

Social Context, Student's Motivation, and Academic Achievement: Toward A Process Model^{*}

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Abstract. The purpose of the present research was to propose and test a motivational process model of academic achievement. The model posits that parental, teachers, and school administration support for students' autonomy positively influences students' perceived school competence and autonomy. In turn, perceived school competence and autonomy affect positively self-determined school motivation which in turn influences academic achievement. Two studies using a prospective design tested the adequacy of the model. In Study 1, participants were 1,623 ninth-grade students. Results from structural equation modeling supported the motivational model. Participants in Study 2 were 1,098 tenth-grade students. Results from this study corroborated those of Study 1 controlling for students' prior achievement in the ninth grade. The role of self-determined school motivation in academic achievement is discussed and avenues for future research are considered.

In the course of their academic curriculum, students go through several evaluations. Their level of achievement at these evaluations represents the primary criterion to determine if students meet the academic requirements to be promoted successfully to the next grade level (Pierson & Connell, 1992). Therefore, academic achievement has an important impact on students' progress in school. Empirical work has focused on psychological and contextual factors that predict academic achievement (e.g., DeBaryshe, Patterson, & Capaldi, 1993). Thus far, research has shown that motivation is an important factor to consider in examining academic success (e.g., Grolnick, Ryan, & Deci, 1991). For instance, studies have shown that intrinsic motivation toward education (i.e., doing academic activities out of pleasure) positively influences academic achievement (e.g., Gottfried, 1985, 1990; Lloyd & Barenblatt, 1984).

However, some limitations of these previous studies should be addressed. First, few studies have controlled for prior academic achievement or intellectual func-

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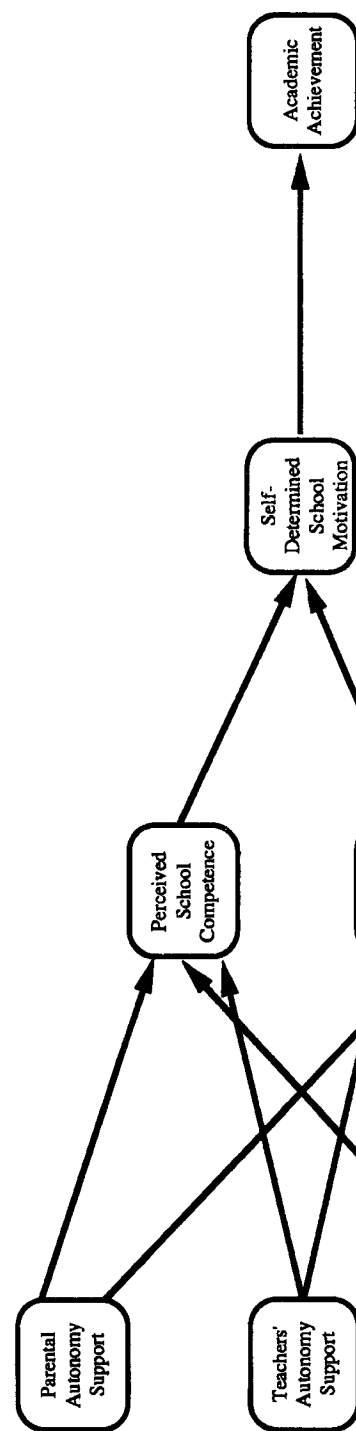
tioning. Thus, it is difficult to determine if motivation influences academic achievement over and beyond prior achievement or intellectual functioning. Second, little research has investigated simultaneously the role of different social agents such as teachers, parents, and school administrators in students' motivation. Third, some of this research is not based on an empirically tested theoretical framework. Consequently, it is difficult to have a better understanding of the process involved in academic success. The purpose of the present investigation was to test a structural process model of academic achievement that addresses these limitations. This model is based on a theoretical framework that has been supported in various contexts, namely Self-Determination Theory (Deci & Ryan, 1985, 1991).

A Process Model of Academic Achievement

Based on Self-Determination Theory and previous findings in the literature we propose a model of academic achievement (see Figure 1) which can be summarized in three basic propositions. First, parental, teachers, and the school administration support for students' autonomy should positively influence students' perceived school competence and autonomy. Second, students' perceptions of competence and autonomy should positively influence their self-determined school motivation. Finally, students' self-determined school motivation should positively affect their academic achievement. In other words, we propose that students who are supported in their autonomy by parents, teachers, and the school administration will feel more competent and autonomous. Consequently, they will experience higher levels of self-determined school motivation, which in turn should positively influence their academic achievement. The next three sections present the rationale and empirical evidence for each proposition of the model.

Self-Determined School Motivation and Academic Achievement

Over the past two decades, much research has shown that self-determined motivation is a useful concept to understand human behavior in various life settings (see Deci & Ryan, 1985, 1991). Self-determined motivation is generally defined as the extent to which individuals engage in an activity out of personal choice and pleasure (see Blais, Sabourin, Boucher, & Vallerand, 1990; Grolnick & Ryan, 1987; Vallerand & Bissonnette, 1992). For instance, a student who solves mathematical problem because it will allow him to enter the job market in a field that he likes (e.g., engineering) and also for pleasure displays a self-determined motivational orientation. On the other hand, a student with a non self-determined motivational orientation will engage in school related activities for external reasons and/or internal pressure. For example, a student who solves mathematical problems in order to avoid being criticized by his parents and/or because he will feel guilty if he did not.



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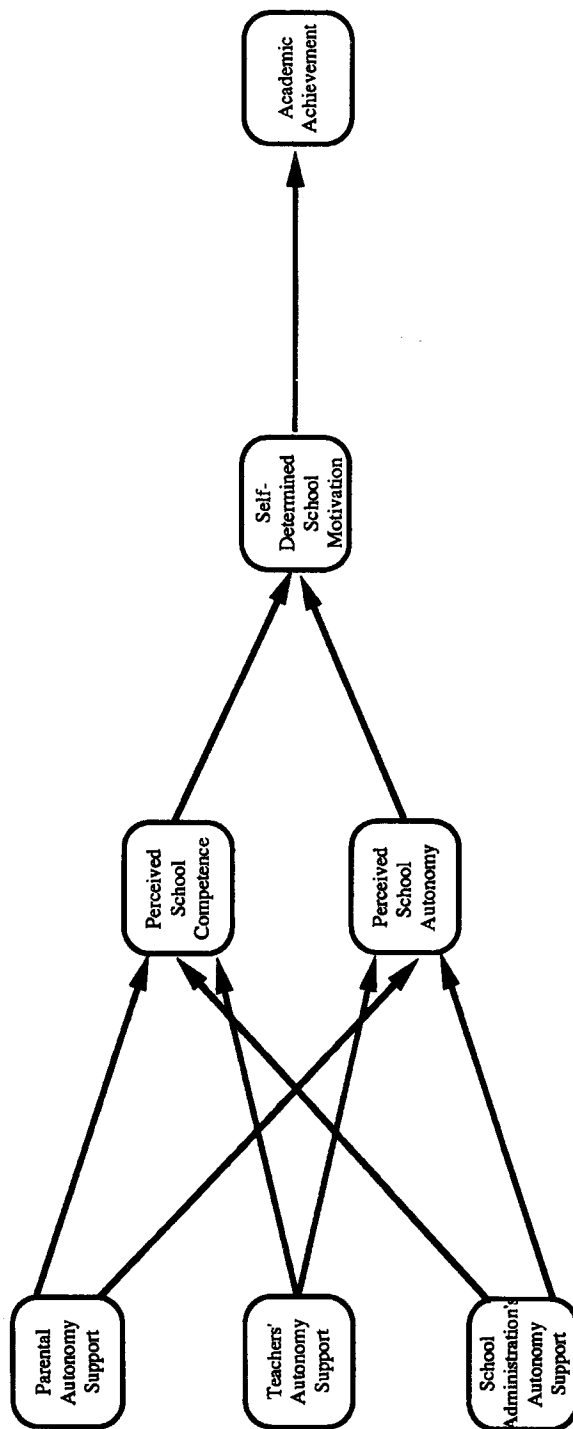


Figure 1. A Motivational Process Model of Academic Achievement.

Since self-determination has been hypothesized to be associated with enhanced psychological functioning (Deci, 1980; Deci & Ryan, 1985), one would thus expect self-determined motivation to lead to positive outcomes. This finding has been obtained with several educational outcomes such as creativity (Amabile, 1983; Koestner, Ryan, Bernieri, & Holt, 1984), cognitive engagement (Meece, Blumenfeld, & Hoyle, 1988; Meece & Holt, 1993; Pokay & Blumenfeld, 1990; Pintrich & De Groot, 1990), learning (Benware & Deci, 1984; Boggiano, Flink, Shields, Seelbach, & Barrett, 1993; Butler, 1987, 1988; Butler & Nissan, 1986; Elliot & Dweck, 1988; Flink, Boggiano, & Barrett, 1990; Graham & Golan, 1991; Grolnick & Ryan, 1987; Lange, MacKinnon, & Nida, 1989; Licht & Dweck, 1984), and persistence (Vallerand & Bissonnette, 1992; Vallerand, Fortier, & Guay, 1997).

