were posited from the proposed model. The first hypothesis was that negative peer relationships (i.e., greater rejection and lower peer acceptance within the classroom) should foster feelings of loneliness and social dissatisfaction (or lack of relatedness). Some empirical evidence in the literature provides support for this hypothesis. For example, Asher, Parkhurst, Hymel, and Williams (1990) reported that rejected children tend to experience significantly greater feelings of loneliness and social dissatisfaction than nonrejected children (see also Asher & Wheeler, 1985; Boivin & Hymel, 1997; Boivin, Hymel, & Bukowski, 1995; Boivin, Poulin, & Vitaro, 1994; Cassidy & Asher, 1992; Sletta, Valas, Skaalvik, & Sobstad, 1996; Williams & Asher, 1992). In addition, Boivin et al. (1995) showed that negative peer relations predicted increases in loneliness over a 1-year period. Thus, it seems that peer rejection leads to overall feelings of loneliness, revealing a lack of companionship and a diminished sense of belongingness, on the one hand, and lack of emotional support and affection, on the other.

What are the scholastic consequences of feeling unrelated to others? The second hypothesis addresses this issue by postulating that classroom feelings of loneliness should negatively predict perceived academic competence. Recent studies have shown that significant others may influence perceived academic competence, although these studies have mainly emphasized adult influences (i.e., teacher and parent; Connell & Wellborn, 1990; Guay & Vallerand, 1997; Vallerand, Fortier, & Guay, 1997). Far less empirical support is available concerning the nature of the link between perceived loneliness and perceived academic competence. Nevertheless, some empirical findings suggest that feelings of loneliness may mediate the relation between peer acceptance and self-perceptions. For example, in examining the links between social behavior, peer experiences, and general self-worth, Boivin and Hymel (1995, 1997; see also Boivin et al., 1995) showed that perceived social acceptance and feelings of loneliness mediated the negative impact of aversive peer experiences on general self-worth (see also Sletta et al., 1996).

The third hypothesis of the model posits that perceived academic competence should predict increases in scholastic achievement over the elementary school years. Evidence converges in the literature to support the notion that children's attitudes and beliefs about themselves are powerful determinants of school success (e.g., Bandura et al., 1996; Grolnick & Slowiaczek, 1994; Pierson & Connell, 1992; Zimmerman & Bandura, 1994). For example, laboratory studies show that students with higher perceptions of ability display greater persistence, and perform better on more difficult tasks, than students with lower perceptions of ability (e.g., Crandall, 1969; Eccles, Adler, & Meece, 1984). A field study by Grolnick et al. (1991) revealed that perceived academic competence predicted academic achievement (see also Grolnick & Slowiaczek, 1994). More important, Miserandino (1996) has revealed that the effect of perceived academic competence on achievement exists over and beyond ability. Specifically, results of this study showed that when controlling for ability (as measured by the Stanford Achievement Test), perceived competence was a significant predictor of math and social studies grades. Children who perceived themselves as academically competent received higher grades in both of these subjects. In light of these

previous results, we expected that perceived academic competence would predict change in achievement over the school years.

In sum, the proposed model posits that a negative status in the peer group will foster feelings of loneliness and social dissatisfaction in the classroom (or lack of relatedness). In turn, perceiving oneself as lonely will contribute to lower perceptions of being effective in one's interactions with school activities (i.e., academic competence). Finally, as fewer children perceive themselves as competent in academic activities, greater decreases in academic achievement will be evidenced over the school years.

Method

Participants

Participants were 397 French Canadian children (206 girls, 191 boys; mean age = 108 months, range = 88-157 months) from 10 elementary schools from a variety of socioeconomic environments in Québec City, Canada. Children attended second (n = 122), third (n = 183), and fourth (n = 92) grades. Children's participation required parental consent. The participation rate was over 98%.

Procedure

The study was conducted across a 2-year period and involved three waves of data collection. At Time 1, children participated in an individual interview in which sociometric status within the classroom was assessed during the middle of the spring semester. Self-report measures of perceived loneliness and perceived academic competence were administered in group testing sessions, and teachers completed a questionnaire assessing children's academic achievement in three subjects: writing, reading, and mathematics. At Time 2, 1 year later, perceived loneliness and perceived academic competence were measured again. Finally, at Time 3 (2 years after initial assessments), teachers completed a questionnaire assessing children's academic achievement.

Measures

Peer status. Social status within the classroom was assessed through a picture nomination sociometric procedure. Children were asked to identify three "liked most" (LM) and three "liked least" (LL) choices in each of three situations: playing together, inviting others to a birthday party, and sitting next to others on the bus on a class excursion. LM and LL scores were computed by summing the choices each child received from all classmates across all situations. These LM and LL scores yielded good internal consistency ($\alpha = .88$ for LM, $\alpha = .93$ for LL). Following the procedure outlined by Coie and Dodge (1983), LM and LL scores were standardized within each

class and used to compute an index of social preference ($SP = LM - LL$) for each child. Higher SP scores reflect greater acceptance and lower rejection within the classroom.¹

Academic perceived competence. Children completed the Academic Perceived Competence subscale from the Self-Perception Profile for Children (Harter, 1985). This subscale included six items (e.g., "Remember things easily") and had adequate Cronbach alpha values at Time 1 (.78) and Time 2 (.82). Items were scored on a 4-point ordinal scale (1 = low perceived academic competence, 4 = high perceived academic competence).

Perceived loneliness. Children's feelings of loneliness within the classroom were assessed with four items (i.e., "It is hard to get kids in school to like me"; "I have a lot of friends in my class"-reverse scoring; "I feel left out of things at school"; "There's no other kids I can go to when I need help in school") from the Loneliness and Social Dissatisfaction Questionnaire (Asher & Wheeler, 1985). We decided to use 4 of the 16 items of the Loneliness scale because we did not want to estimate a high number of free parameters in the structural models (see Results section below). These items were selected on the basis of their skewness and kurtosis values to ensure that they were normally distributed because nonnormal items can bias results obtained under the maximum likelihood (ML) method of estimation (West, Finch, & Curran, 1995). The correlation of this 4-item subscale and the full 16-item scale was .81 ($p < .001$). This abridged version thus shares similar properties with the original scale. Items were rated on a 4-point ordinal scale (1 = *low perceived loneliness*, 4 = *high perceived loneliness*).

