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Student's Interest in Science and Technology and its Relationships with Teaching Methods, Family Context and Self-Efficacy

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In order to explore students' interest towards S&T, we developed and validated a questionnaire that simultaneously takes into account 18 components (general interest in school-S&T, utility of school-S&T, teaching methods preferences, perceived importance and preference for school-S&T with respect to other school subjects, etc.). The questionnaire was administered to 1,882 students from grades 5 through 11 (seven grade levels). Findings indicate that: a) students show a high general interest in S&T and a preference for student-centred teaching methods rather than teacher-centred ones; however, few of them perceive the utility of school-S&T for everyday life, want to spend more time doing S&T in school or intend to pursue S&T related studies or careers. Grade level differences appear to be important while gender differences are weak; b) in terms of school subjects, perceived importance and preference order, S&T seem to occupy an intermediate position; the preference order is not, however, similar to the perceived importance order. The latter, and therefore the role of S&T in school, appear to be strongly influenced by its status or its social value given in the curriculum; c) the analysis based on correlations and regressions propose some important predictors of general interest towards S&T. The results highlight, among other things, the importance for school to intervene on certain factors that promote the development of students' interest in S&T. For instance, 1) to affirm the importance of S&T right from the beginning of elementary school, 2) to use teaching methods that allow students to establish links between what they learn in school and their lives, as well as methods centered on students' development of inquiry processes, 3) to promote cultural activities related to S&T, and 4) to promote a positive development of self-concept through quality schooling.

Keywords: interest, science and technology, school subjects

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INTRODUCTION

Important issues are associated to science and technology (S&T) education in modern societies. First among these is the development of a scientific and technological culture for all citizens, whether they are destined to pursue careers in S&T or not. In societies strongly marked by scientific knowledge and technological advances, the paucity of such a culture in the population hinders the exercise of informed citizenship. These issues are also related to social progress. The shortage of people with training in this field may deprive societies of critical human resources needed for the industrial and economic development on which they are based. Furthermore, over the past decades a growing gap has been observed between the scientific and technical expertise offered by schools, on one hand, and the social demand in this regard, on the other: societies are showing a growing need for individuals trained in this field, while the number of students attracted to it is stagnating and in some cases declining (Organisation for Economic Cooperation and Development [OECD], 2006; 2008). This gap, which many describe as students' loss of interest in S&T, has been observed in many parts of the world, for example in England (Convert, 2005; Cotgreave & Davies, 2005; Hannover & Kessels, 2004) in Germany (Haas, 2005), in the United States (Foster, 2010), in Canada (Dobson & Burke, 2013) and also in France (Convert, 2005; Ourisson, 2002 ; Porchet, 2002).

In this context, developing students' interest in S&T and its related studies and careers, over and beyond the quality of learning, must be a preoccupation for schools, educational policies and academic research in education. The hypothesis behind this position is that strong interest in S&T might influence students' involvement in scientific tasks (Ainley, Corrigan, & Richardson, 2005; Ainley, Hidi, & Berndorff, 2002; Schiefele, Krapp, & Winteler, 1992) and studies, and consequently their engagement in developing a scientific and technological culture as well as pursuing career choices associated with these disciplines (Baram-Tsabari & Yarden, 2009; Hidi & Harackiewicz, 2000; Khoo & Ainley, 2005).

Many studies related to this issue have been conducted over the past decades, addressing various aspects of interest in S&T and progressively building knowledge in this field. Analysis of these studies and related syntheses (Krapp & Prenzel, 2011; Potvin & Hasni, 2014; Renninger & Hidi, 2011; Schraw & Lehman, 2001) shows that while a lot has been learned about interest, further research is still needed, particularly in different cultural and educational contexts—since interest seems to depend on these contexts (Ainley & Ainley, 2011; Wang & Berlin, 2010) — with a focus on classroom teaching methods (House, 2009; Palmer, 2009). Osborne, Simon, & Collins (2003), in a review on attitude toward S&T, note that "there is a greater need for research to identify those aspects of science teaching that make school science engaging for pupils" (p. 1049). Other authors have also pointed out the need to develop research and tools that simultaneously take into account a number of interest-related components (Lamb, Annetta, Meldrum & Vallett, 2012). The contribution of this article is precisely to address these preoccupations, as indicated by the research objectives below.

Objectives of the study

Analysis of studies and syntheses that we have just cited shows that interest is strongly associated with certain variables and dimensions. For example, the literature review of Potvin & Hasni (2014) based upon 228 research articles indicates that in addition to other variables (gender, grade level, country of origin, etc.), the studies highlight the important role of school-related variables (including teaching methods), self-efficacy, and sociological variables (including the socioeconomic level of parents as well as family background). The literature review of Krapp & Prenzel (2011) stresses the need to pay special attention to specific domains or scientific disciplines (biology, physics, chemistry, etc.) and to consider a comparison of S&T with the other subjects that make up the curriculum. Moreover, the same review also highlights the importance of variables such as gender, grade level, and self-efficacy.

On one hand, the selection of variables and dimensions to consider in our study stems from analysis of the earlier studies and literature reviews that we have cited above. However, although these variables and dimensions have often been examined in an isolated way in earlier research, our aim is to consider them simultaneously in one study, while seeking to establish relationships between them and general interest in S&T. On the other hand, the selection of variables and dimensions also follows the priorities jointly established by the researchers and partners of the *Chaire de recherche sur l'intérêt des jeunes à l'égard des sciences et de la technologie* (CRIJEST) under which this survey was conducted. The Chair is managed in partnership by two universities and six school boards (administrative entities responsible for local management of the education system) that account for more than half of the schools in Quebec (French Canadian province). The Chair's research and interventionspriorities are jointly defined through an Executive Committee composed of representatives of Chair partners. In the context of this committee, it was agreed to study, among all the variables and the dimensions reported in the literature, primarily those on which the school can act (teaching methods, self-efficacy, family involvement in cultural activities, support for students, etc.). This rationale also explains why some variables and dimensions, such as the role of the socio-economic status of parents, were not retained. It is important to note that in addition to conducting research, the Chair, based on its findings, also aims to suggest activities and interventions that target teachers, students and parents with a view to improving S&T learning and interest in S&T and related careers. Examples of these activities are presented on the website of the Chair (http://crijest.org/).

In light of the issue that we have presented, as well as the needs expressed by the partnering school boards, this article addresses three specific objectives:

1) To describe students' interest in school S&T while considering seven grade levels, from grades 5 through 11, and various related aspects: S&T in general; teaching methods (experienced/preferred); utility (value) of S&T outside the school; etc.

2) To consider interest in S&T with respect to the other school subjects in the curriculum (mathematics, French, English, social sciences, etc.). One might legitimately suppose that student engagement and future choices (studies and careers) also depend on this "relative" interest and not only on "specific" interest. In addressing these first two objectives, a differentiation will be made according to gender and grade level.

3) To describe the relationship between interest in S&T at school and the three following main contextual components:

a) Teaching methods. It is primarily through these methods that school exposes students to S&T and can consequently influence their interest.

b) The family context, considering the following two types of family activities: frequency of family participation in cultural practices involving S&T (magazines, television programs, visits to museums, etc.) and frequency of conversations with children about what they are doing in school.

c) Self-efficacy at school (Bong & Skaalvik, 2003): perception of ability to understand S&T-contents or to carry out specific tasks in this school subject.

Conceptual framework

The concept of interest is used in a variety of research fields, including psychology, educational psychology, sociology, S&T education (Krapp & Prenzel, 2011). Our study is located primarily in this last field. Our focus is to understand phenomena related to S&T education rather than to make a contribution to theorization about the concept of interest *per se*. The conceptual framework will therefore present the way we use the concept of interest to determine, based on writings in this field, the main dimensions (components) and indicators to use in order to develop tools for data collection and analysis. As Renninger & Hidi (2011) underscore, "The construction of a theoretically satisfactory interest measure requires a specification of the interest construct or a particular aspect of this construct that is used as a basis for operationalization" (p. 36). The synthesis published by these authors (Renninger & Hidi, 2011) clearly shows that there is no one stabilized and fully agreed-upon theoretical orientation towards the concept of interest. However, "general agreement can be found with regard to the central characteristics of the interest construct" (Krapp & Prenzel, 2011, p. 30). Three sets of characteristics can be found in most texts and will be used as a basis here to operationalize the concept in our research: a) the attributes of the concept of interest; b) the dimensions that make up this construct; and c) the analytical levels on which it is examined in studies.

Characterization of the concept of interest

Following on Gardner (1996, in Krapp, 2007), many authors (Hidi, Renninger & Krapp, 2004; Krapp, 2007, Krapp & Prenzel, 2011; Renninger & Hidi, 2011) consider that "the decisive criterion of the interest construct which enables it to be clearly distinguished from several neighbouring motivational concepts [such as attitude and motivation] is its *content specificity*" (Krapp & Prenzel, 2011, p. 30). "One cannot simply have an interest: one must be interested in something" (Gardner, 1996, p. 6, in Krapp, 2007). "The interest construct is conceptualized as a relational concept: an interest represents or describes a more or less enduring specific relationship between a person and an object in his or her life-space" (Krapp, 2007, p. 8).