Moreover, some studies have shown a positive relation between self-determined school motivation and achievement (Fortier, Vallerand, & Guay, 1995; Grolnick, Ryan & Deci, 1991; Gottfried, 1985, 1990; Gottfried, Fleming, & Gottfried, 1994; Lloyd & Barenblatt, 1984; Miserandino, 1996). In line with such research, it is posited that self-determined school motivation has a positive influence on school achievement. That is, the more an individual is performing school activities out of choice and pleasure, the greater the depth of processing, retention, integration, generalization of knowledge, and thereby academic achievement.

Perceived School Competence and Autonomy as Determinants of Self-Determined School Motivation

Competence pertains to the sense of effectance that one experiences when performing an activity, whereas autonomy refers to the capacity to choose among several courses of actions (Deci & Ryan, 1985). Thus, one would expect that an individual who feels competent and autonomous will experience higher levels of self-determined motivation. That is, the more individuals experience a sense of effectance and feel that they can make choices when performing an activity the more they will engage in the activity out of personal choice and pleasure. These findings have been obtained in experimental studies (see Deci & Ryan, 1985, 1991; Harackiewicz, 1979; Harackiewicz & Larson, 1986; Harackiewicz, Sansone, & Manderlink, 1985; Vallerand & Reid, 1984, 1988) as well as in the education domain (see Fortier et al., 1995; Gottfried, 1985, 1990; Grolnick & Ryan, 1989; Harter & Connell, 1984; Ryan & Grolnick, 1986; Vallerand, Blais, Brière, & Pelletier, 1989; Vallerand, Pelletier, Blais, Brière, Sénécal, & Vallières, 1993).

The Social Context as a Determinant of Self-Determined Motivation and Autonomy

Several studies have investigated the enhanced or undermined by contextual factors (e.g., Grolnick & Slowiaczek et al., 1994; Grolnick & Slowiaczek, 1994). One area of interest is whether social agents pressure or whether they control their behavior, and to which people use techniques which are used in school activities. At the opposite, a coercive, pressuring, or rewarding technique (e.g., Grolnick & Ryan, 1989).

Research has shown that an authoritarian style of authority has a positive impact on students' motivation (Schwartz, Sheinman, & Ryan, 1981; Ryan & Deci, 1991). More specifically, much research has shown that represents an important factor in determining self-determined motivation. Indeed, students who have teachers display higher levels of competence and autonomy with control-oriented teachers (Deci & Ryan, 1985; Vallerand, 1996; Ryan & Grolnick, 1991).

Parental interpersonal style has also been found to influence their children's perceptions of competence and autonomy (Grolnick and Ryan (1989) noted a positive relation between students' sense of competence. Moreover, students who were more likely to report higher internal motivation (see also Ginsburg & Bronstein, 1993).

In addition to teachers and parents, the school administration represents an important factor in students' perceptions of competence and autonomy. It is that the school administration takes a role that may influence students' perceptions of competence and autonomy (disciplinary sanctions and school policies are a rationale).

It should be noted, that some studies have shown that the social context and students' motivation have a positive impact on students' perceived competence and autonomy (Grolnick & Slowiaczek, 1994 for example). The influence of the social context is an important factor in the determination of students' perceptions of competence and autonomy. They have shown the mediating role of these factors (Reeve & Deci, 1996; Vallerand & Ryan, 1993). The role of perceived competence and autonomy is an important factor in the determination of students' perceptions of competence and autonomy.

size is expected to be associated with enhanced academic achievement (Deci & Ryan, 1985), one would thus expect positive outcomes. This finding has been replicated in a number of studies such as creativity (Amabile, 1983; Mumford, 1983), cognitive engagement (Meece, Blumenfeld, & Grolnick, 1990; Pintrich, 1984; Boggiano, Flink, Shields, 1988; Butler & Nissim, 1986; Elliot & Grolnick, 1989; Licht & Dweck, 1984), and the relation between self-determined motivation and academic achievement (Vallerand, Fortier, & Guay, 1997). In line with such research, it is expected that a positive influence on school achievement is performing school activities out of choice, processing, retention, integration, and academic achievement.

Autonomy as Determinants of

It is expected that one experiences when performing school activities out of choice that one experiences when performing school activities out of choice to the capacity to choose among alternatives (Deci & Ryan, 1985). Thus, one would expect that students who will experience higher levels of autonomy will experience higher levels of achievement. More individuals experience a sense of autonomy when performing an activity out of choice and pleasure. Experimental studies (see Deci & Ryan, 1985; Harackiewicz & Larson, 1986; Harackiewicz, 1984, 1988) as well as in the field (Deci, 1985, 1990; Grolnick & Ryan, 1989; Grolnick, 1986; Vallerand, Blais, Brière, Senécal, & Vallières, 1993).

The Social Context as a Determinant of Perceptions of School Competence and Autonomy

Several studies have investigated the ways in which students' motivation can be enhanced or undermined by contextual factors at home and at school (e.g., Gottfried et al., 1994; Grolnick & Slowiaczek, 1994; Ryan & Stiller, 1991). One dimension of interest is whether social agents provide students support for their autonomy or whether they control their behavior. *Autonomy support* is defined as the degree to which people use techniques which encourage choice and participation toward school activities. At the opposite, a *control orientation* refers to punitive, disciplinary, pressuring, or rewarding techniques to motivate students (Grolnick & Ryan, 1989).

Research has shown that an autonomy supportive style from people in position of authority has a positive impact on school motivation (deCharms, 1976; Deci, Schwartz, Sheinman, & Ryan, 1981; Grolnick & Ryan, 1989; Grolnick et al., 1991). More specifically, much research has shown that *teachers' autonomy support* represents an important factor in determining students' feelings of competence and self-determined motivation. Indeed, students taught by an autonomy-supportive teacher display higher levels of competence and intrinsic motivation than students with control-oriented teachers (Deci et al., 1981; Flink et al., 1990; Pelletier & Vallerand, 1996; Ryan & Grolnick, 1986).

Parental interpersonal style has also been found to have important effects on their children's perceptions of competence and autonomy at school. For instance, Grolnick and Ryan (1989) noted a positive impact of parental autonomy support on students' sense of competence. Moreover, children of autonomy-supportive parents were more likely to report higher interest in school tasks and higher achievement (see also Ginsburg & Bronstein, 1993; Grolnick et al., 1991 for similar results).

In addition to teachers and parents, we believe that autonomy support from the school administration represents another potential determinant of students' perceptions of competence and autonomy. The rationale for such a proposition is that the school administration takes decisions concerning important elements that may influence students' perceptions of competence and autonomy such as disciplinary sanctions and school policies (see also Vallerand et al., 1997, for such a rationale).

It should be noted, that some studies assessing the relation between the social context and students' motivation have not taken into account the mediating impact of students' perceived competence and autonomy (see Grolnick et al., 1991; Grolnick & Slowiaczek, 1994 for examples). More precisely, it is possible that the influence of the social context is an indirect one, resulting primarily by the facilitation of students' perceptions of competence and autonomy. Indeed, previous studies have shown the mediating role of these variables (Harackiewicz & Larson, 1986; Reeve & Deci, 1996; Vallerand & Reid, 1984, 1988). Moreover, the mediating role of perceived competence and autonomy between the social context and self-

determined motivation is one of the theoretical assumptions of Self-Determination Theory. Consequently, it was hypothesized that students' perceived competence and autonomy represent two important mediators of the social context and self-determined school motivation relation.

In sum, it is posited that parental, teachers, and school administration support for student autonomy positively influences students' perceived school competence and autonomy which positively affect self-determined school motivation. In turn, self-determined motivation positively influences academic achievement.

The Present Investigation

In a recent study dealing with high school dropout, Vallerand, Fortier, and Guay (1997) provided support for some of the elements of the proposed model. More specifically, these researchers showed that an autonomy-supportive style from the teachers and parents positively affected students' sense of perceived competence and autonomy, while such a style from the school administration had a positive impact only on students' sense of autonomy. In turn, students' sense of competence and autonomy positively influenced their self-determined school motivation which negatively affected intentions to dropout of school. These intentions were later implemented during the school year. The purpose of the present set of studies was to extend the results of the Vallerand, Fortier, and Guay (1997) study with respect to academic achievement. More precisely, the goal of Study 1 was to test the adequacy of the proposed model in a prospective design. The purpose of Study 2 was to corroborate results obtained from Study 1 with a different sample while controlling for participants' prior achievement. This control variable was included in order to determine if self-determined school motivation influences academic achievement even if we controlled for prior achievement.