Academic achievement. The measure used to assess academic achievement was a three-item teacher rating scale. Each of the three items was designed to assess academic achievement in reading, writing, and mathematics. That is, teachers rated a child's academic performance in these three subjects relative to other classmates using the following ordinal scale: 1 = *quite under the mean*, 2 = *slightly under the mean*, 3 = *at the mean*, 4 = *slightly above the mean*, 5 = *quite above the mean* (see also Frenzt et al., 1991, for a similar methodology). This method was used because it allows the classification of children's academic achievement in relation to the mean achievement of other children in the same class, thereby controlling for strict versus permissive grading systems of different teachers. A score of 5 represents the best academic achievement, whereas a score of 1 represents the worst level of achievement. Cronbach alpha values for this measure were .93 for Time 1 and .91 for Time 3.

Results

Results are presented into two sections. In the first section, we performed a cross lag model to untangle the direction of effects between perceived competence and perceived loneliness. In addition, we performed a test of the cross lag model invariance across gender to rule out the possibility that gender moderates the relationships among variables. In the second section, we tested the hypothesized overall model using an approach that partials out measurement error

¹ In the present study, we did not use SP scores based on LL and LM scores standardized within sex and class for two reasons. First, this measure correlated highly ($r = .92$) with our SP measure that is only based on LL and LM scores standardized within class. Second, using standardized scores within class enabled us to use the overall information (i.e., nominations across sex), which is not the case with standardized scores within class and sex where only same sex nominations are used.

associated with change in academic achievement. A test of the model invariance across gender and three analyses with plausible alternative models were also conducted. Table 1 provides descriptive data for the variables included in the study.

The Cross Lag Model

Model specification and fit indices. The adequacy of the cross lag model was assessed by structural equation modeling with the EQS program (Bentler, 1989, 1993). The proposed model contained four latent constructs, namely perceived competence and loneliness, that were both measured at Time 1 and Time 2. The perceived competence and the perceived loneliness constructs were formed of six and four indicators, respectively. In this model, perceived academic competence at Time 2 was predicted by Time 1 measures of perceived academic competence and loneliness. Similarly, perceived loneliness at Time 2 was determined by Time 1 perceived academic competence and loneliness. In addition, the covariance between Time 1 variables was estimated.

As discussed by Krause, Liang, and Yatomi (1989), autocorrelated measurement error may create special problems in the estimation of a cross lag model. The extent of this problem was assessed empirically by allowing the measurement errors variances for the identical lagged observable indicators to be correlated through time.

The overall model contained 55 parameters to be estimated (i.e., 16 factor loadings, 20 measurement errors, two variances, 11 covariances, four structural paths, and two disturbance terms). Bentler (1993) suggested that the ratio of sample size to number of free parameters to be estimated may be able to go as low as 5:1 under normal elliptical theory, whereas a ratio of at least 10:1 may be more appropriate for arbitrary distribution. Herein, the measurement strategy used offered a ratio of 7:1. Consequently, we were confident to obtain trustworthy z tests on the significance of parameters. Furthermore, the sample size of this study ($n = 397$) was larger than the cut-off value of 200 participants as suggested by some researchers to produce stable results (Baldwin, 1989; Bearden, Sharma, & Teal, 1982).

A covariance matrix with the 20 observed variables was used as a database for the structural analysis. Moreover, skewness and kurtosis values for all variables were considered satisfactory. The specified model was tested with standardized coefficients obtained from the ML method of estimation. A growing body of research indicates that ML performs reasonably well when the data are multivariate normally distributed and the sample size is large enough (e.g., Chou & Bentler, 1995), as in this study.

The EQS program provides different indices to ascertain the model fit. Herein, we used the chi-square (Bollen, 1989), the comparative fit index (CFI; Bentler, 1990), the Bentler-Bonnet nonnormed fit index (NNFI; Tucker & Lewis, 1973), and the parsimonious normed comparative fit index (PCFI; Mulaik et al., 1989). The chi-square indicates the lack of fit resulting from overidentifying restrictions placed on the model (Bollen, 1989). Consequently, a nonsignificant chi-square indicates that the model is an adequate representation of the sample data. However, because the chi-square statistic is a poor estimate when the sample is large (Marsh, Balla, & McDonald, 1988), as in this study, we also used the CFI and the NNFI. The CFI assesses the relative reduction in lack of fit as estimated by the noncentral chi-square of a target model versus

a baseline model where all the observed variables are uncorrelated (Bentler, 1990). The NNFI compares the lack of fit of a target model to the lack of fit of the baseline model. Thus, the NNFI estimates the relative improvement per degree of freedom of the target model over the baseline model (Bentler & Bonett, 1980). The CFI index varies between 0 and 1, whereas the NNFI can go out of this range (i.e., > 1). Herein, models with a CFI and NNFI above .90 were considered acceptable (Bentler & Bonett, 1980). Finally, the PCFI compares the degrees of freedom of the target model over the baseline model and calibrates this proportion from the CFI (i.e., $PCFI = df_{\text{target}}/df_{\text{baseline}} \cdot CFI$). Thus, this coefficient weights the parsimony of the model against its use in achieving goodness of fit. That is, a parsimonious target model with a high CFI value will have a high PCFI coefficient. PCFI values of .80 and above provide support for the validity of the model (Byrne, 1995a).