The object of interest in the field of S&T can be a specific subject (biology, physics, chemistry, etc.), a specific area or field of knowledge (the study of animals), a concrete operation or object (lab manipulations), an abstract scientific activity (formulating a scientific problem or question, or analyzing data), etc. (Häussler, 1987; Häussler & Hofmann, 2000; Krapp, 2007; Krapp & Prenzel, 2011). When discussing S&T as an object of interest, it is also important to distinguish the way S&T are perceived in society (outside school) from the way it is taught and learned in school context. The focus of our research is the latter.

Dimensions of the concept of interest

While some researchers have characterized interest as an 'affective variable' or stressed this particular aspect in their studies (Rennie & Punch, 1991; Steinkamp & Maehr, 1983), others believe in the importance of not simply equating it with 'enjoyment while learning' (Krapp & Prenzel, 2011). Interest is a multidimensional construct whose operational definition requires emotional, cognitive (knowledge) and related value [value attributed to the object of interest] dimensions (Hidi, 2006; Hidi & Renninger 2006; Hidi, Renninger, & Krapp, 2004; Krapp, 2007; Krapp & Prenzel, 2011; Renninger & Hidi, 2002, 2011; Schiefele, 2009).

Models such as the 'four-phase model' of interest development by Hidi & Renninger (2006) propose interdependency between these dimensions as interest grows and is maintained. Although the very earliest phases of interest might be considered to be an emotion and to involve minimal knowledge requirements (Hidi, 2006; Reeve, Jang, Hardre & Omura, 2002), "Hidi and Renninger suggested that for interest to develop, knowledge and value, in addition to affect, need to be present" (Ainley et Ainley, 2011, p. 69).

a) Emotional (affective) characteristics – According to the authors cited above, this "feeling-related" dimension refers to emotion and the sense of enjoyment provided by the actual or evoked presence of a given object, as well as the involvement in an interaction with it. For example, this can mean enjoying science, having fun with science or with its specific objects (contents, teaching methods, etc.). As Krapp (2007) recalls, "it has been proposed that emotional experiences are considered as related to the basic needs of competence, autonomy and social relatedness in order to characterise interest-specific emotional experiences" (p. 11).

b) Cognitive aspects – This dimension bears on object-related knowledge: what students know or think they know about it. Indeed, without knowledge, there is no interest. Students cannot be hoped to express interest in the inquiry process or in biology knowledge (such as photosynthesis), for example, without having some minimal knowledge of these objects. Moreover, interest in an object prompts a desire to find out more about it. Krapp (2007) noted that:

A person who is interested in a certain subject area is not content with his or her current level of knowledge or abilities in that interest domain. Rather, there is a high readiness to acquire new information, to assume new knowledge and to enlarge the competencies related to this domain. But there is also a high readiness for activating interest-related competencies in situations that do not require new learning (p. 10).

c) Value-related characteristics – Ainley & Ainley (2011) "used data from the PISA international study of science achievement to suggest that value is a strong predictor of students' enjoyment of science and that enjoyment mediates the predictive effects of value in learning science" (Renninger & Hidi, 2011, p. 171). In our case, this is the value individuals attribute to the object of their interest (S&T or its components). According to Krapp (2007),

From such a theoretical perspective, positive evaluation results from the degree of identification with the object of interest. The value component of an interest is also referred to by using the concept of 'self-intentionality' to make it clear that the goals and volitionally realised intentions related to the object area of an interest are compatible with the attitudes, expectations, values and other aspects of the person's self-system (p. 11).

In connection with this dimension, one might also consider the role individuals ascribe to the S&T learned at school in their lives outside school.

In our research, we suggest that while this value can be studied in a "specific" way (value attributed to S&T or to one of its characteristic objects), it can also be studied in a "relative" way via comparison of the value assigned to S&T with respect to the other school subjects (languages, arts, social sciences, etc.). Research into students' preferences for school subjects (Colley & Comber, 2003; Hendley, Stables, & Stables, 1996) shows the importance of taking relativity into account in connection with interest. Works stemming from the Sociology of Curriculum (Bernstein, 1971; 1997; Young, 1971, 1997) also show that the hierarchy of school subjects, widespread in school systems, has a strong impact on which subjects teachers and, consequently, students (Lenoir & Hasni, 2010) will consider important or not to the school education. Students' interest and engagement in S&T is likely to also depend on this "relative value."

Levels for studying interest

Numerous authors make a distinction between two levels of interest, which some consider to be two current directions of research in this area (e.g., Ainley et al., 2002; Hidi, 2001; Hidi & Harackiewicz, 2000; Hidi & Renninger, 2006; Krapp, 2007;

Renninger & Hidi, 2011; Schiefele et al., 1992; Swarat, Ortony, & Shieh, 2012): situational interest and individual (personal) interest.

a) *Situational interest* is characterized by its association with an external factor (a situation, a task, a context, etc.) to which an individual is exposed and in which the individual is involved in an interaction (Ainley et al., 2002; Hidi & Renninger, 2006). The situation may produce a positive feeling (for example, the joy of engaging in a scientific experiment) or a negative one (for example, disgust in observing and describing the parts of a scorpion) (Swarat, Ortony, & Revelle, 2012). In the school context, this situation may involve, for example, specific knowledge to which students are exposed or the tasks in which they are involved (conducting experiments, listening to the teacher, reading textbooks, etc.). According to Hidi (2001, 2006) "this psychological state involves focused attention, increased cognitive functioning, persistence, and affective involvement" (Krapp, 2007, p. 9).

Another characteristic of this type of interest is that even if it is transitory, under some conditions it can provide the basis for longer situational interest (Krapp, 2007): "When situational interest is maintained over time, or when it occurs repeatedly in response to the same stimuli, does it possibly lead to long-term interest, increased knowledge, changes in values, and consistent positive feelings" (Swarat et al., 2012, p. 4). In an extensive review, Hidi & Harackiewicz (2000) conclude that "situational interest can contribute to the development of long-lasting personal interest" (p. 155). In other words, certain conditions in the learning environment can do more than momentarily *catch* one's interest, they can also *hold* it (Hidi & Harackiewicz, 2000). When situational interest is sustained (held) by conditions in the learning environment, it may lead to intrinsic motivation and individual interest (Hidi & Harackiewicz, 2000).

b) *Personal (individual) interest*, a particular focus of this study, is characterized by the intrinsic desire to understand a specific topic that persists over time (relatively stable) (Krapp, 2007; Renninger & Hidi, 2011; Schraw & Lehman, 2001; Wade, 2001). It is a cognitive and affective quality that individuals carry with them from place to place. "The basis of personal interest appears to be pre-existing knowledge, personal experiences and emotions, high value" (Schraw & Lehman, 2001, p. 28). It develops slowly over time and tends to be long lasting (Schraw & Lehman, 2001).

Over time, individual interest may be integrated into the person's value system and become one of its basic components.

Therefore, it is suggested that people carry with them a set of individual interests, which influence how they interact with various objects. When people with certain individual interest encounter a situation that matches the particular interest, their individual interest is actualized — referred to as actualized individual interest by some researchers (Swarat et al., 2012, p. 4).

Individual interest is based on existing knowledge about and values concerning tasks, objects, or ideas and is the desire to be involved in activities related to these concepts (Swarat et al., 2012). This type of interest is personal, broad, and often long-lasting. Hidi & Harackiewicz (2000) describe individual interest in greater detail, stating that it is "a relatively stable motivational orientation or personal disposition that develops over time in relation to a particular topic or domain and is associated with increased knowledge, value and positive feelings" (p. 152).

c) Predisposition or intention to act. Another important characteristic of *individual interest* is that it leads to "a relatively enduring preference for certain topics, subject areas, or activities'' (Schiefele et al., 1992, p.152) or to an "enduring predisposition to attend to certain objects and events and to engage in certain activities, contents or objects" (Hidi & Renninger, 2006, p.113). This behaviour or predisposition "is associated with a psychological state of positive affect and persistence and tends to result in increased learning" (Ainley et al., 2002, p. 545). The predisposition to act is understood here as a favorable response to a given object on a consistent basis. As regards the research on interest (Ainley & Ainley, 2011),

We can predict that having a coherent body of science knowledge and understanding (knowledge), enjoying science (affect), and valuing science (value) will be predictive of the level of general interest in learning science (individual interest), which in turn will predict being currently engaged in science activities and having the intention to engage with science activities in the future (current and future engagements) (p. 55).

In the context of our study, we consider that this predisposition to act can be examined at different levels, including a) the engagement in S&T classes and b) the intention to pursue S&T-related studies or careers.

METHODOLOGY

Questionnaire development and validation

Taking into account our conceptual framework and research objectives, we developed a questionnaire incorporating numerous items that had already been used in other international studies and were relevant to our study (examples : Ainley & Ainley, 2011; Häussler & Hauffmann, 2002; House, 2009; Juuti, Lavonen, Uitto, Byman, & Meisalo, 2010; Kanter & Konstantopoulos, 2010; Lamb et al., 2012; OCDE, 2006; Tuan, Chin, & Shieh, 2005). Other questions were formulated *de novo* (for example, those about "relative" interest in S&T) or were adapted to take account of the Quebec school context, as well as the fact that the same questionnaire was intended for both elementary and secondary students. These adaptations included the following:

- Identifying school subjects by the names they have been given in Quebec programs, which are more meaningful to students. Examples: *The Living World*, instead of biology; *The Material World,* which groups together physics and chemistry; *Social Sciences* (geography, history and citizenship education); etc. The same principle was applied when developing items concerning the utility of S&T in life outside the school. For this component, we took into account the three main issues addressed by the Quebec S&T program, since they are well known to students: health, environment and sexuality.