STUDY 1

Method

PARTICIPANTS

The sample of Study 1 was formed of 1,623 ninth-grade French-Canadian students (males=798; females=823; missing observations for sex=2) from seven Montreal public high schools. Participants' mean age was 14.5 years.

MEASURES

Questionnaire. The questionnaire was made up of three sections. Table 1 shows sample items for each scale used in the questionnaire. In the first part, students completed 3 scales assessing their perceptions of parental, teachers, and school admin-

Table I. Sample Items for Scales used

| Scales |
|---|
| Parental Autonomy Support (3 indicators) |
| Teachers' Autonomy Support (3 indicators) |
| School administration's Autonomy Support (3 indicators) |
| Perceived School Competence (3 indicators) |
| Perceived School Autonomy (3 indicators) |
| Academic Motivation Scale (composed of 7 subscales of 4 items each) |
| IM Knowledge |
| IM Accomplishment |
| IM stimulation |
| Identified Regulation |
| Introjected Regulation |
| External Regulation |
| Amotivation |

(*R) = Reverse scoring

istration's autonomy support. The scale was made up of 2 scales assessing perceived competence and autonomy. The 5 scales mentioned above were made up of 3 items each. The type scale (1) "not agree at all" to 5 "strongly agree". The parents, teachers, and school administration's autonomy support scale was an adaptation of the Perceived Interpersonal Style Scale (Vallerand & Losier, 1990). The school competence scale was an adaptation of the Life Domains Scale (Losier et al., 1990). The school autonomy scale was an adaptation of the Perceived School Autonomy Scale (Blais, Vallerand & Lachance, 1990).

In the third section of the questionnaire, students completed the "Motivation en Éducation" (Vallerand

al assumptions of Self-Determination that students' perceived competence mediators of the social context and self-

s, and school administration support students' perceived school competence determined school motivation. In turn, ces academic achievement.

ropout, Vallerand, Fortier, and Guay ments of the proposed model. More autonomy-supportive style from the ents' sense of perceived competence school administration had a positive In turn, students' sense of compe- ir self-determined school motivation out of school. These intentions were purpose of the present set of studies ortier, and Guay (1997) study with sely, the goal of Study 1 was to test ective design. The purpose of Study dy 1 with a different sample while . This control variable was included ool motivation influences academic hievement.

Table I. Sample Items for Scales used in Study 1 and Study 2

| Scales | Sample Items |
|---|---|
| Parental Autonomy Support (3 indicators) | "My parents provide me with lots of opportunity to make personal decisions concerning my school activities" |
| Teachers' Autonomy Support (3 indicators) | "I feel that my teachers pressure me to do what they want" (*R) |
| School administration's Autonomy Support (3 indicators) | "The school administration generally consults students before establishing new policies" |
| Perceived School Competence (3 indicators) | "I consider myself to be a good student" |
| Perceived School Autonomy (3 indicators) | "In school I am free to do the things I want" |
| Academic Motivation Scale (composed of 7 subscales of 4 items each) | "Why do you go to school?" |
| IM Knowledge | "Because my studies allow me to continue to learn about many things that interest me" |
| IM Accomplishment | "For the satisfaction I experience when I am in the process of achieving difficult academic activities" |
| IM stimulation | "For the 'high' feeling that I experience while reading on various interesting subjects" |
| Identified Regulation | "Because eventually it will allow me to enter the job market in a field that I like" |
| Introjected Regulation | "To show myself I am an intelligent person" |
| External Regulation | "In order to get a more prestigious job later on" |
| Amotivation | "Honestly, I don't know; I truly have the impression of wasting my time in school" |

(*R) = Reverse scoring

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istration's autonomy support. The second part of this self-report questionnaire was made up of 2 scales assessing perceived school competence and autonomy. These 5 scales mentioned above were made up of 3 items each rated on a 7-point Likert-type scale (1) "not agree at all" to (7) "agree completely". Scales assessing parents, teachers, and school administration autonomy support were adapted from the Perceived Interpersonal Style Scale (Pelletier, 1992) whereas the perceived school competence scale was an adaptation of the Perceived Competence toward Life Domains Scale (Losier et al., 1993). Finally, the perceived school autonomy scale was an adaptation of the Perceived Autonomy toward Life Domains Scale (Blais, Vallerand & Lachance, 1990).

In the third section of the questionnaire, students completed the "Échelle de Motivation en Éducation" (Vallerand et al., 1989). This is the French version of the

Academic Motivation Scale (AMS; Vallerand, Pelletier, Blais, Brière, Senécal, & Vallières, 1992; Vallerand et al., 1993). This scale assesses students' motivational orientation toward education. This instrument is composed of seven subscales of four items each, assessing three types of intrinsic motivation (IM-knowledge, IM-stimulation, and IM-accomplishment; see Vallerand et al., 1989, 1992, 1993 for a definition), three types of extrinsic motivation (identified, introjected, and external regulation), and amotivation (see Deci & Ryan, 1985 for a definition). Items are rated on a 7 point Likert-type scale where students indicate the extent to which each item corresponds to the reasons why they engage in school-related behavior.

Self-determined school motivation (i.e., performing school activities out of choice and pleasure) was obtained by integrating the information from the different motivational subscales. This was done by computing four separate indexes. Each index was obtained by ascribing each item a specific weight and then summing the products. Consequently, intrinsic motivation and identified regulation items were assigned respectively the score of +2 and +1 (higher self-determined forms of motivation) whereas amotivation and external regulation items (less self-determined forms of motivation) were attributed respectively the weights of -2 and -1. There were four items for each motivational construct and consequently four indexes were computed using the following formula: $[(2X(\text{IM knowledge} + \text{IM accomplishment} + \text{IM stimulation})/3 + 1 \text{ identified regulation}) - ((1 \text{ external regulation} + 2X(\text{amotivation})))]$. Introjected regulation items were not included in this formula since the specific weights have to be equally balanced between non self-determined types of motivation and self-determined ones. Several studies have shown the usefulness of this composite index (Blais et al., 1990; Grolnick & Ryan, 1987; Miserandino, 1996; Vallerand & Bissonnette, 1992).

Academic achievement. Academic achievement in French, Mathematics, and Geography was gathered at the end of the school year. These subjects were selected because they are compulsory in grade 9 and thus available for all students. Academic achievement was computed using the following methodology: students' grade for each subject was ranked as being either in the first, second, third, fourth, or fifth position with respect to others students of the same class. This methodology was used because it offers a standardized measure of achievement. Indeed, student achievement in each course was classified in relation with the mean achievement of other students of the same class, thereby controlling for strict vs. permissive grading systems of different teachers. Scores on this measure were recoded. Consequently, a score of 5 represents the best academic achievement whereas a score of 1 represent the worst level of achievement. Academic achievement latent construct was thus assessed by students' achievement of each subject.

PROCEDURE

Students completed the questionnaire described previously in October, approximately one month after the beginning of the school year. This time period was

chosen to ensure that students had a good relationship with their teachers. Participants completed the questionnaire. An experimenter explained that the purpose of the study was to study the feelings and behavior of high school students. That additional information would be gathered. For this reason, participants were asked to complete the questionnaire. They were assured that their answers would be confidential. The experimenter explained how to complete the questionnaire. At the end of the school year, students' academic achievement in French, Mathematics, and Geography were gathered in collaboration with the teachers.

Results and Discussion

DATA ANALYSIS

The adequacy of the model was assessed using the LISREL program (version 7.17). The statistical procedure conveys that the proposed model is a simultaneous analysis in order to determine the model with the sample data (for more details see Bollen, 1989). The model tested in the present study is a structural equation model. It comprises a measurement model and a structural model. The measurement model is defined by a set of linear equations that cannot be observed directly to their structural model. The structural model includes the links among the latent variables. The purpose of this analysis is to determine the structure of the full latent model proposed. The indices can be used (see section on fit indices).