A test of the cross lag model. Results showed that the chi-square was significant, $\chi^2(155, n = 397) = 261.04, p < .05$. Although the CFI (.95) and the NNFI (.94) were satisfactory, the PCFI (.78) was slightly under the .80 value suggested by Byrne (1995a). In addition, four covariances between measurement errors were nonsignificant. Consequently, a second analysis was performed where these covariances were not estimated. Results of this analysis showed that the chi-square was significant, $\chi^2(159, n = 397) = 265.47, p < .05$. However, the CFI (.95) and the NNFI (.94), and the PCFI (.80) values were satisfactory. Figure 1 presents the standardized solution for the structural and measurement models. All hypothesized path coefficients (except one), factor loadings, covariances, measurement errors, and factor residuals were significant ($z > 1.96$). As shown in Figure 1, the relationship between Time 1 and Time 2 perceived academic competence constructs was relatively high ($\beta = .42$), as was the one between Time 1 and Time 2 perceived loneliness ($\beta = .60$) measures, thereby indicating the stability of these constructs over time. Despite the stability of these constructs, Time 1 perceived loneliness was significantly related to Time 2 perceived competence ($\beta = -.19$). However, Time 1 perceived competence scores did not appear to exert a statistically significant impact on Time 2 perceived loneliness ($\beta = -.07, ns$). On the basis of these results, it would appear that perceived loneliness in elementary school influences perceived academic competence rather than the contrary.

Test of invariance across gender. On the basis of samples of 206 girls and 191 boys, the focus of this analysis was to test for the equivalence of factor loadings and path coefficients across gender. Given that the testing of equality constraints related to error variances and covariances is now considered to be excessively stringent, these analyses were not conducted (Bentler, 1989; Byrne, 1995b). The fit indices for the invariant model were indicative of a well-fitting model: $\chi^2(345, n = 397) = 540.49, p < .05$, CFI = .91, NNFI = .90. Remarkably, only 3 of the 27 imposed equality constraints were found to be untenable. These three significant constraints were one factor loading for Time 1 perceived academic competence and two factor loadings for Time 2 perceived competence. However, the differences found were very small, and for that reason the model was considered to be invariant across gender.

The Hypothesized Model

Preliminary analyses. Table 2 presents correlations among the model variables. All correlations were found to be significant. A strong positive relation was found between Time 1 and Time 3 school achievement ($r = .67$), thereby indicating the stability of these constructs over time. In addition, a positive relation was obtained between social preference and school achievement at

Time 3 ($r = .26$), but a negative one was obtained between social preference and loneliness ($r = -.30$). Furthermore, perceived loneliness (Time 1) was negatively related ($r = -.29$) to perceived academic competence (Time 2). Finally, perceived competence was positively related to school achievement at Time 1 ($r = .39$) and at Time 3 ($r = .42$). Partial correlations controlling for age and sex among model variables were also conducted. Results of this analysis were essentially the same as the ones presented in Table 2.

Method for measuring change in academic achievement. The method proposed by Raykov (1992) was used to measure change in academic achievement. This method is based on a multiple-indicator structural model and is an extension of the base-free measurement of change proposed by Tucker, Damarin, and Messick (1966). The structural model derived from this method permits consistent and efficient estimation of the degree of interrelationship between true change in longitudinally assessed constructs and other variables, such as correlates and predictors of that change.

Three pairs of indicators were used to measure true pretest (Time 1) and posttest (Time 3) academic achievement (see Figure 2). In this model, true pretest was assumed to be uncorrelated with the base-free measure of change (g). That is, $\text{cov}(\text{achievement time-1}, g) = 0$ was assumed and no two-headed arrow connects these two entities. The residualized gain score g was obtained by specifying six paths from true pretest in academic achievement (Time 1) to indicators of academic achievement at Times 1 and 3 and by designating three paths from the residualized gain score g to indicators of academic achievement at Time 3 (see Raykov, 1992, for more details on the model specifications). The model presented in Figure 2 was useful in the present research situation where interest centered on identifying correlates of patterns of change. That is, this procedure tests the hypothesis that high levels of perceived competence were associated with improvements in academic achievement over a 3-year school period.

Model specifications. The model contained five constructs, namely social preference (Time 1), perceived loneliness (Time 1), true pretest academic achievement (Time 1), perceived academic competence (Time 2), and the residual gain score in academic achievement (g). Social preference was assessed with a single indicator obtained by the procedure described earlier, whereas perceived loneliness and perceived competence were measured by four and six indicators, respectively. Finally, as described previously, the academic achievement latent construct (Time 1 and Time 3) was assessed with three indicators measuring achievement in three areas (reading, writing, and mathematics). Thus, the overall model contained 40 parameters to be estimated (i.e., 15 factor loadings, 16 measurement errors, four covariances, five variances) and thus offered an adequate (10:1) ratio of sample size to number of free parameters. Finally, the fit indices to ascertain the model adequacy were the same as those used in the panel analysis, namely the chi-square, CFI, NNFI, and PCFI. Once again the ML method of estimation was used to test the model.

A test of the hypothesized model. Results of the structural analysis showed that the chi-square was significant, $\chi^2(113, n = 397) = 259.81, p < .05$. However, the CFI (.96), the NNFI (.95), and the PCFI (.80) were satisfactory. All hypothesized covariances, factor loadings, and measurement errors were significant ($z > 1.96$). More precisely, as shown in Figure 2, Time 1 social preference was negatively associated with Time 1 perceived loneliness ($r = -.37$), and Time 1 loneliness was negatively related to Time 2 perceived competence ($r = -.25$). Finally, Time 2 perceived competence was positively related to the residualized true change in academic achievement ($r =$

.22) and Time 1 true pretest in academic achievement ($r = .42$). In other words, it appears that the more children are rejected by their peers (i.e., more negative nominations and fewer positive ones), the greater are children's perceptions of loneliness and social dissatisfaction. In turn, the more children perceive themselves as lonely, the lower their levels of perceived academic competence. Finally, low levels of perceived academic competence led to a decrease in academic achievement.