- Formulating most of the questions to allow students to give their opinions according to six levels of agreement (*strongly*, *moderately* or *slightly disagree*; *slightly*, *moderately or strongly agree*) or frequency (*never*, *very rarely*, *rarely*, *sometimes*, *often*, *very often*) (Figure 1a).

82. In my S&T classe, I would like to spend more time listening to the teacher give explanations at the front of the class.	Strongly disagree	Moderately disagree	Slightly disagree	Slightly agree	Moderately agree	Strongly agree
	☐	☐	☐	☐	☐	☐

Figure 1a. Structure used for the main questions in the questionnaire

For certain questions, this scale was inadequate and other six-level formulations were used. For example, to explore the "relative value" of S&T, we asked the students to tell us in each case whether this subject was more or less important than each of the other subjects in the curriculum: languages, mathematics, social sciences, etc. (Figure 1b). This allowed us to avoid answers influenced by social desirability (answers favourable to all the subjects) as well as to clearly situate S&T with respect to other subjects.

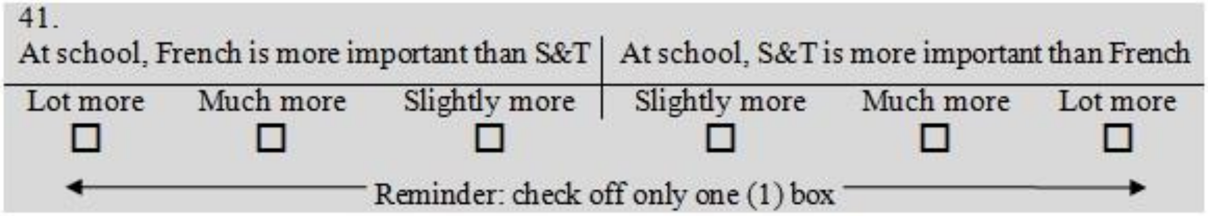


Figure 1b. Example of a question aiming to distinguish between importance of S&T and importance of other subjects

- Using short-answer questions that were easy to understand and left minimal room for interpretation, since the same questionnaire was addressed to 5th year elementary students (11 year old students) as well as to 5th year secondary students (17 year old students).

The final questionnaire, which was made up of 139 questions, was validated with 220 students (verifying their understanding of the items and determining the answering time). Certain questions were amended before the questionnaire distribution in the context of the study.

Given the very large number of items (questions), two versions of the questionnaire were created to avoid making the test too long and tiring for the students. Our main concern was to make sure that young elementary pupils as well as older students would be able to complete the questionnaire in less than 30 minutes. We wanted to avoid obtaining "unreliable" answers that might be due to the fatigue of students. One of these versions (referred to below as version A) was distributed to students whose names began with a letter between "A" and "J" (inclusively), and the other to the remaining participants (version B). This approach allowed us to get in each class an equivalent number of students for each version. The intent was also to allow each student to complete the same version of the questionnaire year after year as part of our longitudinal studies. About two-thirds of the items were identical in both versions, leaving other items to be answered by only half of the participants. This explains why some of our analyses were obtained with half of the population (see the Results section). Given that this approach

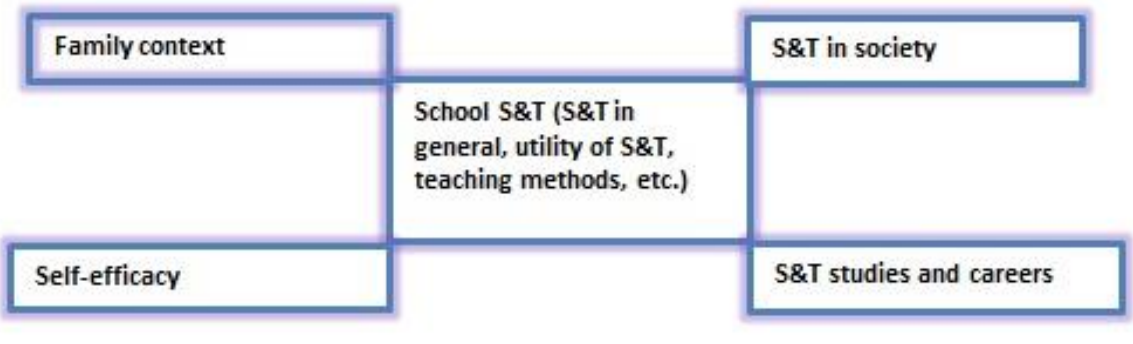


Figure 2. Main sections of the questionnaire

randomly divides the students into two subsamples, we believe that the consequences are less harmful for the research than giving up some items and dimensions that are important to our research objectives (i.e, using a single short questionnaire) or using a very long questionnaire (including all 139 items).

Figure 2 presents the main sections of the questionnaire; Appendix 1 shows items (translated from French) that illustrate these sections, as well as the main components and sub-components associated with the three objectives examined in this text. The letters a, c, v and i at the end of each item indicate that the item pertains to affective (a), cognitive (c) or related value (v) dimensions, or to the intention to act (i). It should be noted, for example, that data regarding pursuit of S&T studies and careers will not be dealt with here.

Sample

The questionnaires were distributed to students in cycle three of elementary school and secondary school across 39 schools belonging to school boards that had partnered with CRIJEST (Chaire de recherche sur l'intérêt des jeunes à l'égard des sciences et de la technologie).

In total, 1,822 students provided us (via their teachers) with their completed questionnaires and parental consent; ethical approval obtained through an appointed university committee was required to gather data from minor students. Questionnaires obtained without parental consent were excluded. The respondents were distributed across the following grade levels (cycles): 523 (28.8%) from cycle three of elementary school (5th and 6th years: Y5 and Y6); 527 (29.0%) from cycle one of secondary school (Y7 and Y8); 626 (34.5%) from cycle two of secondary school (Y9 and Y10); and 140 students (7.7%) from the final year of secondary school (Y11).

Data analysis

We used statistical procedures adapted to ordinal variables. We avoided immediately transforming ordinal data into continuous data; we have therefore avoided the priority use of statistics based on averages. Such statistics (ANOVA) will be cited where necessary, as complementary information. Aside from the calculation of frequencies and percentages, we performed three types of data analysis:

1) The questionnaire components and sub-components were statistically validated using a principal component factor analysis, as per techniques used in other research seeking to produce and validate interest or attitude questionnaires (Lamb et al., 2012; Tuan et al., 2005; Wang & Berlin, 2010).

2) Association tests were used to analyze the data according to gender and grade level (Objectives 1 and 2). For gender (binary variable), we used an alternative to the chi-squared test adapted to data tables that vary from the 2 lines x 2 columns format (Fox, 1999), namely the chi-squared likelihood ratio. This test was accompanied by the Cramer *V* ($Ø_c$) measure, which offers an indication of association strength (magnitude). Along with other authors, Howell (1998) notes that "if I had to use only one measure of association, I would choose the Cramer $Ø_c$" (p. 182), since this test depends on neither the size of the table that is crossed, nor the size of the sample.

To study the answers to most of the questionnaire items in relation to grade level (all ordinal variables) we used the Goodman-Kruskal Gamma test (γ), which also provides a measure of the strength of association (Fox, 1999).

3) To study the relation between the sub-component of *General interest in S&T* and the other components and sub-components considered in the study (Objective 3), we used correlations and linear regression techniques.

RESULTS

The results will be presented in three stages: a) a statistical validation of the questionnaire components considered in this article; b) a portrait of student interest in school-S&T, taking into account gender and grade level differentiation (Objectives 1 and 2); and c) a presentation of correlations and regression considering *General interest in S&T*, on one hand, and other selected components and sub-components, such as teaching methods, family context and self-efficacy in S&T (Objective 3), on the other.

Statistical validation of questionnaire components and sub-components

We performed a principal component factor analysis with varimax rotation (Muijs, 2011), taking into account items from the main sections of the questionnaire that were associated with this article's objectives. We used the *A* version of the questionnaire first, since it contains most of the items associated with these objectives. The analysis reveals 11 factors (F) that account for 67.29% of variance (Appendix 2).

When comparing these results with Appendix 1, the factors that emerge from the statistical validation are similar or identical to several questionnaire components and sub-components that were initially proposed on a theoretical basis.

Moreover, these factors add additional nuances. For example:

- The items of component C3 in the questionnaire were distributed across two factors during statistical validation: F6 (PARTICIP_INVEST) and F11 (PARTICIP_HANDS);
- The items of component C4 in the questionnaire (preferred teaching methods) were distributed across three factors during statistical validation: F7 (PREF_TRAD), F8 (PREF_EXT) and F10 (PREF_INVEST). All of these factors are meaningful from a theoretical perspective and were retained for subsequent analysis.