The Statistical Model to be Estimated. The model included four exogenous variables and four endogenous variables. The four exogenous variables were parental, teacher, and peer support. Each of these latent constructs was measured by three observed variables which serve as indicators. The four endogenous variables were competence, perceived school autonomy, academic achievement, and perceived school climate. Each of these latent constructs was measured by three observed variables each, where the observed variables were measured by the four motivational constructs. Academic achievement was assessed by students' achievement in French, Mathematics, and Geography. The paths between the exogenous variables were estimated between each of the exogenous variables. The full model contained 56 free parameters. The ratio of sample size to number of parameters should be able to go as low as 5:1 under normal distribution. A ratio of at least 10:1 may be more appropriate for

Pelletier, Blais, Brière, Senécal, & ... scale assesses students' motivational ... is composed of seven subscales of ... ic motivation (IM-knowledge, IM- ... erand et al., 1989, 1992, 1993 for a ... identified, introjected, and external ... n, 1985 for a definition). Items are ... dents indicate the extent to which ... engage in school-related behavior. ... performing school activities out of ... ng the information from the differ- ... computing four separate indexes. ... m a specific weight and then sum- ... otivation and identified regulation ... +2 and +1 (higher self-determined ... external regulation items (less self- ... ed respectively the weights of -2 ... tional construct and consequently ... ng formula: $[(2X(\text{IM knowledge} + \text{identified regulation}) - ((1 \text{ external} ... ulation items were not included in ... be equally balanced between non ... ermined ones. Several studies have ... blais et al., 1990; Grolnick & Ryan, ... ette, 1992).$

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d previously in October, approxi- ... school year. This time period was

chosen to ensure that students had an opportunity to become familiar with their teachers. Participants completed the questionnaire in their respective classrooms. An experimenter explained that the purpose of the study was to know more about feelings and behavior of high school students. Moreover, it was carefully explained that additional information would be gathered later on concerning their grades. For this reason, participants were asked to put their student ID number on the questionnaire. They were assured that their answers would be kept confidential. Finally, the experimenter explained how to complete the questionnaire. Eighth months later, at the end of the school year, students' achievement in French, Mathematics, and Geography were gathered in collaboration with the Quebec Ministry of Education.

Results and Discussion

DATA ANALYSIS

The adequacy of the model was assessed by structural equation modeling (SEM) with the LISREL program (version 7.12; Jöreskog & Sörbom, 1989). This statistical procedure conveys that the proposed model under study can be tested in a simultaneous analysis in order to determine the extent to which it is consistent with the sample data (for more details on the SEM procedure see Byrne, 1994). The model tested in the present study is called a full latent variable model since it comprises a measurement model and a structural model. A measurement model is defined by a set of linear equations relating the latent variables (i.e., constructs that cannot be observed directly) to their indicators (i.e., measured scores) whereas a structural model includes the links among the latent variables themselves. Thus, the purpose of this analysis is to determine how well the sample data fit the restricted structure of the full latent model proposed in this study. To this end, various fit indices can be used (see section on fit indices below).

The Statistical Model to be Estimated. The proposed model contained three exogenous variables and four endogenous variables (see Figure 2). The three exogenous variables were parental, teachers, and school administration autonomy support. Each of these latent constructs was measured by three observed variables which serve as indicators. The four endogenous variables were perceived school competence, perceived school autonomy, self-determined school motivation, and academic achievement. Perceived school competence and autonomy were assessed by three observed variables each, whereas self-determined school motivation was measured by the four motivational composite indexes described earlier. Finally, academic achievement was assessed by the standardized achievement measure in French, Mathematics, and Geography as outlined above. Moreover, covariances were estimated between each of the exogenous variables. Consequently, the overall model contained 56 free parameters to be estimated. Bentler (1993) suggests that the ratio of sample size to numbers 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 distributions. Herein, the measure-

ment strategy used offered a ratio of 29:1 for a normal multivariate distribution. Consequently, we are confident to obtain trustworthy z-tests on the significance of parameters.

Matrix to be Analyzed and Method of Estimation. A covariance matrix among the 22 observed variables was estimated with the PRELIS program (see Appendix 1; Jöreskog & Sörbom, 1989). This matrix was used as a database for the measurement and structural models. The specified model was tested with standardized coefficients obtained from the maximum likelihood (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 the present study.

Fit Indices. The LISREL program provides different indices to ascertain the model fit. Herein, we used the chi-square (χ^2 ; Bollen, 1989), the "Critical-N" statistic (CN; Hoelter, 1983), the Comparative Fit Index (CFI; Bentler, 1990), the Bentler-Bonett NonNormed Fit index (NNFI; Tucker & Lewis, 1973), and the GFI/AGFI (Jöreskog & Sörbom, 1981). The χ^2 indicates the lack of fit resulting from over-identifying restrictions placed on the model (Bollen, 1989). Consequently, a non-significant χ^2 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 as in this study, we also used the "critical-N" (CN) statistic (Hoelter, 1983). This statistic consists of the value that would be required for accepting the fit of a given model for a chi-square test. Hoelter (1983) suggests that a CN value exceeding 200 indicates that a given model is an adequate representation of the sample data. On the other hand, the CFI assesses the relative reduction in lack of fit as estimated by the noncentral χ^2 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). Moreover, the GFI indexes the relative amount of the observed variances and covariances accounted for by a model whereas the AGFI adjusts this proportion from the degrees of freedom of the target model. CFI, NNFI, GFI/AGFI values of 0.90 and above provide support for the validity of the model (Bentler & Bonett, 1980).

A Test of the Process Model of Academic Achievement. Figure 2 presents the completely standardized solutions for the structural and measurement models. Numbers in brackets are the explained variance for the latent constructs. All path coefficients, correlations among exogenous variables, and factors loadings were found to be significant (t values > 2.00) except for the path between school administration autonomy support and perceived school competence. Furthermore, model estimates indicated an acceptable fit for the model (CFI=0.93, NNFI=0.91, GFI=0.94, and AGFI=0.93). Although, the chi-square was significant [χ^2 (197,

$N=1623)=1057.99, p<0.05$], the CN indicating that the model is an adequate representation.

As it can be seen in Figure 2, results suggested that students' perceptions of school autonomy support positively influenced their perceived school competence. Parental and teachers' autonomy support also had a positive effect on perceived school competence. Autonomy support from the school administration was not a significant predictor of this variable.

Moreover, it should be noted that results also indicated that children's sense of competence and self-determined school motivation were significant predictors of academic achievement. Coefficients revealed that parental autonomy support ($\beta=0.31$) and teachers' autonomy support ($\beta=0.22$) had a greater influence on perceived school competence than autonomy support from the school administration ($\beta=0.07$).

Furthermore, perceived school competence and self-determined school motivation were significant predictors of academic achievement ($\beta=0.29$). Finally, self-determined school motivation ($\beta=0.36$) eight months later and explained 13% of the variance in academic achievement.

In sum, the results from this study supported the process model of academic achievement. Specifically, results revealed that autonomy support could enhance students' perceived school competence. Furthermore, these two psychological variables were significant predictors of self-determined school motivation, which in turn predicted academic achievement.

Results of Study 1 showed support for the process model of academic achievement. The purpose of the present study was to test a different sample while controlling for prior achievement with previous research (e.g., Gottfried et al., 1994). We hypothesized that self-determined motivation would be a significant predictor of academic achievement when we controlled for prior achievement.

Method

PARTICIPANTS

Participants were 1,098 tenth-grade students (males=550; females=546; missing data=2) with a mean age of 15.28 years and were all from the same school.

for a normal multivariate distribution. Two worthy z -tests on the significance of

information. A covariance matrix among the PRELIS program (see Appendix) was used as a database for the measurement model was tested with standardized likelihood (ML) method of estimation. A performs reasonably well when the sample size is large enough (e.g.,

uses different indices to ascertain the χ^2 ; Bollen, 1989), the "Critical-N" the Fit Index (CFI; Bentler, 1990), the GFI; Tucker & Lewis, 1973), and the χ^2 indicates the lack of fit resulting from the model (Bollen, 1989). Consequently, it is an adequate representation of the model if the statistic is a poor estimate when the "critical-N" (CN) statistic (Hoelter, 1983) would be required for accepting the model. Hoelter (1983) suggests that a CN value of 100 is an adequate representation of the model if the relative reduction in lack of fit from the baseline model versus a baseline model where all paths are fixed to zero (Bentler, 1990). The NNFI compares the fit of the target model versus the baseline model. Thus, the NNFI of freedom of the target model over the baseline model. The CFI index varies between 0 and 1 (e.g., >1). Moreover, the GFI indexes of variance and covariances accounted for by a model from the degrees of freedom of the model of 0.90 and above provide support for the model (Bollen, 1989).

Achievement. Figure 2 presents the structural and measurement models. The model was tested for the latent constructs. All variables, and factors loadings were significant except for the path between school administration and school competence. Furthermore, the model (CFI=0.93, NNFI=0.91, χ^2 was significant [197,

$N=1623$)=1057.99, $p<0.05$], the CN=365.03 was higher than 200 thereby indicating that the model is an adequate representation of the sample data¹.

As it can be seen in Figure 2, results supported the hypothesized model and suggested that students' perceptions of parental, teachers, and school administration autonomy support positively influenced perceived school autonomy. However, only parental and teachers' autonomy support influenced perceived school competence. Autonomy support from the school administration had no significant impact on this variable.