A test of invariance across gender. As in the cross lag model analysis, the focus of this analysis was to test for the equivalence of factor loadings and covariances across gender. The fit indices for the invariant model were indicative of a well-fitting model: $\chi^2 (245, n = 397) = 453.562, p < .05$, CFI = .94, NNFI = .93. Only 4 of the 19 imposed equality constraints were found to be untenable. These 4 significant constraints were two factor loadings for Time 2 perceived competence and two factor loadings from Time 1 true pretest scores in academic achievement. However, these differences were very small and for that reason the model was considered to be invariant across gender.

Alternative models. To verify the mediational role of self-perceptions between social preference and change in academic achievement, we generated three alternative models. The first alternative model (M1) postulated the same links as the hypothesized model but also the two following covariances: (a) covariance (perceived loneliness, Time 1 true pretest scores in academic achievement), and (b) covariance (perceived loneliness, g). The second alternative model (M2) included the same relations as in M1 but also these two covariances: (a) covariance (social preference, Time 1 true pretest scores in academic achievement), and (b) covariance (social preference, g). The third alternative model (M3) included the same relationships as in M2 but also one additional covariance: covariance (social preference, perceived academic competence). M3 thus included all possible relationships between the latent variables under study.

The hypothesized model would be rejected if one of these alternative models showed a better PCFI value. The PCFI value was selected as the major criterion to test the plausibility of the relations under study because it offers the possibility to weight the parsimony of the model against its use in achieving goodness of fit. As is shown in Table 3, none of the three alternative models offered higher PCFI values than the hypothesized model. For that reason, the hypothesized model was considered as the better representation of the data under study. Perceived loneliness and academic competence thus seemed to play a mediational role between peer experiences and change in academic achievement over the elementary school years.

Discussion

The purpose of this study was to test a model integrating existing knowledge on the linkages between peer relations and academic achievement. This model posits that negative peer relationships lead to a decrease in academic achievement through the mediation of self-system processes involving low perceived relatedness and low perceived academic competence. Results of the present study provided support for the proposed model. First, the test of the cross lag model showed that perceived loneliness led to perceived academic competence, rather than the contrary. Further, the proposed mediational model was found to fit reasonably well with the data, and the estimated coefficients were all significant. The present results have important implications for research on peer relationships and school adjustment. We discuss each of these implications below.

According to Connell and Wellborn (1990), feelings of relatedness, autonomy, and competence are central aspects of the self intervening between the school context and the child's academic adjustment. Until now, most studies conducted in line with this view have stressed parent, teacher, and school administrator influences on children's self-system processes (Connell & Wellborn, 1990; Grolnick & Ryan, 1989; Grolnick et al., 1991; Grolnick & Slowiaczek, 1994; Guay & Vallerand, 1997; Vallerand et al., 1997). Although Pierson and Connell (1992) noted a positive relation between relatedness to peers and academic performance, their study did not specifically test any processes underlying this relation. The present results thus extend the Pierson and Connell findings by showing how the peer context may influence perceived relatedness with peers and perceived academic competence.

Ladd, Kochenderfer, and Coleman (1996) proposed that friendship quality could increase children's feelings of security and competence in the classroom. Furthermore, feelings of classroom belongingness and peer-teacher support in middle school have been associated with school motivation and expectancies for academic success (Goodenow, 1983). The present findings are generally consistent with these past studies, as they showed how feelings of social disaffection with classmates may impair a sense of effectiveness toward school activities. The mediational role of loneliness is also congruent with previous studies indicating that perceived loneliness mediates the relation between actual peer status and more general appraisals of self-worth (Boivin & Hymel, 1997; Sletta et al., 1996). However, at least in one study (Wentzel & Asher, 1995), subgroup differences were found with respect to the school adjustment of peer rejected children, with aggressive-rejected, but not submissive-rejected children, displaying lower interest in school work, less optimal self-regulated learning, and poorer general school adjustment. These subgroup findings call for a qualified interpretation of the present results, while raising new questions for future research. For instance, research on children's self-concept has revealed substantial within-group variations in self-perceptions among peer rejected children, and such a variation has been systematically linked to differences in aggressive, submissive, and withdrawn behavior (Boivin, Thomassin, & Alain, 1989; Hymel, Bowker, & Woody, 1993; Patterson, Kupersmidt, & Griesler, 1990). It would be important in future research to evaluate whether any reduction in perceived and actual academic competence associated with a negative peer status could be accounted for by behavioral tendencies alone.

There may be multiple processes through which social behavior and peer status affect social and academic self-perceptions. Even though most children are likely to report that it is important to associate with classmates, this may not be the case for every child. For instance, Rubin and Asendorpf (1993) emphasized the need to distinguish children isolated by their peers from children who prefer to be alone. The experience of loneliness might thus differ as a function of social motivation. For example, low peer status may not affect feelings of loneliness for children who prefer to be alone (i.e., children who attach less importance to personal relationships), and these children may dedicate more time and interest for scholastic matters. Consequently, future research may benefit from consideration of individual differences in the degree to which children attach importance to being related to others.

Another factor in the peer context that may intervene in the peer status-loneliness relation is the experience of victimization. As Boivin and Hymel (1997) pointed out, because peer status relies on the affective evaluation of the group, it may be difficult for the child to have access to such an evaluation. Manifest aversive peer behaviors such as peer victimization, may provide the kinds of

negative experiences through which children come to feel lonely and socially dissatisfied with respect to the classroom context. However, it is likely that, as the children get older, the classroom will progressively give way to more specific peer clusters as reference points for children's feelings of belongingness and self-definition. This could mean that with age, classroom-based assessment becomes less relevant for these issues, and that we need to take into account other relationships (e.g., friends, teachers, clique membership) than those based on classroom nominations to more realistically reflect the changes in feelings of relatedness. For example, rejected children with supportive parents and teachers may feel less lonely and more academically competent. Moreover, having a best friend may moderate the negative effects of peer rejection on perceived loneliness and social dissatisfaction (see Hodges, Malone, & Perry, 1997, on this issue), but it is also possible that hanging around with deviant friends, although fostering a sense of belongingness, may also lead to academic problems and school dropout. Therefore, not only is it essential to take into account a wider spectrum of relationships, but it is also necessary to understand how specific affiliations may lead to school adjustment problems. Further tests of the model are thus awaited that will include different populations (i.e., older children), dyadic measures of friendships, and clique assessments, as well as measures assessing teachers' influence. However, in light of the present results we maintain that loneliness (or lack of relatedness) is not simply an outcome of negative peer experiences, but is also a contributing factor to academic maladjustment through perceived academic competence processes.