For the *B* version, and with respect of our research objectives, the factor analysis reveals 11 factors that account for 66.05% of variance (Appendix 3). Four of these components encompass items common to the A version: a) (SELF_EFFIC) (F1); b) INTENT_ACT (F2); c) PARENT-SCHOOL (F4); d) PARTICIP_CULT (F5). The seven other factors essentially have to do with "relative" interest (degree of ease and order of importance and preference of S&T and subjects). We numbered them consistent with those of the K-Z questionnaire, i.e., F12 to F18, in order to make them easier to identify:

- *The ease of S&T disciplinary fields*: EASE_ST (F12)
- *Utility of S&T in society*: UTIL_ST_SOC (F13)
- *School subjects with higher status than S&T*: STAT_SUBJ (F14)
- *Relationships to various school subjects (ease and preference)*, respectively F15 to F18: relationship to social sciences (REL_SS), mathematics (REL_M), English (REL_ENG) and physical education (REL_PHYSED).

"Specific" interest in S&T at school (Objective 1)

The following abbreviations will be used to indicate the presence or absence of an association as well as its strength (magnitude) in reference to Cramer *V* values and Goodman–Kruskal gamma (γ) values, in accordance with the nature of the variables examined (Fox, 1999; Stafford & Bodson, 2007; Imbeau, 2004): (n.s) designating a non-significant association; (+) a weak association ($V < .2$); (++) a medium association (approximately between .2 and .4); and (+++) a strong association (.4 and above). As for γ, we take into account the fact that its value slightly overestimates strength of association (Fox, 1999) by using the following intervals: less than .25 (+); between .25 and .45 (++); and .45 and above (+++). The strength of the relationship (magnitude) can be illustrated using the two following simplified examples for which associations are statistically significant:

- For the item "I intend to pursue studies in S&T," the observed number of girls who state that they disagree (*strongly*, *moderately* or *slightly*) is only 2.4% higher than the expected theoretical number (according to the null hypothesis stipulating no differences in answers based on gender: H_0); the observed number of girls who agree is only 2.3% lower than the theoretical number calculated by SPSS based on H_0. The situation is the reverse for the boys. Hence, even if the measure of association shows that fewer girls agree with this statement than boys, the association is weak (+), as indicated by the *V* value of .106;

- Among the students who say that they prefer French over S&T (see Figure 1b for the structure of the question), girls are over-represented by 17.29% (gap between the observed number and the theoretical expected number); among the students who say that they prefer S&T over French, girls are under-represented by 8.7%. For this situation, the *V* value (.234) indicates that the association is stronger than the previous one and can be described as medium (++).

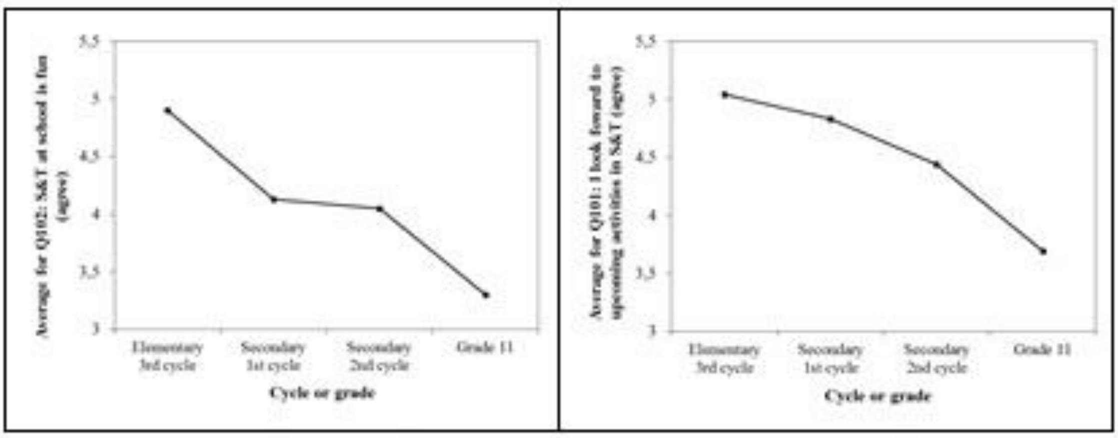
General Interest in School S&T – Table 1 shows that the students globally exhibit positive interest in S&T in terms of most of the items explored, with the exception of Q104. Gender-based differences are minor: when the associations are

Table 1. General interest in S&T according to gender and grade level

Questions	% agree	Association with gender	Association with grade level
Q102. S&T at school is fun	71.7	(+): Proportionally more boys "strongly agree"; the reverse is true for girls (L^2 = 12.948 [5], $p < .05$; $V = .120$, $p < .05$)	(++): The proportion of students who "strongly" agree decreases from primary school to the 5th year of secondary school (Y11); the reverse is true for "strongly" disagree (γ = - .304; $\varepsilon\tau$ = 0.032; $p < .001$)
Q103. S&T at school is boring ("reversed")	32.4	(+): More boys "strongly" disagree; the reverse is true for girls (L^2 = 13.362 [5], $p < .05$; $V = .121$, p < .05)	(++): Same type of association, but reversed compared to the previous one (γ = .257; $\varepsilon\tau$ = 0.034; p < .001)
Q104. We should spend more time doing S&T at school	52.9	(+): Proportionally more boys agree than girls (L^2 = 29.125 [5], $p < 0.001$; V = 0.178, $p < 0.001$)	(++): More primary students "strongly" agree and fewer disagree; this proportion is reversed when moving to Y11 (γ = - 0.376; $\varepsilon\tau$ = 0.031; $p < .001$)
Q105. If I had a choice, I wouldn't go to S&T class anymore ("reversed")	25.3	(+): More boys disagree than girls; the reverse is true for agreement (L^2 = 19.655 [5], $p < .001$; $V = .145$, $p < .002$)	(+): Same type of association (but reversed compared to the previous one (γ = .119; $\varepsilon\tau$ = 0.039; $p < .01$)
Q101. I look forward to upcoming activities in S&T	82.6	(+): More boys agree; the reverse is true for girls (L^2 = 17.920 [5], $p < .005$; $V = .140$, p < .005)	(++): More primary students and cycle One secondary students "strongly" agree; the reverse is true for the 2nd cycle of secondary school (γ = - .326; $\varepsilon\tau$ = 0.035; $p < .001$)

Notes:
1. This number is the sum of slightly, moderately, and strongly agree. The other 28.9% is the sum of slightly, moderately, and strongly disagree.
2. Throughout the article, the expressions "more" and "less" are used to refer to deviation (positive or negative) with respect to the expected theoretical number, as per the H_0 hypothesis.

significant, they are weak and indicate that fewer girls express positive general interest in S&T. The most pronounced differences are between elementary students (more of whom express high interest) and secondary students (fewer of whom express high interest): for most of the items, the number of positive answers drops as grade level rises, as shown by the negative sign in front of γ. The ANOVAs performed on questions Q102 and Q101 (Figures 3a and 3b) enable a graphic illustration of this situation.



F = 27,304, p<0.001 F = 23,028, p<0.001

Figure 3. ANOVA for Q 102; Figure 3b. ANOVA for Q 101

Utility of School S&T – As regards the items relating to the utility of S&T learned in school for the student's life outside school, the percentage of participants in agreement varies by roughly one half to 3/4 (Table 2). There are no differences in answers based on gender. More elementary students say that S&T is useful in life in a general sense (Q109) and that it allows people to better preserve the environment (Q111); secondary school students (especially in the second cycle) mainly see this utility in terms of managing nutrition and sexuality. However, even if the associations are significant, they are weak.

Table 2. The utility of S&T outside school according to gender and grade level

Questions	**% agree**	**Association with gender**	**Association with grade level**
Q109. The S&T I learn in school is useless in my life outside school "reversed")	35.7	n.s	(+): More elementary students disagree, in contrast with secondary school students (γ = .100; ετ = 0.036; *p* < .01)
Q110. The S&T I learn in school helps me to find out about healthier eating	58.3	n.s	(+): More cycle Two of secondary students agree, while the reverse is true for elementary school (γ= .096; ετ = 0.035; *p* < .01)
Q111. The S&T I learn in school allows me to better preserve the environment	70.5	n.s	(+): More elementary students agree; the reverse is true for secondary students (γ= - .150; ετ = 0.035; *p* < .001)
Q112. The S&T I learn in school allows me to better understand and manage my sexuality	44	n.s	(+): More elementary students disagree; the reverse is true for the cycle Two of secondary school (γ = .095; ετ = 0.037; *p* < .05)

Preferences for the Most Common Teaching Methods – Table 3 shows that certain methods are more appreciated by students than others. Students prefer teaching methods in which they are active and collect scientific facts (observation, experimentation, etc.) or debate with others. They show less interest in methods based on explanations and textbooks, and even less in exercises and oral presentations. It is important to note that aside from items Q83, Q84 and Q88 (medium strength of association), associations with gender or grade level are non-significant or weak.