Moreover, it should be noted that parents seem to play a crucial part in their children's sense of competence and autonomy. Indeed, the standardized path coefficients revealed that parental autonomy support ($\beta=0.42$) had the strongest influence on students' perceived school autonomy, followed by school administration ($\beta=0.31$) and teachers' ($\beta=0.22$) autonomy support. Similarly, parental autonomy support ($\beta=0.47$) had a greater impact on perceived school competence than autonomy support from the teachers ($\beta=0.32$).

Furthermore, perceived school autonomy ($\beta=0.68$) was the strongest predictor of self-determined school motivation comparatively to perceived school competence ($\beta=0.29$). Finally, self-determined school motivation influenced achievement ($\beta=0.36$) eight months later and explained 13% of the variance in this variable.

In sum, the results from this study supported the process model of academic achievement. Specifically, results revealed that a school context which provides autonomy support could enhance students' feelings of competence and autonomy. Furthermore, these two psychological mediators have a positive impact on self-determined school motivation, which in turn positively influences achievement.

STUDY 2

Results of Study 1 showed support for the proposed motivational model of academic achievement. The purpose of Study 2 was to replicate these results with a different sample while controlling for participants' prior achievement. In line with previous research (e.g., Gottfried, 1985; Lloyd & Barenblatt, 1984) it was hypothesized that self-determined motivation would influence achievement even if we controlled for prior achievement.

Method

PARTICIPANTS

Participants were 1,098 tenth-grade students of seven Montreal public high school (males=550; females=546; missing observations for sex=2). Participants had a mean age of 15.28 years and were all different from those of Study 1.

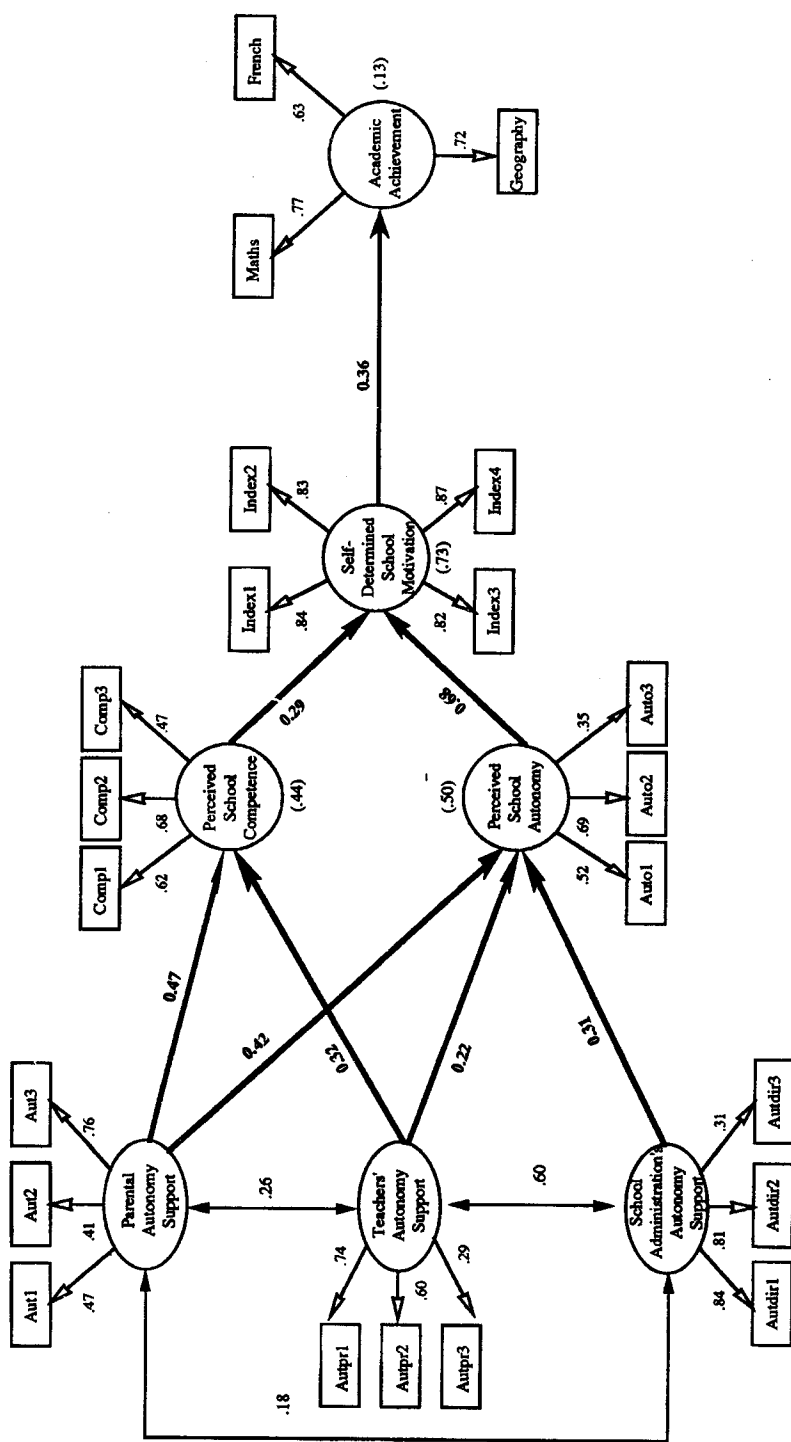


Figure 2. Study 1: Results of the measurement and structural models. All coefficients were standardized to facilitate interpretability and significant at $p < .05$. Numbers in brackets indicate the explained variance.

PROCEDURE, MEASURES, AND DATA

The procedure, measures, and data are described in the present study. As in Study 1, students completed the questionnaire at the beginning of the year. However, the academic achievement was measured at the end of the year. These grades were also gathered for the final achievement of the ninth-grade students. The methodology used in Study 1 was also used in Study 2.

Results and Discussion

As in Study 1 a covariance matrix was estimated with the PRELIS program (see Appendix 1). The strategy used offered a ratio of sample size to number of parameters of 5:1. Confirmatory and structural analysis were conducted (see Figure 3). All paths (except the path from my support and school competence), were significant. Factor loadings for the hypothesized model were: .47, .42, .53, .22, .18, .60, .47, .42, .29, .89, .36. The model was an adequate representation of the variance explained in academic achievement ($\chi^2(236, N=1098)=918.8, p < .001$, CFI=0.92, NNFI=0.90, GFI=0.93, a significant $\chi^2(236, N=1098)=918.8, p < .001$). In Study 1 ($\beta=0.22$), it nevertheless showed the influence of prior achievement on subsequent achievement. This influence of motivation on achievement imposes a powerful test of this relationship.

Overall, results from Study 2 provided a good fit to the hypothesized model. Indeed, all paths, factor loadings, and R-squared values were significant, except those of Study 1 even if we controlled for prior achievement. In Study 1, the path between school administration support and school competence was not significant. Furthermore, the strongest influence on perceived school competence was from teachers and the school administration.

General Discussion

Overall, results from both studies showed that perceived school competence and school autonomy predict academic achievement which is based on the

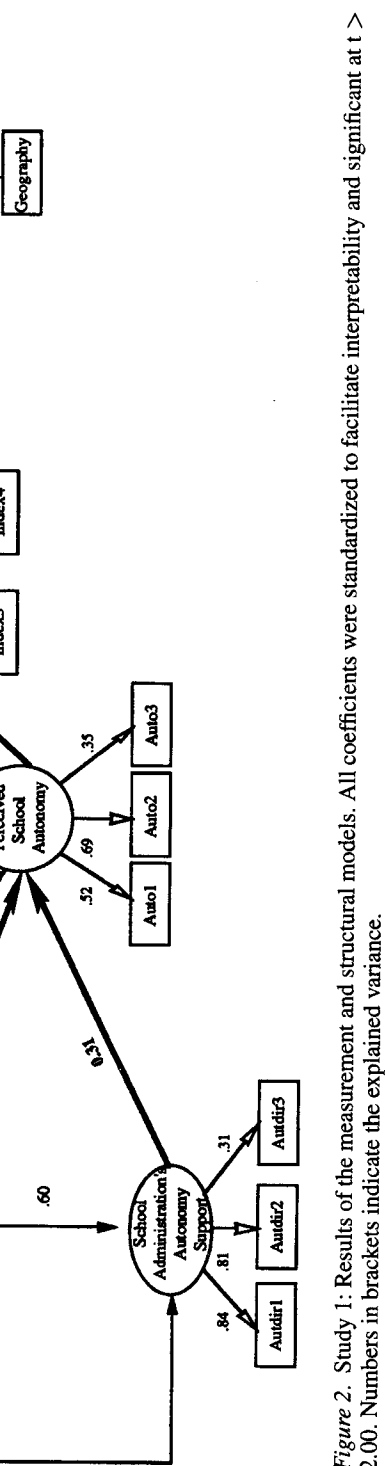


Figure 2. Study 1: Results of the measurement and structural models. All coefficients were standardized to facilitate interpretability and significant at $t > 2.00$. Numbers in brackets indicate the explained variance.