The present findings showed that perceived academic competence was positively associated with change in academic achievement over a 3-year school period. Although these findings corroborate previous work (Bandura, 1986; Grolnick et al., 1991; Miserandino, 1996), the present research did not focus on specific patterns of action that could mediate the linkages between self-system processes and school related outcomes. According to Connell and Wellborn (1990), these patterns of action may be evidenced in cognitive (e.g., flexible problem solving), behavioral (e.g., extracurricular academically oriented), and emotional engagement (e.g., curiosity). For example, Connell and Wellborn showed that perceived competence influences teacher-rated student engagement (i.e., positive emotion, flexible problem solving, and extracurricular academics), which in turn is associated with students' grades and achievement scores. In addition, it should be noted that other studies have shown that other psychological mechanisms could intercede in the self-system processes-outcomes relationship. For example, Guay and Vallerand (1997) have revealed that self-determined academic motivation (i.e., engagement in an activity out of personal choice and pleasure) is a key mediator between perceived academic competence and scholastic achievement. In sum, focusing on specific psychological variables that could intervene in the self-system processes-outcomes relationship could benefit our understanding of the paths leading to academic success.

Although the present results provided support for the proposed model, at least three limitations should be taken into consideration when interpreting the findings. First, even though we used structural equation modeling, it is nevertheless inappropriate to make strong causal inferences. For example, a nonrecursive relationship may exist between academic achievement and peer status. That is, children may reject some classmates on the basis of poor school grades. Moreover, it is possible that there is a cyclic interchange among perceptions of competence and grades. Longitudinal studies over several years are thus needed to provide validity for these assumptions. A second limitation concerned the fact that peer status was assessed only at Time 1. Using multiple assessments would have allowed us to examine whether change in peer status affected change in

loneliness, perceived academic competence, and/or academic achievement. Third, shared method variance may exist between self-report measures. Thus, stronger support for this model could have been obtained by using a multitrait-multimethod approach to evaluate these constructs. It should be noted, however, that self-report measures are the only means to get at children's view of their internal states. Furthermore, using a longitudinal design with different informants (i.e., peers and teachers) alleviated possible confounding between other measures.

In sum, despite the limitations mentioned above, a model of peer experiences and self-system processes was tested and supported. We believe that the present findings have outlined the importance of self-system processes in the linkages between peer experiences and school achievement. That is, these present results, in conjunction with numerous other findings, give some cues for promoting school adjustment. People involved in children's education should be aware of the elements in the school context that foster or impede children's self-system processes. Such an understanding may go a long way toward promoting academic achievement and school persistence.

References

- Asher, S. R., Parkhurst, J. T., Hymel, S., & Williams, G. A. (1990). Peer rejection and loneliness in childhood. In S. R. Asher & J. D. Coie (Eds.), *Peer rejection in childhood* (pp. 253-273). New York: Cambridge University Press.
- Asher, S. R., & Wheeler, V. A. (1985). Children's loneliness: A comparison of rejected and neglected peer status. *Journal of Consulting and Clinical Psychology, 53*, 500-505.
- Baldwin, B. (1989). A primer in the use and interpretation of structural equation models. *Measurement and Evaluation in Counseling and Development, 22*, 100-112.
- Bandura, A. (1986). *Social foundation of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice Hall.
- Bandura, A., Barbamelli, C., Caprara, G. V., & Pastorelli, C. (1996). Multifaceted impact of self-efficacy beliefs on academic functioning. *Child Development, 67*, 1206-1222.
- Barrington, B. L., & Hendricks, B. (1989). Differentiating characteristics of high school graduates, dropouts, and nongraduates. *Journal of Educational Research, 82*, 309-319.
- Bearden, W. O., Sharma, S., & Teal, J. E. (1982). Sample size effects on chi-square and other statistics used in evaluating causal models. *Journal of Marketing Research, 19*, 425-430.
- Bentler, P. M. (1989). *EQS: Structural equations program manual*. Los Angeles: BMDP Statistical Software.
- Bentler, P. M. (1990). Comparative fit indices in structural models. *Psychological Bulletin, 107*, 238-246.
- Bentler, P. M. (1993). *EQS: structural equation program manual*. Los Angeles: BMDP Statistical Software.
- Bentler, P. M., & Bonen, D. G. (1980). Significance tests and goodness -of-fit in the analysis of covariance structures. *Psychological Bulletin, 88*, 588-606.
- Boggiano, A. K., Flink, C., Shields, A., Seelbach, A., & Barrett, M. (1993). Use of techniques promoting students' self-determination: Effects on students' analytic problem-solving skills. *Motivation and Emotion, 17*, 319-336.
- Boivin, M., & Hymel, S. (1995, April). *Problematic peer relationships and negative self-perceptions: A study of process among French-Canadian children*. Paper presented at the Biennial Meeting of the Society for Research in Child Development, Indianapolis, IN.
- Boivin, M., & Hymel, S. (1997). Peer experiences and social self-perceptions: A sequential model. *Developmental Psychology, 33*, 135-145.