Table 3. Preferences for S&T teaching methods according to gender and grade level

Statements that students were asked to respond to	% agree	Associations according to gender	Associations according to grade level
Q83. In my S&T class, I would like to spend more time doing observations, manipulation and experiments	90.5	n.s	(++): More elementary and cycle One of secondary school students express agreement; the reverse is true for cycle Two of secondary students (γ = - .308; ετ = 0.040; *p* < .001).
Q88. In my S&T class, I would like to spend more time doing projects	79.2	n.s	(++): More elementary and cycle One of secondary school students agree; the reverse is true for cycle Two of secondary students (γ = - .327; ετ = 0.034; *p* < .001).
Q89. In my S&T class, I would like to do more field trips (museums, parks, etc.)	86.4	n.s	(+): More elementary and cycle One of secondary students agree; the reverse is true for cycle Two of secondary school (γ = - .148; ετ = 0.041; *p* < .001).
Q90. In my S&T class, I would like for more guests to come talk to us about S&T and related occupations	80.7	n.s	n.s
Q91. In my S&T class, I would like to watch more documentaries	75.8	(+): More boys agree, while the reverse is true for girls (L^2 = 24.911[5], $p < .001$; $V = .165$, $p < .001$)	(+) : More elementary students disagree, while the reverse is true for cycle Two of secondary school (γ = .159; ετ = 0.036; *p* < .001)
Q85. I would like to spend more time talking with the teacher and other students to learn S&T	67.2	(+): More girls disagree compared to boys (L^2 = 11.562 [5], $p < .05$; $V = .112$, $p < .005$)	n.s
Q82. In my S&T class, I would like to spend more time listening to the teacher give explanations at the front of the class	46.0	(+): Fewer girls "strongly" agree, while the reverse is true for boys (L^2 = 11.156 [5], $p < .05$; $V = .112$, $p < .05$)	n.s
Q86. In my S&T class, I would like to spend more time using textbooks or websites	44.0	n.s	(+): More elementary students agree, contrary to secondary students (γ = -.212; ετ = 0.034; *p* < .001)
Q84. In my S&T class, I would like to spend more time doing oral presentations	27.8	n.s	(++): The proportion of students who agree is higher in elementary school and decreases when moving to the Y11 (γ= - .323; ετ = 0.036; *p* < .001)
Q87. In my S&T class, I would like to spend more time doing exercises in handouts or workbooks	24.5	(+): More girls agree, while the reverse is true for boys (L^2 = 13.770 [5], $p < .05$; $V = .121$, $p < .05$)	n.s
Q93. In my S&T class, I would like to spend more time doing mathematical calculations	29.6	(+): More girls disagree and less agree; the reverse is true for boys (L^2 = 14.590 [5], $p < .05$; $V = .126$, $p < .05$)	n.s

Intention to Act: Pursuing S&T Studies and Careers – Table 4 shows that the intention to pursue S&T studies or a career in this field, or to learn more about such careers applies only to roughly half of the students; associations with gender and grade level are weak or inexistent.

Table 4. Intention to pursue S&T studies or careers

Questions	% agree	Association with gender	Association with grade level
Q130. I intend to learn more about S&T careers	56.7	(+): Slightly more girls "strongly" disagree; only slightly more boys "strongly agree" (L^2 = 23.652 [5], p < .001; V = .116, p < .001)	(+): More elementary students agree, in contrast with cycle One of secondary and Y11 (γ = - 0.102; ετ = 0.025; p<0.001)
Q134. I intend to do studies in S&T	49.9	(+): Same type of association as the previous one (L^2 = 18.871 [5], p < .01; V = 0.106, p < .05)	n.s
Q136. I intend to pursue a carreer related to S&T later on	41.7	(+): Same type of association (L^2 = 12.831 [5], p < .05; V = .086, p < .05)	(+): Same type of association as Q130 (γ = - .051; ετ = 0.026; p < .05)

The Order of preference and order of importance of school S&T with respect to other subjects ("Relative Value") (Objective 2)

In six questions, we asked the students to give their opinions on S&T compared to the other main school subjects that make up the curriculum (Q44 to Q49); in six other questions, we asked them to give us their perception of the importance of school S&T with respect to these subjects (Q38 to Q43). Table 5 summarizes the results obtained.

Table 5. The order of preference and order of importance of S&T with respect to other subjects

Subject x, compared to S&T	Preference		Subject x, compared to S&T	Importance	
	At school, I prefer S&T over ... (subject x)	At school, I prefer... (subject x) over S&T		At school, S&T is more important than ... (subject x)	At school, ... (subject x) is more important than S&T
French (first language)	61.4%	38.6%	Arts	81.7%	18.3%
Social Sciences	59.4%	41.6%	Physical Education	67.8%	32.2%
English (second language)	55.8%	44.2%	Social Sciences	64.3%	35.7%
Mathematics	49.1	50.9	English	34.1%	65.9%
Arts	41.0%	59.0%	French	25.8%	74.2%
Physical Education	39.1%	60.6%	Mathematics	19.2%	80.8%

The results reported in this table show a discrepancy between student preferences and the perceived order of importance of various school subjects:

- S&T are slightly preferred over French (first language), Social Sciences and English (second language); the reverse is true for arts and physical education. The students are divided in terms of preference between S&T or mathematics.

- The subjects that students consider more important than S&T are mathematics (80.8%), followed by languages (French and English). S&T appears to be more important than social sciences, physical education and arts.

In terms of the results about students' preferences that were expressed, weak associations can be observed according to grade level (Table 5). However, differences in answers can be noted depending on gender: proportionally more girls express a preference for subjects other than S&T, with a medium strength of association for French (L^2 = 47.848 [5], $p < .001$; V = .234, $p < .001$) and arts (L^2 = 76.162 [5], $p < .001$; V = 0.296, $p < .001$), and a weak strength of association for English (L^2 = 22.677 [5], $p < .001$; V = 1.61, $p < .001$). Proportionally more boys prefer physical education over S&T (L^2 = 21.068 [5], $p < .01$; V = .157, $p < .01$).

As for the relative importance of S&T with respect to the other subjects, the difference according to gender is weak: proportionally fewer girls favour arts (L^2 = 23.674 [5], $p < .001$; V = 1.64, $p < .001$), French (L^2 = 17.117 [5], $p < .01$; V = .141, $p < .01$) and English (L^2 = 14.647 [5], $p < .05$; V = .131, $p < .05$); more boys favour physical education (L^2 = 11.495 [5], $p < .05$; V = .116, $p < .05$).

Weak or medium associations can also be observed according to grade level (Table 6). These associations are weak except for mathematics and physical education, which appear to be more important to elementary students.

Table 6. Order of preference and importance of S&T according to grade level

Subject	Relative preference of S&T	Relative importance of S&T
English	(+): More elementary students prefer S&T over English; the reverse can be observed for cycle One of secondary school (γ = - .092; $\varepsilon\tau$ = 0.035; $p < .01$)	(+): More elementary and cycle One of secondary students say that English is more important than S&T; the reverse is true for the cycle Two of secondary school (γ = .170; $\varepsilon\tau$ = 0.036; $p < .001$)
Arts	(+): Fewer elementary students prefer arts over S&T; the reverse is true for cycle One of secondary school (γ = -.130; $\varepsilon\tau$ = 0.036; $p < .001$)	(+): More 1st cycle secondary students say that this subject is more important, while the reverse is true for the 2nd cycle of secondary school (γ = .145; $\varepsilon\tau$ = 0.037; $p < .001$)
French	n.s	(+): The difference is mainly between elementary and 1st cycle secondary students (more of the latter consider French to be more important) and 2nd cycle secondary students (more of whom consider S&T to be more important) (γ = .239; $\varepsilon\tau$ = 0.035; $p < .001$)
Mathematics	(+): While more elementary students say they prefer mathematics, the reverse is true for secondary school, especially 2nd cycle (γ = .163; $\varepsilon\tau$ = 0.036; $p < .001$)	(++): More elementary and 1st cycle secondary students consider mathematics to be more important than S&T; the reverse is true for the 2nd cycle of secondary school (including Y11) (γ = .329; $\varepsilon\tau$ = 0.033; $p < .001$)
Social Sciences	(+): More elementary students prefer S&T over social sciences, contrary to the first cycle of secondary school (γ = -.142; $\varepsilon\tau$ = 0.034; $p < .001$)	(+): More elementary and 1st cycle secondary students consider social sciences to be more important than S&T, contrary to 2nd cycle secondary students (γ = - .173; $\varepsilon\tau$ = 0.036; $p < .001$)
Physical Education	n.s	(++): The main difference is between elementary students (more of whom consider physical education more important than S&T) and 2nd cycle secondary students (more of whom answer the reverse) (γ = .284; $\varepsilon\tau$ = 0.034; $p < .001$)

Relationship between general interest in S&T and the other factors (components) examined in the study (Objective 3)

To reveal the relationship between *General interest in S&T* and other school-related components of interest (especially teaching methods) as well as components involving family context and students' self-efficacy, we used correlation and linear regression taking into account the factors presented in Appendix 2.

Table 7 shows a positive correlation between the factor of *General interest in S&T at school* and other factors. This correlation is moderate to strong (approximately .4 or above) with the following factors: *Self-efficacy in S&T and at School* (F1); *Intention to act* (F2); and *Frequency of family participation in S&T cultural practices* (F5).