PROCEDURE, MEASURES, AND DATA ANALYSIS

The procedure, measures, and data analysis employed in Study 1 were also used in the present study. As in Study 1, students completed the questionnaire in October. However, the academic achievement construct was composed of achievement of three compulsory courses in the tenth-grade, namely French, English, and History. These grades were also gathered at the end of the school year. Furthermore, final achievement of the ninth-grade French and Mathematics courses were added in the model in order to control for participants' prior achievement. The same methodology used in Study 1 was also used to assess academic achievement in this Study.

Results and Discussion

As in Study 1 a covariance matrix among the 24 observed variables was estimated with the PRELIS program (see Appendix 2). For this study, the measurement strategy used offered a ratio of sample size to number of free parameters of 18:1. Confirmatory and structural analysis revealed results similar to those of Study 1 (see Figure 3). All paths (except the one between school administration autonomy support and school competence), correlations among exogenous variables, and factor loadings for the hypothesized model were significant even though participants' prior achievement in ninth-grade French and Mathematics courses were integrated in the model. Furthermore, model fit estimates were all acceptable (i.e., CFI=0.92, NNFI=0.90, GFI=0.93, and AGFI=0.91). The chi-square statistic was significant [χ^2 (236, N=1098)=918.87, $p < 0.05$] but the CN=368.25 indicated that the model was an adequate representation of the sample data². A total of 50% of the variance was explained in academic achievement. Even if the influence of self-determined school motivation on academic achievement was not as high as in Study 1 ($\beta=0.22$), it nevertheless remained significant despite the strong influence of prior achievement on subsequent achievement ($\beta=0.61$). We considered this influence of motivation on achievement acceptable since prior achievement imposes a powerful test of this relation.

Overall, results from Study 2 provided a strong empirical support for the hypothesized model. Indeed, all paths, factor loadings, and model estimates were similar to those of Study 1 even if we controlled for students' prior achievement. As in Study 1, the path between school administration's autonomy support and perceived school competence was not significant. Furthermore, parental autonomy support had the strongest influence on perceived school competence and autonomy comparatively to teachers and the school administration.

General Discussion

Overall, results from both studies supported the motivational model of academic achievement which is based on the motivation literature and Self-Determination

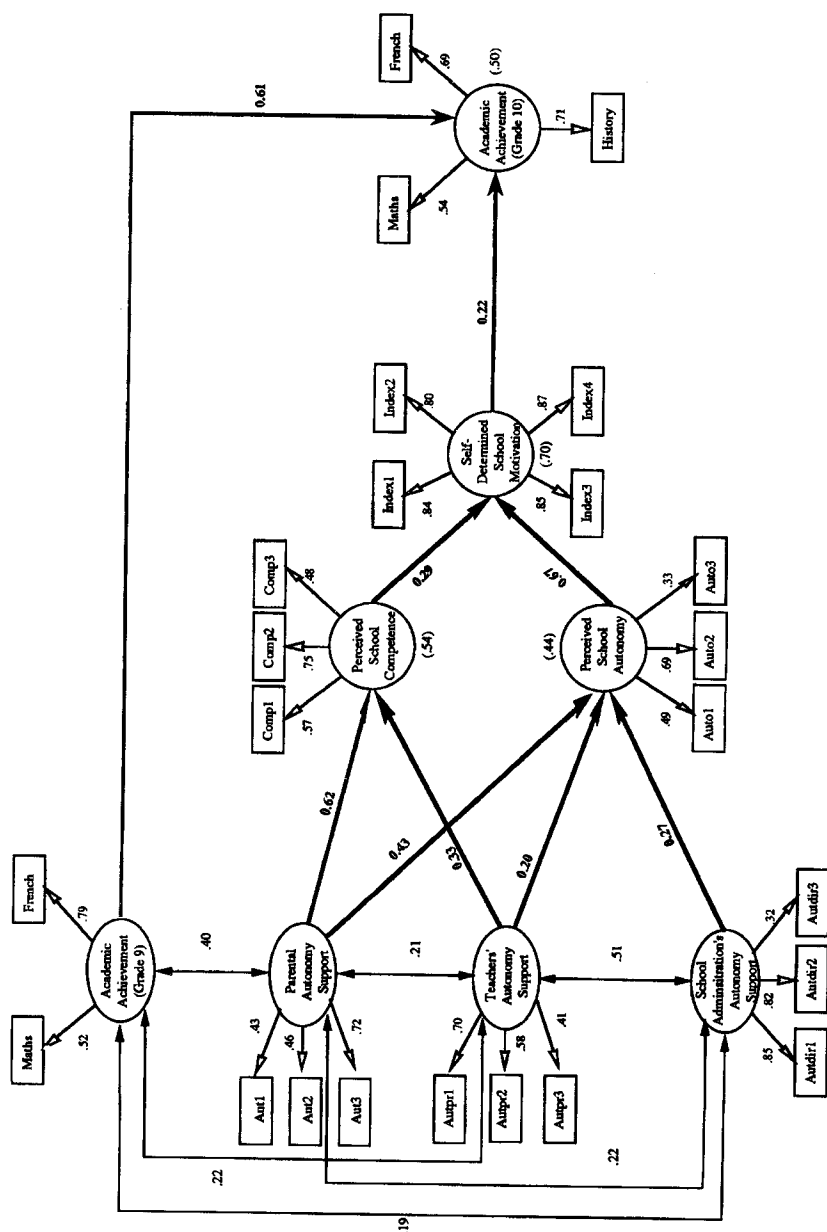


Figure 3. Study 2: Results of the measurement and structural model. All coefficients were standardized to facilitate interpretability and significant at $t > 2.00$. Numbers in brackets indicate the explained variance.

Theory (Deci & Ryan, 1985). These findings are consistent with Fortier, and Guay (1997) school dropouts study which found a positive influence on perceived school competence and self-determined school motivation. Finally, the results of the 8-months later even though we controlled for the effects of Study 2)³. These findings leads to a number of implications for the next sections.

SELF-DETERMINED SCHOOL MOTIVATION

Results from both studies supported the hypothesis that self-determined motivation on achievement. More precisely, self-determined motivation positively affected academic achievement such that this relation exists even if we control for perceived school competence. Also achievement is not the only predictor of self-determined motivation. Also have to be motivated in a self-determined way (Deci & Ryan, 1985; Lloyd & Barenblatt, 1984 for studies out of choice and/or pleasure will be more engaging in school activities for external

PERCEIVED SCHOOL AUTONOMY AND SELF-DETERMINED MOTIVATION

The present results have shown that school autonomy and competence are two important determinants of self-determined motivation. Both studies have shown that perceived school autonomy and competence on self-determined school motivation. These findings are consistent with those that have ascertained this relationship (e.g., Vallerand et al., 1993). Furthermore, the results of the present study on self-determined school motivation, those of previous studies conducted in the field (e.g., Katz, 1988; Gottfried, 1985, 1990; Fortier, 1997; Vallerand et al., 1989, 1993, 1997) and in the laboratory (e.g., Reid, 1984, 1988). Also in line with the findings of Deci (1985), the results from both studies indicate that a more powerful influence on school achievement is perceived school autonomy is more fundamental in enhancing achievement than is the need for competence (Deci & Ryan, 1985). Competent (i.e., sense of effectance in the environment) feel that their environment allows them to

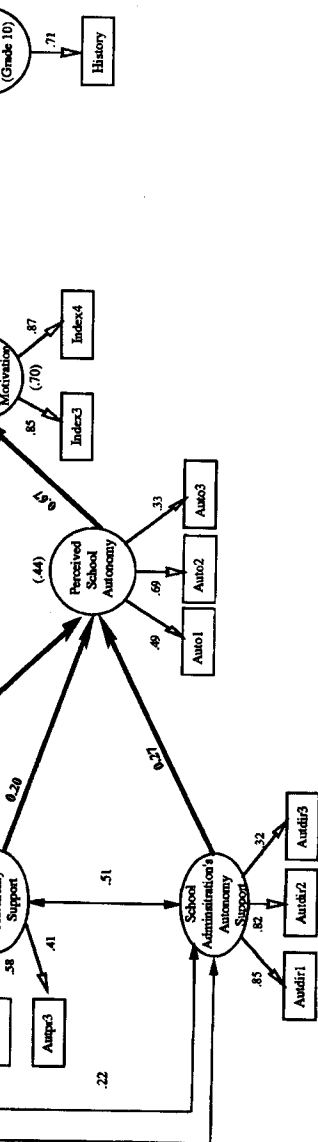


Figure 3. Study 2: Results of the measurement and structural model. All coefficients were standardized to facilitate interpretability and significant at $t > 2.00$. Numbers in brackets indicate the explained variance.