- Boivin, M., Hymel, S., & Bukowski, W. M. (1995). The roles of social withdrawal, peer rejection, and victimization by peers in predicting loneliness and depressed mood in childhood. [Special issue: Developmental processes in peer relations and psychopathology] *J. Development and Psychopathology*, 7, 765-785.
- Boivin, M., Poulin, F., & Vitaro, F. (1994). Depressed mood and peer rejection in childhood. *Development and Psychopathology*, 6, 483-498.
- Boivin, M., Thomassin, L., & Alain, M. (1989). Peer rejection and self-perceptions among early elementary school children: Aggressive rejectees versus withdrawn rejectees. In B. H. Schneider, G. Attili, J. Nadel, & R. P. Weissberg (Eds.), *Social competence in developmental perspective* (pp. 392-393). Boston, MA: Kluwer Academic.
- Bollen, K. A. (1989). *Structural equations with latent variables*. New York: Wiley.
- Byrne, B. M. (1995a). Bumout: Testing for the validity, replication, and invariance of causal structure across elementary, intermediate, and secondary teachers. *American Educational Journal*, 31, 645-673.
- Byrne, B. M. (1995b). *Structural equation modeling with EQS and EQS/Windows: Basic concepts, applications, and programming*. Thousand Oaks, CA: Sage.
- Caspi, A., Eider, G. H., & Bern, D. J. (1987). Moving against the world: Life-course patterns of explosive children. *Developmental Psychology*, 23, 308-313.
- Cassidy, J., & Asher, S. R. (1992). Loneliness and peer relations in young children. *Child Development*, 63, 350-365.
- Chou, C. P., & Bender, P. M. (1995). Estimates and tests in structural equation modeling. In R. H. Hoyle (Ed.), *Structural equation modeling: Concepts, issues, and applications* (pp. 37-55). Thousand Oaks, CA: Sage.
- Coie, J. D., & Dodge, K. A. (1983). Continuities and changes in children's social status: A five-year longitudinal study. *Merrill-Palmer Quarterly*, 29, 261-281.
- Connell, J. P., & Wellbom, J. G. (1990). Competence, autonomy, and relatedness: A motivational analysis of self-system processes. In M. R. Gunnar & L. A. Stroufe (Eds.), *Minnesota Symposium on Child Psychology* (Vol. 22, pp. 43-77). Hillsdale, NJ: Erlbaum.
- Crandall, V. C. (1969). Sex differences in expectancy of intellectual and academic reinforcement. In C. P. Smith (Ed.), *Achievement related motives in children* (pp. 11-45). New York: Russell Sage Foundation.
- Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behavior*. New York: Plenum.

- Deci, E. L., & Ryan, R. M. (1991). A motivational approach to self: Integration in personality. In R. Dienstbier (Ed.), *Nebraska Symposium on Motivation: Vol. 38. Perspectives on motivation* (pp. 237-288). Lincoln: University of Nebraska Press.
- Dishon, T. J. (1990). The family ecology of boys' peer relations in middle childhood. *Child Development, 61*, 874-892.
- Dryfoos, J. G. (1990). *Adolescents at risk*. New York: Oxford University Press.
- Eccles, J., Adler, T. R., & Meece, J. L. (1984). Sex differences in achievement: A test of alternate theories. *Journal of Personality and Social Psychology, 46*, 26-43.
- Ekstrom, R. B., Goertz, M. E., Pollack, J. M., & Rock, D. A. (1986). Who drops out of high school and why? Findings from a national study. *Teachers College Record, 87*, 356-373.
- Ensminger, M. E., & Slusarcick, A. L. (1992). Paths to high school graduation or dropout: A longitudinal study of a first-grade cohort. *Sociology of Education, 65*, 95-113.
- Epperson, D. C. (1963). Some interpersonal and performance correlates of classroom alienation. *School Review, 71*, 360-376.
- Fortier, M. S., Vallerand, R. J., & Guay, F. (1995). A motivational analysis of academic achievement. *Contemporary Educational Psychology, 20*, 257-274.
- Frentz, C, Gresham, F. M., & Elliot, S. N. (1991). Popular, controversial, neglected, and rejected adolescents: Contrasts of social competence and achievement differences. *Journal of School Psychology, 29*, 109-120.
- Ginsburg, G. S., & Bronstein, P. (1993). Family factors related to children's intrinsic/extrinsic motivational orientation and academic performance. *Child Development, 64*, 1461-1474.
- Goodenow, C. (1983). Classroom belonging among early adolescent students: Relationships to motivation and achievement. *Journal of Early Adolescence, 13*, 21-43.
- Gottfried, A. E. (1985). Academic intrinsic motivation in elementary and junior high school children. *Journal of Educational Psychology, 77*, 631-645.
- Gottfried, A. E. (1990). Academic intrinsic motivation in young elementary school children. *Journal of Educational Psychology, 86*, 104-113.
- Gottfried, A. E., Fleming, J. S., & Gottfried, A. W. (1994). Role of parental motivational practices in children's academic intrinsic motivation and achievement. *Journal of Educational Psychology, 86*, 104-113.
- Grolnick, W. S., & Ryan, R. M. (1989). Parent styles associated with children's self-regulation and competence in school. *Journal of Educational Psychology, 81*, 143-154.