The correlation is moderate to weak (between .2 and .4) with the following factors, listed in decreasing order: *Degree of student involvement in developing the inquiry process* (F6); *Desire to spend more time exposed to teaching methods based on open investigation* (F10); *Desire to spend more time exposed to traditional teaching methods* (F7); *Utility of school S&T* (F9); and *Desire to be exposed to more teaching methods that involve external resources* (F8).

The correlation is absent to weak with two factors: *Frequency of parents' following up on what students are doing in school and in school subjects* (F4); and *Degree of student participation in hands-on activities* (F11).

Table 7. Correlation between the component of general interest in S&T and the other components

	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11
F3	**0.470****	**0.493****	1,00	0.193**	**0.405****	0.375**	.309**	0.204**	0.306**	0.310**	0.164**

***. The correlation is significant at the 0.01 level (bilateral) *. The correlation is significant at the 0.05 level*

Linear regression method was used to explore potential predictors of *General interest in S&T* (GEN_INTER) among the other factors reported in Appendix 2.

Table 8 shows that six factors are very good predictors, since they account for 40.3% of variance in *General interest* (GEN_INTER). The most substantial predictor is *Self-efficacy in S&T* (SELF_EFFIC). It is followed, respectively, by the following factors: *Desire to spend more time exposed to teaching practices based on open investigation* (PREF_INVEST); *Desire to spend more time exposed to traditional teaching practices* (PREF_TRAD); *Degree of student involvement in developing the inquiry process* (PARTICIP_INVEST); *Frequency of family participation in S&T cultural practices* (PARTICIP_CULT) and *Utility of S&T learned in school for the student's life outside school* (UTIL_ST_PERS).

Table 8. Linear regression model: predictors of general interest in S&T

Factors introduced into the model (M)	**Unstandardized coefficients**		**R^2 (cumulative)**	**Standardized coefficients**		
	A	**SE (A)**		Beta	***t***	**Sig. (*p*)**
(Constant)	-5865	1.308			-4,483	.000
M1: (SELF_EFFIC)	.385	.37	.227	.332	10,530	.000
M3: PREF_INVEST	.589	.093	.296	.188	6,338	.000
M4: PREF_TRAD	.264	.050	.345	.159	5,316	.000
M2: PARTICIP_INVEST	.247	.059	.373	.132	4,194	.000
M5: PARTICIP_CULT	.192	.044	.392	.142	4,364	.000
M6:UTIL_ST_PERS	.205	.055	.403	.114	3,711	.000

Three factors were left out of the SPSS regression model, given that their contribution as predictors is non-significant: *Frequency of parents' following up on what students are doing in school and in school subjects* (PARENTS-SCHOOL); *Desire to be exposed to more teaching practices involving external resources* (PREF_EXT); and *Degree of student participation in hands-on activities* (PARTICIP_HANDS).

DISCUSSION

The results presented in this article address three main objectives: to describe the "specific" interest of Quebec elementary and secondary students in S&T; to situate interest in S&T with respect to other school subjects, with a focus on order of importance and order of preference ("relative" interest); and to search, among the factors chosen for this study, for main predictors of *General interest in S&T*.

To conduct our study, we developed and validated a questionnaire adapted to the research objectives while simultaneously incorporating several components. Statistical validation confirmed the coherence of item grouping within each chosen component. Data collection and analysis enabled subsequent adjustments to questionnaire components that were initially developed on a theoretical basis. This is the case for component C4 (preferred teaching methods) within which validation enabled a distinction between three sub-components (factors): traditional methods (PREF_TRAD), methods involving external resources (PREF_EXT) and methods based on open investigation (PREF_INVEST). It would in fact be worthwhile to consolidate this last factor with the addition and validation of other items, since it is represented by only two. The same is true for the PARTICIP_HANDS factor (degree of student participation in hands-on activities). The tool proposed in this study, in spite of the limitations we have just noted, appears in our view to make a contribution to the field of interest studies, since most questionnaires used in past research were based on a limited number of items and components, as Lamb et al. (2012) have pointed out.

Using the questionnaire with 1,882 students across seven elementary and secondary school grade levels reveals certain important constants relating to each of the three research objectives.

Observations in connection with Objective 1. When it comes to this objective, the study indicates that students globally show positive general interest in S&T (items Q101, Q102, Q103 and Q105 in Table 1). It is true that this result was obtained from subsample *A* only (these items were absent in version *B* of the questionnaire). However, considering that the students in each class were randomly assigned to two equivalent subsamples, it is possible to hypothesize that the result would be the same for the entire sample. In this regard, our results in Quebec echo those of studies performed in other cultural contexts (Ainley & Ainley, 2011; OECD, 2006). These positive results for general interest do not, however, lead all students to make links between what they learn in school S&T and life outside the school, to desire to spend more time doing S&T at school, or to intend to pursue studies or careers in this field:

1) While roughly 3/4 of the participants (students) think that what they learn in S&T can assist them in preserving the environment, only approximately one half say the same regarding health and sexuality (Table 2). In our view, this positive result for the environment should be associated with the broad movement of environmental education (or sustainable development) currently under way in Quebec's schools, as in many OECD countries, where it is much more visible than health or sexuality education. In other words, when links between S&T and life outside the school are explicitly incorporated into the curriculum, they appear to be more thoroughly addressed in classroom teaching and therefore possibly better perceived by students.

2) Only roughly half of the participants are in favour of the idea of investing more time in S&T at school (Q104 in Table 1) or intend to pursue studies in S&T later on, exercise related careers, or learn more about such careers (Table 6). Our results show that the PISA survey (OECD, 2006) results with 15 year-old students appear to extend to the other elementary and secondary grade levels. It should be kept in mind that in the PISA survey, a very high proportion of the students exhibit strong interest in S&T: almost all of them consider this field important to understand the natural world (93% of students) and think that advances in S&T contribute to the improvement of living conditions (92%). Even so, only roughly half of the participants consider this knowledge relevant to them; even fewer state that they would like to pursue careers in S&T.

This link between general interest and the intention to act, even if it exists, is not direct. It is important to take other factors into consideration in this relationship, including student interest in other school subjects ("relative" interest). Firstly, as shown for example by Jovanic & King (1998), interest in S&T depends on students' perception of the other school subjects: these results suggest that the main factor explaining the lower interest of girls in S&T is that they perceive that they perform better in other school subjects. Secondly, even if students display high interest in S&T, if this interest is even stronger for the other subjects (such as arts, sports or languages), it is not unreasonable to think that the choice of studies or career to undertake in the future does not simply have to do with the interest shown in S&T, but also involves a tension between this interest and interest in the other subjects that make up the curriculum. It is these concerns, which were presented in the introduction section, that led us to consider Objective 2 in our study.

When specifically considering student preferences for certain teaching methods (Table 3), we can see that most students express a desire to attend to more teaching methods in which they are active, i.e., methods based on collecting scientific data (observation, experimentation, etc.) or debates with others. They show less preference for methods centred on explanations and the use of textbooks, and even less in exercises and oral presentations (methods that could be described as traditional and transmission-oriented).

What differences can be found between boys and girls and between different grade levels? The results presented in this study show that, with the exception of a very small number of items (e.g., girls' marked preference for arts and French over S&T) or the usual preferences for specific subjects (e.g., biology for girls and physics and chemistry for boys), gender-based differences are non-significant or weak (in favour of boys, in this case). This observation holds true for all factors considered in this study: general interest in S&T; preferred teaching methods; utility of school S&T; and intention to act. These results, partially consistent with those obtained in other research (Krstovic, Brown, Chacko, & Trinh, 2008; Wang & Berlin, 2010; Zeyer, 2010), contrast with other studies maintaining that girls show lower interest than boys (Bennet, Green, & White, 2001; Chang, Yeung, & Cheng, 2009; Desy, Peterson, & Brockman, 2011) or showing differences with boys in terms of preferred teaching methods (Juuti et al., 2010). Two hypotheses can be formulated to explain this observation:

a) A methodological hypothesis: in many cited studies that maintain the existence of differences between boys and girls, the conclusions are essentially based on disqualification of null hypotheses or on comparing averages; in contrast, we have introduced additional information, namely the strength (magnitude) of the difference observed, in addition to the H_0 rejection test. These choices reveal that most of the significant associations are weak.

b) A sociological hypothesis: the difference between boys and girls depends on social contexts. In the case of Quebec, for example, many studies undertaken in the 1990s maintain that girls are increasingly doing better in school than boys, and that the school is now better adapted to girls (Conseil supérieur de l'éducation, 1999; Institut de statistique du Québec, 2014). This situation may lead to bridging the gap in S&T interest between boys and girls. This hypothesis, in our view, would require further investigation, both in and out of Quebec.