Theory (Deci & Ryan, 1985). These findings are also in line with the Vallerand, Fortier, and Guay (1997) school dropout study. Indeed, the social context had a positive influence on perceived school competence and autonomy. Moreover, perceived school competence and autonomy produced a positive influence on self-determined school motivation. Finally, motivation predicted academic achievement 8-months later even though we controlled for participants prior achievement (i.e., Study 2)³. These findings leads to a number of conclusions which are presented in the next sections.

SELF-DETERMINED SCHOOL MOTIVATION AND ACHIEVEMENT

Results from both studies supported the positive influence of self-determined school motivation on achievement. More precisely, results of Study 1 revealed that motivation positively affected academic achievement, whereas results of Study 2 showed that this relation exists even if we controlled for prior achievement. Thus, prior achievement is not the only predictor of subsequent achievement. Indeed, students also have to be motivated in a self-determined way to be successful (see Gottfried, 1985; Lloyd & Barenblatt, 1984 for similar results). That is, doing school activities out of choice and/or pleasure will produce higher levels of achievement than engaging in school activities for external reasons and/or internal pressure.

PERCEIVED SCHOOL AUTONOMY AND SCHOOL COMPETENCE AS DETERMINANTS OF SELF-DETERMINED MOTIVATION

The present results have shown that students' perceived competence and autonomy are two important determinants of self-determined school motivation. Results of both studies have shown that perceived school autonomy has a positive influence on self-determined school motivation. This result is in line with previous studies that have ascertained this relationship (Deci et al., 1981; Ryan & Grolnick, 1986; Vallerand et al., 1993). Furthermore, the influence of perceived school competence on self-determined school motivation, observed in both studies, was consistent with those of previous studies conducted in the education domain (Boggiano, Main, & Katz, 1988; Gottfried, 1985, 1990; Fortier et al., 1995; Harter & Connell, 1984; Vallerand et al., 1989, 1993, 1997) as well as experimental studies (Vallerand & Reid, 1984, 1988). Also in line with Self-Determination Theory (Deci & Ryan, 1985), the results from both studies indicate that perceived school autonomy has a more powerful influence on school self-determined motivation than perceived school competence. This result is consistent with the notion that the need for autonomy is more fundamental in energizing self-determined motivated behaviors than is the need for competence (Deci & Ryan, 1985). In sum, students who feel competent (i.e., sense of effectance in school activities) and autonomous (i.e., who feel that their environment allows them to make choices regarding school activities)

display higher levels of self-determined motivation (i.e., they go to school for reasons inherent in their true self -out of choice and pleasure).

SOCIAL CONTEXT AND STUDENTS' PERCEIVED COMPETENCE AND AUTONOMY

Results of both studies have shown that students' perceptions of the social context had an influence on students' sense of competence and autonomy. More precisely, findings revealed that students who perceived their parents as autonomy supportive (i.e., providing choice and encouraging participation in school activities) experienced higher levels of perceived school competence and autonomy. These findings are in line with past research which has found that parental autonomy has a positive influence on perceptions of competence (Grolnick & Ryan, 1989; Grolnick et al., 1991; Vallerand et al., 1997). Results also revealed that the more students perceived their teachers as autonomy supportive, the more they felt competent and autonomous. These results are in line with previous studies (Deci et al., 1981; Flink et al., 1990; Grolnick & Ryan, 1987; Ryan & Grolnick, 1986; Vallerand et al., 1997) which have shown the positive impact of autonomy supportive style on students' perceived competence and autonomy.

Another interesting result was that autonomy support from the school administration had a positive influence on students' perceived school autonomy. Consequently, a school administration that takes into consideration students' opinions toward school policies would appear likely to produce higher levels of school autonomy in its students. The lack of relationship between school administration autonomy support and perceived school competence may stem from the fact that students have much less interaction with the school's administration than with their teachers or parents. Thus, the school administration may not provide students with competence feedback as regularly as do teachers and parents. Nevertheless, the school administration does seem to influence students' feelings of autonomy, possibly through disciplinary sanctions and the establishment and enforcement of school policies (see also Vallerand et al., 1997).

The path coefficients of both studies revealed some interesting results concerning the relative influence of social agents on students' school competence and autonomy. First, perceived parental autonomy support had the strongest influence on autonomy followed respectively by the school administration and teachers' autonomy support. Second, parental autonomy support had a stronger influence on perceived school competence than teachers' autonomy support. These findings underscore the major importance of parents in motivating their children in a self-determined fashion toward school activities (Grolnick & Ryan, 1989). Third, the school administration had a greater influence on school autonomy than teachers. This finding is somewhat surprising since students interact on a more regular basis with their teachers than with the school's administration. There is no clear data-based interpretation of this result, although we might speculate that the school administration creates a general school climate that might prove more important

than the influence of the teachers' style, which appears to be less important.

Another important result that needs to be mentioned is that the social context on motivation is mediated by the mediating role of students' perceptions. This finding is in line with other research reports (e.g., Grolnick & Ryan, 1984, 1988; Vallerand et al., 1997).

LIMITATIONS AND FUTURE RESEARCH

Although the present results provide some interesting findings, several limitations should be taken in consideration. Even though we used structural equation modeling to control for the influence, it is nevertheless inappropriate for a correlational study, for instance, may reveal a causal relationship between school motivation and achievement. Second, a given point in time may influence the results. The impact on subsequent self-determined motivation was focused on a limited number of factors. Third, it could be interesting to ascertain the relative influence of these different determinants. Fourth, school motivation is a key mediator of academic achievement. This construct may represent a key mediator of academic achievement (Meece & Holt, 1993; Pintrich & De Groot, 1993). Third, some studies have shown that parental autonomy support produce an impact on motivation (Grolnick & Ryan, 1989; Grolnick & Slowiaczek, 1994). This finding is in line with previous studies. It would thus be interesting to investigate the influence of these different parental and teacher variables on perceived competence and autonomy. Finally, the influence of peer relations on school motivation is a key mediator of school motivation (Connell, 1992) have found that students' perceptions of peers have a better academic performance. School motivation is a key mediator of academic achievement. That is, feeling accepted by peers leads to school motivation which in turn influences academic achievement. This hypothesis would appear important.

In sum, despite the limitations mentioned above, the findings appear important for the educational practice. Grolnick and Lusk (1987) suggested, more precisely, that sanctions are effective for learning. However, teachers, and school administrators should take into account an understanding of the social context in order to improve students' motivation and achievement.

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COMPETENCE AND AUTONOMY

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Another important result that needs to be underscored is that the impact of the social context on motivation is an indirect one, resulting primarily from the mediating role of students' perceptions of competence and autonomy. This result is in line with other research reports (e.g., Reeve & Deci, 1996; Vallerand & Reid, 1984, 1988; Vallerand et al., 1997).

LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

Although the present results provide support for the proposed model, at least four limitations should be taken in consideration when interpreting the findings. First, even though we used structural equation modeling to determine the direction of influence, it is nevertheless inappropriate to make causal inferences. A longitudinal study, for instance, may reveal a nonrecursive effect between self-determined school motivation and achievement. That is, self-determined school motivation at a given point in time may influence performance which in turn may produce an impact on subsequent self-determined school motivation. Second, this research focused on a limited number of factors predictive of academic achievement. It could be interesting to ascertain the role of students' learning strategies as an additional determinant of academic achievement. Indeed, some studies have shown that this construct may represent a key mediator between motivation and achievement (Meece & Holt, 1993; Pintrich & De Groot, 1990; Pokay & Blumenfeld, 1990). Third, some studies have shown that other variables such as parental involvement produce an impact on motivation (Grolnick & Ryan, 1989; Grolnick et al., 1991; Grolnick & Slowiaczek, 1994). This variable was not assessed in the present studies. It would thus be interesting in future research to assess the relative impact of these different parental and teaching styles on students' perceptions of competence and autonomy. Finally, the present model does not take in consideration the influence of peer relations on self-determined school motivation. Pierson and Connell (1992) have found that students who feel accepted and respected by their peers have a better academic performance. Thus, it is possible that self-determined school motivation is a key mediator between quality of peer relations and academic achievement. That is, feeling accepted by others could enhance self-determined school motivation which in turn influences academic achievement. Future research on this hypothesis would appear important.