- Grolnick, W. S., Ryan, R. M., & Deci, E. L. (1991). Inner resources for school achievement: Motivational mediators of children's perceptions of their parents. *Journal of Educational Psychology, 83*, 508-517.
- Grolnick, W. S., & Slowiaczek, M. L. (1994). Parents' involvement in children's schooling: A multidimensional conceptualization and motivation model. *Child Development, 65*, 237-252.
- Guay, R., & Vallerand, R. J. (1997). Social context, students' motivation, and academic achievement: Toward a process model. *Social Psychology of Education, 1*, 211-233.
- Harter, S. (1985). *Manual for the Self-Perception Profile for Children*. Denver, CO: University of Denver.
- Hodges, E. V. E., Malone, M. J., & Perry, D. G. (1997). Individual risk and social risk as interacting determinants of victimization in the peer group. *Developmental Psychology, 33*, 1032-1039.
- Hymel, S., Bowker, A., & Woody, E. (1993). Aggressive versus withdrawn unpopular children: Variations in peer, teacher and self-perceptions in multiple domains. *Child Development, 64*, 879-896.
- 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.
- Kazdin, A. E. (1985). *Treatment of antisocial behavior in children and adolescents*. Homewood, IL: Dorsey Press.
- Krappman, L. (1985). The structure of peer relationships and possible effects on school achievement. In R. A. Hinde, A. N. Perret-Clermont, & J. Stevenson-Hinde (Eds.), *Social relationships and cognitive development* (pp. 149-166). Oxford, England: Clarendon Press.
- Krause, N., Liang, J., & Yatomi, N. (1989). Satisfaction with social support and depressive symptoms: A panel analysis. *Psychology and Aging, 4*, 88-97.
- Ladd, G. W. (1990). Having friends, keeping friends, making friends, and being liked by peers in the classroom: Predictors of children's early school adjustment? *Child Development, 61*, 1081-1100.
- Ladd, G. W., Kochenderfer, B. J., & Coleman, C. C. (1996). Friendship quality as a predictor of young children's early school adjustment. *Child Development, 67*, 1103-1118.
- Marsh, H. W., Balla, J. R., & McDonald, R. P. (1988). Goodness-of-fit indexes in confirmatory factor analysis: The effect of sample size. *Psychological Bulletin, 103*, 391-410.

- Miserandino, M. (1996). Children who do well in school: Individual differences in perceived competence and autonomy in above-average children. *Journal of Educational Psychology, 88*, 203-214.
- Mulaik, S. A., James, L. R., Van Alstine, J., Bennett, N., Lin, S., & Stilwell, C. D. (1989). Evaluation of goodness-of-fit indices for structural equations models. *Psychological Bulletin, 105*, 403-445.
- Normandeau, S., & Guay, F. (1998). Preschool behavior and first-grade school achievement: The mediational role of cognitive self-control. *Journal of Educational Psychology, 90*, 111-121.
- Patterson, C. J., Kupersmidt, J. B., & Griesler, P. C. (1990). Children's perceptions of self and of relations with others as a function of socio-metric status. *Child Development, 61*, 1335-1349.
- Patterson, C. J., Kupersmidt, J. B., & Vaden, N. A. (1990). Income level, gender, ethnicity, and household composition as predictors of children's school-based competence. *Child Development, 61*, 485-494.
- Pierson, L. H., & Cornell, J. P. (1992). Effect of grade retention on self-system processes, school engagement, and academic performance. *Journal of Educational Psychology, 84*, 300-307.
- Raykov, T. (1992). Structural models for studying correlates and predictors of change. *Australian Journal of Psychology, 44*, 101-112.
- Rubin, K. H., & Asendorpf, J. B. (1993). Social withdrawal, inhibition, and shyness in childhood: Conceptual and definitional issues. In K. H. Rubin & J. B. Asendorpf (Eds.), *Social withdrawal, inhibition and shyness in childhood* (pp. 3-17). Hillsdale, NJ: Erlbaum.
- Ryan, R. M., & Grolnick, W. S. (1986). Origins and pawns in the classroom: Self-report and projective assessments of individual differences in children's perceptions. *Journal of Personality and Social Psychology, 50*, 550-558.
- Ryan, R. M., & Powelson, C. L. (1991). Autonomy and relatedness as fundamental to motivation and education. *Journal of Experimental Education, 60*, 49-66.
- Ryan, R. M., & Stiller, J. (1991). The social context of internalization: Parent and teacher influences on autonomy, motivation, and learning. In M. L. Maehr & P. R. Pintrisch (Eds.), *Advances in motivation and achievement* (Vol. 7, pp. 115-149). Greenwich, CT: JAI Press.
- Sletta, O., Valas, H., Skaalvik, E., & Sobstad, F. (1996). Peer relations, loneliness, and self-perceptions in school-aged children. *British Journal of Educational Psychology, 66*, 431-445.
- Steinberg, L., Dornbusch, S. M., & Brown, B. B. (1992). Ethnic differences in adolescent achievement: An ecological perspective. *American Psychologist, 47*, 723-729.

- Tremblay, R. E., Masse, B., Perron, D., LeBlanc, M, Schwartzman, A. E., & Ledingham, J. E. (1992). Early disruptive behavior, poor school achievement, delinquent behavior, and delinquent personality: Longitudinal analyses. *Journal of Consulting and Clinical Psychology, 60*, 64-72.
- Tucker, L. R., Damarin, R, & Messick, S. (1966). A base-free measure of change. *Psychometrika, 31*, 457-473.
- Tucker, L. R., & Lewis, C. (1973). A reliability coefficient for maximum likelihood factor analysis. *Psychometrika, 38*, 1-10.
- Vallerand, R. J., Fortier, M. S., & Guay, F. (1997). Self-determination and persistence in real-life setting: Toward a motivational model of high school dropout. *Journal of Personality and Social Psychology, 72*, 1161-1176.
- Vasudeva, P., & Verma, P. (1974). Sociometric status as related to achievement, anxiety, and intelligence. *Journal of Psychological Researches, 18*, 93-95.
- Wentzel, K. R. (1991). Relations between social competence and academic achievement in early adolescence. *Child Development, 62*, 1066-1078.
- Wentzel, K. R., & Asher, S. R. (1995). The academic lives of neglected, rejected, popular, and controversial children. *Child Development, 66*, 754-763.
- West, S. G., Finch, J. F., & Curran, P. J. (1995). Structural equation models with nonnormal variables. In R. H. Hoyle (Ed.), *Structural equation modeling: Concepts, issues, and applications* (pp. 56-75). Thousand Oaks, CA: Sage.
- Williams, G. A., & Asher, S. R. (1992). Assessment of loneliness at school among children with mild mental retardation. *American Journal of Mental Retardation, 96*, 373-385.
- Zimmerman, B. J., & Bandura, A. (1994). Impact of self-regulatory influences on writing course attainment. *American Educational Research Journal, 29*, 663-676.