Although the differences observed between boys and girls in our study are generally non-significant or weak, those concerning grade level are more pronounced. For many of the items pertaining to general interest and to the other factors considered in our study, a progressive drop can generally be observed in the proportion of participants in favour of S&T when moving from elementary school up to the end of secondary school. Our hypothesis is that this progressive decline is not associated only with age, but also with the curriculum and with teaching methods. For example, in elementary school students are often led to explore their surrounding objects and phenomena without the constraint of national testing; the scarcity of scientific activities in class is also likely to enhance the desirability of the subject for students. It is important to keep in mind that in elementary schools in Quebec, no official block of time is devoted to S&T, even if there is an official program associated with this subject. In many cases, S&T is seen by the students as a reward for instances when more fundamental subjects (language and mathematics) "go well". In secondary school, teaching methods are often focused on memorization and adapted to constraints exerted by demanding programs; evaluation (with mandatory ministry criteria) plays a greater role in the regulation of educational practice. This approach to S&T appears to be more pronounced in the 2nd cycle than in the 1st cycle of secondary school. Our hypothesis is also supported by other data. In a systematic analysis of 228 studies published between 2000 and 2012 (Potvin & Hasni, 2014), the results generally appear to confirm certain teaching methods' positive impact on the various components of interest (or attitude or motivation): anchoring teaching in extracurricular activities (summer camps, museums, etc.); methods centred on investigation (inquiry, problem-based learning, etc.); collaborative work; the contextualization of learning (links with life outside the school); use of ICT; etc.

Among our research contributions associated with Objective 1, we first wish to point out the development and validation of a questionnaire that considered a high number of dimensions. Our study took into account together in the same survey 18 components which were considered separately in previous research. This approach opens the way to investigating the relationships between general interest in S&T and many other components at the same time (Objective 3). Ours is also one of the few studies that take into account seven (7) grade levels simultaneously[1] and that consequently enables comparison of the evolution of interest according to grade level over a long period (see Objective 2). In addition, our findings shed light on the issue of interest in a cultural and educational context that was not considered by earlier studies (Potvin & Hasni, 2014), namely that of Quebec. These results show a clear convergence with previous research for some components (for example, the level of student's general interest in S&T, the evolution of interest according to grade level, etc.). They also show differences with respect to other components. For example, unlike the majority of studies conducted in other contexts, it seems that boys and girls in Quebec show only minor differences in relation to the studied components. Comparative qualitative studies could provide clearer insight on the origin of these convergences and differences (whether school related or other). Finally, Objective 1 allowed us to innovate on a methodological level, namely the production and the validation (with the participation of students and using statistics) of a questionnaire made up of 139 questions grouped into 18 dimensions while integrating new items that were not present in the questionnaires of previous studies. This is the case, for instance, of the 18 items about the "relative status" of S&T.

Observations in connection with Objective 2: two important observations emerge from the preceding analyses:

1) S&T seems to occupy an intermediate status among the school subjects that make up the curriculum. Thus, students prefer S&T over three subjects and seem to prefer it to three other subjects; they likewise consider S&T more important than three of these subjects and less important than three others.

2) Student preferences appear to be focused on subjects that may appear to them as low on conceptual content or closely tied in with their daily lives (sports and arts). Justifications given by the students in response to open-ended questions (data currently under analysis) appear to bear out this hypothesis: in reference to arts, students widely give justifications along the lines that "I like to do plays," "I like to make drawings," "I like to do arts and crafts," etc.; for physical education, answers include such responses as "I like to move," "I do sports," etc. However, the functions that students assign to each subject of the curriculum would benefit from in-depth study in order to shed light on "relative" interest in S&T.

The order of importance of S&T with respect to the other school subjects appears to be determined by the social value given to these subjects in the curriculum. Languages and mathematics often hold special status and are designated as "fundamental" subjects (compared to "secondary" subjects) (Hasni, Lenoir, Larose, & Squalli, 2012; Lenoir & Hasni, 2010). Regarding this hierarchy, a number of prior studies have importantly shown that elementary teachers and first cycle secondary S&T teachers (Hasni et al., 2012; Lenoir & Hasni, 2010) give this subject (S&T) a similar ranking of importance than students in this study. For example, S&T teachers who participated in one of these recent studies ranked S&T fourth in importance after French (first position), mathematics and English. They justified this choice by answering that these school subjects are, among other things, useful to life outside of school (enabling the learning of the other subjects); they provide fundamental learning (being able to read, write and count); they are allocated more time in the schedule (a sign of the importance assigned to them by the ministry), etc. (Hasni et al., 2012). These results, which have to do with the social value given to these subjects, should be seriously taken into account when attempting to explain the gap observed between the percentage of students showing favourable general interest in S&T and the percentage of students expressing their interest in doing more S&T activities or in pursuing S&T studies and careers. The sociology of the curriculum developed in the 1970s in Great Britain (Bernstein, 1971; 1997; Young, 1971, 1997) may offer a promising framework by which to examine this question. For these authors, the high degree of specialization (lack of links with life), segmentation (compartmentalization) and hierarchy of the curriculum have a negative impact on the place given to certain subjects in students' education.

The results associated with Objective 2 go beyond an exploration of the hierarchy of disciplines (their order of importance as perceived by students) – an issue that has already been discussed in the field of the sociology of knowledge – or an exploration of the order of preference of the disciplines (Colley, Comber, & Hargreaves, 1994; Colley & Comber, 2003). The contribution of our research (related to Objective 2) lies both in the methodology and in the results. Regarding the methodology, we can highlight the consideration of three dimensions in order to study relative status (ease, preference, and importance), and the structure of the selected items (18) used to explore these dimensions (see Figure 1b). These items allow a comparison of S&T with each subject that makes up the curriculum, rather than describing the statut of each subject independently. Regarding results, our article provides nuances to the general observation that arises from many earlier studies, namely that interest in S&T decreases in step with grade level (i.e., interest decreases as students advance to higher grades). Among other things, the findings presented in Table 6 suggest an evolution of the relative status of school subjects that is generally in favor of S&T. In other words, although interest in S&T declines with age, most other subjects seem to experience a decline in the order of preference and importance in comparison to S&T (as age increases, this school subject is generally perceived to be more preferred and more important). These results, which deserve to be supported by more in-depth studies, suggest that the decline of interest in S&T with age is a consequence of a decline of interest in all the subjects that make up the curriculum (and thus in school in general). Findings from the present article also pave the way for further studies that would make it possible, for example, 1) to compare the evolution of the relative status of S&T in various countries, 2) to explore the reasons behind the relative status that students assign to S&T, and, 3) to investigate the possible relationship between relative status and the pursuit of S&T-related studies or careers.

Observations in connection with Objective 3: As prior studies have shown, students' self-efficacy in S&T is a strong predictor of general interest. This observation is not surprising. Like other authors (Ainley & Ainley, 2011), we might hypothesize that student engagement in S&T instruction that increases their understanding and self-efficacy makes it enjoyable for them to get involved in this subject and makes them want to learn more. In other words, at least part of this self-efficacy should be associated with the teaching methods used in the classroom. In fact, three of the four factors associated with these methods are among the predictors of General interest in S&T. Two of these factors encompass the teaching methods preferred by students: preference for open investigation methods (PREF_INVEST) and for "traditional methods" (PREF_TRAD). In terms of preference, no incompatibility can therefore be found between the two categories of teaching methods. To put it otherwise, we can assume that whether traditional or involving open investigation, these methods could positively affect general interest in S&T as long as students are led to "like" them. However, considering that the proportion of students who prefer open investigation methods is by far the greatest (Table 3), school would presumably benefit from emphasizing such methods.

The other factor does not have to do with preferences but rather the degree of students' involvement in certain aspects of inquiry processes in class. These are essentially tasks associated with the development (planning) of inquiry processes (PARTICIP_INQ). It is important to observe, in this regard, that involvement in tasks associated with hands-on, such as manipulations or experimentations followed by results analysis, does not appear to be a predictor of general interest. In other words, the interpretation of these results could lead us to assume that formulating scientific problems and planning inquiry processes appear to have a stronger impact on interest than the tasks associated with their execution. These results are consistent with those of prior studies (Ornstein, 2006; Silver & Rushton, 2008) indicating, for example, that hands-on work has little or no effect on attitude, contrary to inquiry processes.

If some teaching methods are better predictors of general interest in S&T than others, the same is true when it comes to the role of the family. In our study, family participation in cultural activities relating to S&T (PARTICIP_CULT) is a positive predictor of students' general interest in this subject; the fact that parents ask students what they are doing at school in their school subjects in general (PARENT-SCHOOL) does not constitue a predictor. On the basis of these results, it could be hypothesized that the family activities that appear to have the strongest effect on interest are those directly bearing on S&T.

Finally, as regards teaching approaches, and consistent with the results of other studies (Graeber & Lindner, 2008; Walczak & Walczak, 2009), the fact that students see the usefulness of what they are learning in S&T outside the school has a positive effect on their general interest in this subject. The contextualization of S&T in school therefore appears as a promising avenue.

Moreover, it is worth reiterating that, in contrast with earlier studies whitch explored the effects of some factors on interest while considering them individually, our study took into account several factors simultaneously.

CONCLUSION

In the study presented in this article, we developed and validated a questionnaire that simultaneously takes into account multiple components associated with interest in school S&T. The questionnaire was administered to 1,882 students in seven grades from elementary to secondary school in Quebec. The results show, among other things, the importance certain teaching methods can have in the development of interest. These methods are essentially the ones that allow students to make links between what they learn in school and their lives outside school, as well as methods centred on students' development of inquiry processes (formulating problems in S&T or suggesting protocols for observation, experimentation or the choice of materials to use). Methods that prioritize hands-on activities appear to have little effect on interest. As regards the family context, the involvement in S&T-related cultural activities appears to positively affect interest. Since self-efficacy emerges as a strong predictor of interest, we suggest that the cited teaching methods and parents' involvement with students in S&T-related cultural activities strongly contribute to developing this self-efficacy. These are important avenues for school interventions.