In sum, despite the limitations mentioned above, the present findings would appear important for the educational domain. As Boggiano, Barrett, Weiher, McClelland, and Lusk (1987) suggested, most parents and teachers believe that controlling sanctions are effective for learning. In light of the present findings, parents, teachers, and school administrators should be aware that motivating students starts with an understanding of the social context that fulfills students' needs for competence

and autonomy. Such an understanding may go a long way in promoting students' self-determined motivation and subsequent achievement.

Notes

1. Two separate structural models were tested for males and females. Results from these analyses revealed similar path coefficients and model estimates for both males and females (i.e., for males GFI=0.94 and AGFI=0.92; for females GFI=0.92 and AGFI=0.90).
2. As in Study 1, two separate structural models were tested for both males and females. Results from these analyses also revealed similar path coefficients and model estimates (i.e., for males GFI=0.91 and AGFI=0.89; for females GFI=0.92 and AGFI=0.90).
3. Even though this model involved French-Canadian students, we believe that it would be generalized to Anglophone students or students in other national contexts. That is, this model is in line with previous study conducted with American students (see Grolnick & Ryan, 1989 for an example) and with Jewish Israeli students (see Butler, 1987, 1988 for example).

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a long way in promoting students' achievement.

and females. Results from these analyses for both males and females (i.e., for males AGFI=0.90).

tested for both males and females. Results of model estimates (i.e., for males AGFI=0.90).

students, we believe that it would be generalizable to other contexts. That is, this model is in line with previous research (see Grolnick & Ryan, 1989 for an example).

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Note: Variances appear in the diagonal entry.

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Appendix II. Study 2: Variances, Means and Covariance Matrix for Structural and Measurement Model

| Variables | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
|--|--------|-------|--------|--------|-------|-------|-------|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|--------|--------|--------|-------|-------|-------|
| Academic Achievement Grade 9 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1. Mathematics | 0.871 | | | | | | | | | | | | | | | | | | | | | | | |
| 2. French | 0.372 | 0.881 | | | | | | | | | | | | | | | | | | | | | | |
| Parental Autonomy Support | | | | | | | | | | | | | | | | | | | | | | | | |
| 3. Aut1 | 0.036 | 0.048 | 0.846 | | | | | | | | | | | | | | | | | | | | | |
| 4. Aut2 | 0.023 | 0.086 | 0.136 | 0.927 | | | | | | | | | | | | | | | | | | | | |
| 5. Aut3 | 0.132 | 0.150 | 0.309 | -0.330 | 0.875 | | | | | | | | | | | | | | | | | | | |
| Teachers' Autonomy Support | | | | | | | | | | | | | | | | | | | | | | | | |
| 6. Autpr1 | 0.015 | 0.078 | 0.038 | 0.082 | 0.116 | 0.937 | | | | | | | | | | | | | | | | | | |
| 7. Autpr2 | 0.003 | 0.074 | 0.050 | 0.060 | 0.114 | 0.374 | 0.926 | | | | | | | | | | | | | | | | | |
| 8. Autpr3 | -0.012 | 0.106 | -0.004 | -0.028 | 0.026 | 0.289 | 0.227 | 0.946 | | | | | | | | | | | | | | | | |
| School Direction's Autonomy Support | | | | | | | | | | | | | | | | | | | | | | | | |
| 9. Audir1 | 0.045 | 0.119 | 0.046 | 0.070 | 0.102 | 0.284 | 0.248 | 0.151 | 0.951 | | | | | | | | | | | | | | | |
| 10. Audir2 | 0.057 | 0.105 | 0.064 | 0.059 | 0.131 | 0.270 | 0.230 | 0.164 | 0.669 | 0.949 | | | | | | | | | | | | | | |
| 11. Audir3 | 0.066 | 0.067 | 0.134 | 0.227 | 0.152 | 0.165 | 0.127 | 0.042 | 0.245 | 0.226 | 0.942 | | | | | | | | | | | | | |
| Perceived School Autonomy | | | | | | | | | | | | | | | | | | | | | | | | |
| 12. Auto1 | 0.075 | 0.025 | 0.132 | 0.146 | 0.165 | 0.152 | 0.140 | -0.010 | 0.227 | 0.242 | 0.244 | 0.950 | | | | | | | | | | | | |
| 13. Auto2 | 0.060 | 0.098 | 0.139 | 0.132 | 0.227 | 0.155 | 0.148 | -0.038 | 0.224 | 0.218 | 0.136 | 0.337 | 0.951 | | | | | | | | | | | |
| 14. Auto3 | 0.026 | 0.051 | 0.073 | 0.050 | 0.096 | 0.221 | 0.197 | 0.052 | 0.177 | 0.198 | 0.164 | 0.160 | 0.183 | 0.925 | | | | | | | | | | |
| Perceived School Competence | | | | | | | | | | | | | | | | | | | | | | | | |
| 15. Comp1 | 0.134 | 0.160 | 0.099 | 0.141 | 0.187 | 0.200 | 0.171 | 0.152 | 0.100 | 0.092 | 0.088 | 0.013 | 0.124 | 0.142 | 0.918 | | | | | | | | | |
| 16. Comp2 | 0.183 | 0.269 | 0.146 | 0.212 | 0.345 | 0.178 | 0.129 | 0.052 | 0.139 | 0.160 | 0.165 | 0.229 | 0.313 | 0.151 | 0.366 | 0.921 | | | | | | | | |
| 17. Comp3 | 0.166 | 0.189 | 0.082 | 0.101 | 0.113 | 0.097 | 0.124 | 0.100 | 0.074 | 0.043 | 0.080 | 0.039 | 0.084 | 0.135 | 0.381 | 0.297 | 0.882 | | | | | | | |
| Self-Determined School Motivation | | | | | | | | | | | | | | | | | | | | | | | | |
| 18. Index 1 | 0.806 | 1.173 | 1.199 | 1.214 | 1.752 | 1.578 | 1.193 | 0.395 | 1.655 | 1.492 | 1.272 | 1.799 | 2.843 | 1.147 | 1.505 | 2.497 | 1.388 | 34.24 | | | | | | |
| 19. Index 2 | 0.488 | 0.771 | 0.926 | 0.881 | 1.244 | 1.117 | 0.948 | 0.107 | 1.032 | 0.933 | 0.888 | 1.320 | 2.263 | 0.878 | 0.844 | 1.742 | 0.540 | 19.078 | 22.916 | | | | | |
| 20. Index 3 | 0.539 | 1.009 | 1.044 | 0.862 | 1.548 | 1.203 | 1.191 | 0.432 | 1.248 | 1.171 | 1.055 | 1.462 | 2.313 | 1.067 | 1.158 | 2.122 | 0.996 | 21.063 | 15.826 | 25.145 | | | | |
| 21. Index 4 | 0.459 | 0.820 | 1.042 | 0.900 | 1.452 | 1.299 | 1.110 | 0.214 | 1.141 | 1.184 | 1.064 | 1.458 | 2.302 | 1.064 | 0.854 | 1.937 | 0.718 | 19.560 | 16.442 | 17.742 | 22.128 | | | |
| Academic Achievement Grade 10 | | | | | | | | | | | | | | | | | | | | | | | | |
| 22. Mathematics | 0.199 | 0.230 | 0.016 | 0.103 | 0.131 | 0.087 | 0.092 | 0.102 | 0.071 | 0.093 | 0.122 | 0.060 | 0.117 | 0.067 | 0.253 | 0.273 | 0.226 | 1.114 | 0.677 | 0.838 | 0.645 | 0.889 | | |
| 23. French | 0.155 | 0.361 | 0.096 | 0.112 | 0.141 | 0.091 | 0.119 | 0.127 | 0.124 | 0.103 | 0.109 | 0.026 | 0.076 | 0.083 | 0.268 | 0.302 | 0.204 | 1.259 | 0.890 | 1.248 | 0.984 | 0.313 | 0.887 | |
| 24. History | 0.199 | 0.310 | 0.060 | 0.139 | 0.164 | 0.081 | 0.075 | 0.098 | 0.151 | 0.142 | 0.129 | 0.074 | 0.121 | 0.090 | 0.263 | 0.315 | 0.247 | 1.465 | 0.876 | 1.133 | 0.953 | 0.360 | 0.433 | 0.883 |
| Means | 3.800 | 3.661 | 5.732 | 4.877 | 5.543 | 4.892 | 4.927 | 4.655 | 3.934 | 3.984 | 4.481 | 3.730 | 3.862 | 4.443 | 5.126 | 5.298 | 5.343 | 5.350 | 4.075 | 6.360 | 6.072 | 3.410 | 3.459 | 3.485 |

Note: Variances appear in the diagonal entry.

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