Table 1. Descriptive Data for the Variables

Variable	<i>M</i>	<i>SD</i>
School achievement (Time 1)	3.61	1.07
School achievement (Time 3)	3.46	1.11
Social preference (Time 1) ^a	0.15	0.93
Perceived loneliness (Time 1)	1.54	0.62
Perceived loneliness (Time 2)	1.41	0.57
Perceived academic competence (Time 1)	3.23	0.63
Perceived academic competence (Time 2)	3.25	0.62

^aThe mean and standard deviation of the social preference score are based on standardized scores within each class.

Table 2. Correlations Among Variables

Variable	1	2	3	4	5
1. School achievement (Time 1)	—				
2. School achievement (Time 3)	.67	—			
3. Social preference (Time 1)	.26	.26	—		
4. Perceived loneliness (Time 1)	-.16	-.21	-.30	—	
5. Perceived academic competence (Time 2)	.39	.42	.20	-.29	—

Note. These are Pearson product-moment correlations. All coefficients are significant at $p < .01$.

Table 3. Results Obtained With the Hypothesized Model (M0) and the Three Alternative Models (M1-M3)

Model	Fit indexes				
	χ^2	<i>df</i>	CFI	NNFI	PCFI
M0	259.810	113	.96	.95	.80
M1	250.085	111	.96	.95	.78
M2	229.526	109	.96	.95	.77
M3	214.936	108	.97	.96	.77

Note. CFI = comparative fit index; NNFI = nonnormed fit index; PCFI = parsimonious normed comparative fit index.

Figure 1. Results of the cross lag model. Lone = loneliness; comp = competence.

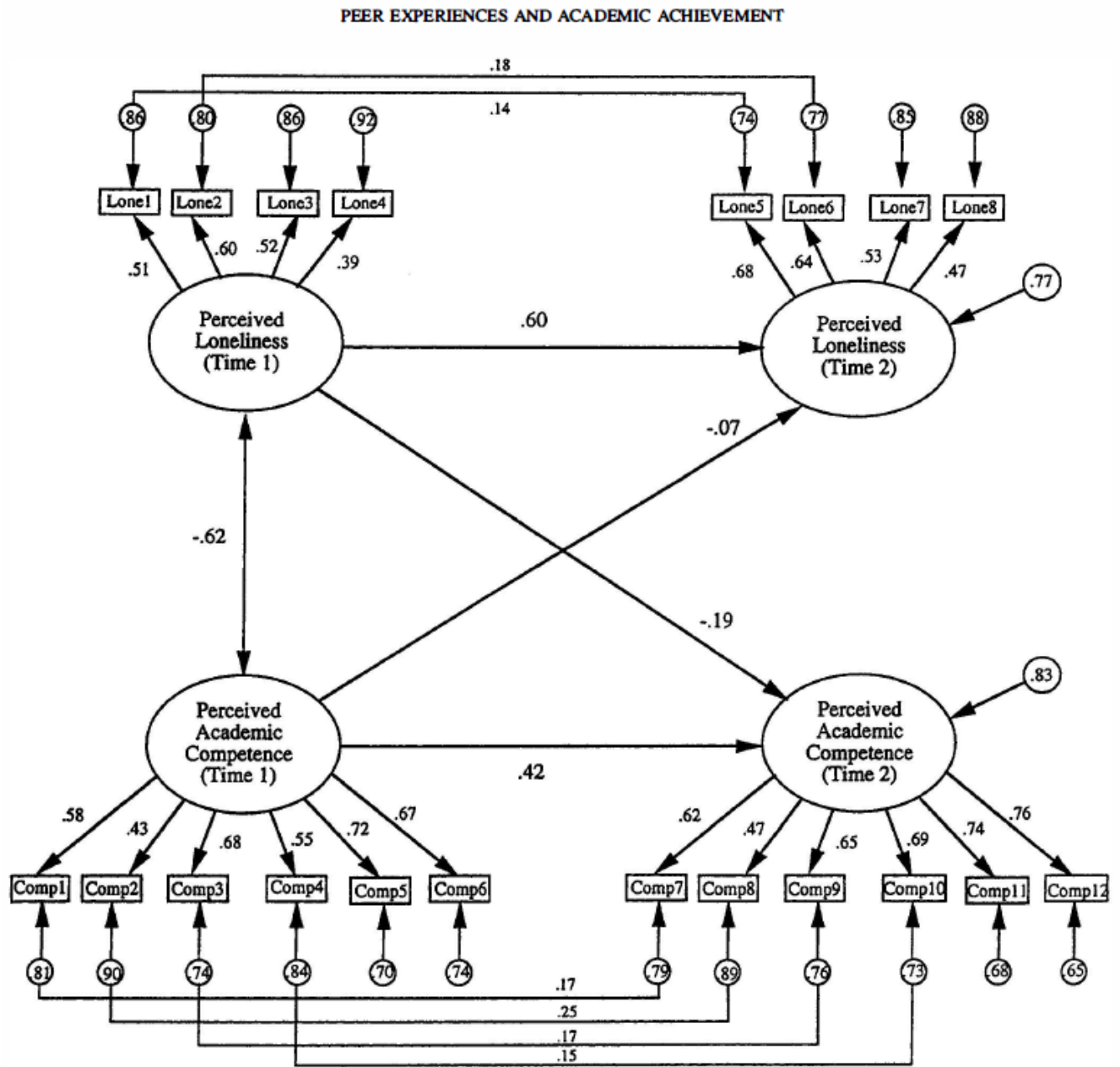


Figure 2. Results of the test of the hypothesized model. All parameters are significant at $z > 1.96$. Lone = loneliness; ach = achievement; comp = competence.