In order to investigate this question more thoroughly and to provide schools with better avenues for intervention, it would be useful, from a research standpoint, to focus on describing the relationship between certain ways of approaching these processes in class and variations in interest, particularly using the analytical framework suggested by the notion of situational interest (Ainley et al., 2002; Hidi & Renninger, 2006).

Our study has also provided an opportunity to raise certain questions for which answers may be found in the future. These notably have to do with differences in interest level based on gender (in various social contexts) and the relationship between "specific" interest in S&T and "relative" interest (the impact that interest in other subjects might have on interest in S&T).

Note:

1. Our review of 228 articles (Potvin& Hasni, 2014) shows that most of the analyzed studies considered a limited number of grade levels. Only a few studies covered more than three levels: that of Pell & Jarvis (2001) involved primary students from Y2 to Y6 (students 6 to 11 years old), while the studies of George (2006), Reid & Skryabina (2002), and Owen, Dickson, Stanisstreet, & Boyes (2008) involved students from four grade levels at the secondary school level. A small number of other studies covered three to five grade levels by simultaneously considering the last two years of primary school and the first two or three years of secondary school, namely Kirikkaya (2011), Sorge (2007), and Vedder-Weiss & Fortus (2011). To our knowledge, our study is the only one to compare student interest while simultaneously taking into account seven grade levels, from the end of primary to the end of secondary school.

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APPENDIX

Appendix 1. Examples of Items Associated With Components (C) of the Questionnaire

INTEREST IN SCHOOL S&T

GENERAL INTEREST IN S&T AND IN SPECIFIC SCHOOL SUBJECTS

C1. General interest in school S&T (5 questions). Cronbach's alpha (α) = 0.90
Q101. I look forward to upcoming activities in S&T (a)
Q102. School S&T is fun (a)
Q 104. We should spend more time doing S&T at school (a)

C2. Utility of school S&T for everyday life (4 questions). α = 0.66
Q 109. The S&T I learn at school is useful in my life (outside school) (v)
Q 111. The S&T I learn in school helps me to better preserve the environment (v)

C3. Teaching methods' engagement - Inquiry process (7 questions). α = 0.70
Q 95. In S&T, when we need to do experiments or construct/manufacture technical objects, I participate in choosing the problem to solve (c)
Q96. In S&T, when we need to do experiments or construct/manufacture technical objects, I participate in choosing the steps to follow (c)

C4. Teaching methods' preferences: The desire to spend more time exposed to certain teaching methods in S&T class (8 questions). α = 0.78
Q 82. In my S&T class, I would like to spend more time listening to the teacher give explanations at the front of the class (a)
Q 83. In my S&T class, I would like to spend more time doing observations, manipulations and experiments (a)
Q 86. In my S&T class, I would like to spend more time consulting textbooks or websites (a)

C5. PREDISPOSITION AND INTENTION TO ACT (6 questions). α = 0.91
Q134. I intend to pursue studies in S&T
Q136. I intend to pursue a S&T related career later on
Q130. I intend to learn more about S&T careers

INTEREST IN S&T WITH RESPECT TO OTHER SCHOOL SUBJECTS (12 questions). α = 0.82
C6. Order of preference for S&T with respect to other school subjects (6 questions)
Q 45. At school, I prefer English over S&T / I prefer S&T over English (v)

C7. Perceived order of importance of S&T in school with respect to other school subjects (6 questions)

Q 42. In school, mathematics is more important than S&T / S&T is more important than mathematics (v)

S&T IN FAMILY CULTURAL ACTIVITIES

C8. Frequency of parents' following up on what students are doing in school (5 questions). α = 0.88

Q 6. My parents talk to me about what I'm doing in school

Q 9. My parents talk to me about what I'm learning in science and technology

C9. Frequency of family participation in S&T cultural practices (5 questions). α = 0.74

Q 11. In my family, we like TV programs that talk about S&T

SELF-EFFICACY

C10. Self-efficacy in S&T (and in school) (8 items). α = 0.81

Q 19. Compared to all the other students, I consider myself… (good) at S&T

Q 22. When I can't understand something in S&T, I always find a way to figure it out

VIEW OF S&T IN SOCIETY

C11. Utility of S&T for society (4 questions). α = 0.68

Q 24. For human beings, S&T leads to… (more problems than advantages / more advantages than problems)

Appendix 2. Component Matrix, With Varimax Rotation (A version of the questionnaire)

	Components										
	1	2	3	4	5	6	7	8	9	10	11
F1. Self-efficacy in S&T (and in school): (SELF_EFFIC)											
Q20. In terms of the ratings I get in S&T, I am… (satisfied)	**.834**	.046	.164	.097	.120	.018	.064	-.023	.008	.064	.014
Q19. Compared to all the other students, I consider myself (good) at S&T	**.822**	.193	.139	.042	.166	.013	.025	.063	.059	.025	.061
Q18. Compared to my friends, I consider myself… (good) at school	**.776**	.108	-.072	.098	.092	.015	-.007	.060	.013	.028	.023
Q21. Compared to my friends, I understand S&T… (easily)	**.763**	.187	.260	.045	.125	.102	.004	.035	.007	.015	.064
Q106. I am discouraged by the ratings I get in S&T (reversed)	**.712**	.050	.268	.002	.034	.009	-.083	-.093	.049	.008	.026
Q22. When I can't understand something in S&T, I always find a way to understand…	**.604**	.125	.269	.116	.120	.185	.115	.071	.135	-.074	.064
F2. Intention to act (pursuing S&T studies or careers): INTENT_ACT											
Q134. I intend to pursue studies in S&T later on	.148	**.866**	.144	.049	.152	.020	.080	.008	.126	-.035	.058
Q137. There is no question that I will pursue a career in S&T later on (inversed)	.091	**.865**	.148	.041	.096	.056	.069	.034	.046	.047	.059
Q136. I intend to have an occupation in S&T later on	.179	**.861**	.092	.063	.121	.032	.086	.050	.113	-.001	.052
Q135. There is no question that I will pursue studies in S&T (inversed)	.117	**.829**	.188	.061	.085	.084	.033	.027	.048	.041	.036
Q130. I intend to learn more about S&T careers	.148	**.694**	.381	.038	.145	.082	.130	.078	.102	-.005	-.009
F3. General interest in school S&T: GEN_INTER											
Q102. School S&T is fun	.236	.191	**.820**	.072	.112	.123	.153	.016	.123	.092	.063
Q103. School S&T is boring (inversed)	.206	.181	**.816**	.067	.124	.096	.072	.003	.106	.039	.077
Q105. If I had a choice, wouldn't go to S&T course anymore (inversed)	.215	.259	**.733**	.077	.047	.052	-.010	.029	.057	-.038	.032
Q101. I look forward to upcoming activities in S&T	.155	.160	**.706**	.001	.109	.158	.057	.147	.100	.297	.075
Q104. We should spend more time doing S&T in school	.180	.150	**.704**	.049	.207	.162	.165	.093	.035	.157	-.061
F4. Frequency of parents' following up on what students are doing in school: PARENT_SCHOOL											
Q8. My parents talk to me about what I'm learning in French	.014	.009	.066	**.833**	.072	.053	.094	-.029	-.009	.136	-.068
Q7. My parents talk to me about what I'm learning in mathematics	.031	.058	.025	**.830**	.134	.036	.062	.009	.096	.041	-.020
Q9. My parents talk to me about what I'm learning in S&T	.093	.158	.136	**.783**	.217	.014	.023	.060	.091	-.078	.062
Q10. My parents talk to me about what I'm learning in social sciences	.117	.009	.030	**.764**	.167	.032	.027	.040	.055	-.055	-.010

Q6. My parents talk to me about what I'm doing in school	.075	.006	-.023	**.752**	.133	-.009	-.025	.003	.013	.121	.117
F5. Frequency of family participation in S&T cultural practices: CULT_PARTICIP											
Q12. In my family, we like newspapers and magazines that talk about S&T	.095	.205	.132	.233	**.679**	.081	.118	.134	.024	-.063	-.014
Q14. In my family, I'm encouraged to participate in science-related recreational activities (*Débrouillards* or other science clubs, etc.)	.102	.127	.078	.182	**.663**	.142	.186	.014	.006	.123	-.099
Q13. In my family, we visit museums or exhibits related to S&T	.187	.077	.109	.258	**.642**	-.006	-.006	.112	.024	-.037	.054
Q15. My parents let me do scientific experiments at home	.093	.057	.079	.045	**.614**	.064	-.111	-.057	.114	.159	.175
Q11. In my family, we like TV programs that talk about S&T	.220	.183	.158	.240	**.581**	.027	.012	.191	.056	-.039	.048
F6. Degree of student involvement in developing the inquiry process: PARTICIP_INQ											
Q96. In S&T, when we have to do experiments or construct/manufacture technical objects, I participate in choosing the steps to follow	.060	.067	.085	.053	.071	**.874**	.056	.052	.065	.082	.024
Q97. In S&T, when we have to do experiments or construct/manufacture technical objects, I participate in choosing the materials to use	.056	.047	.152	.020	.072	**.848**	.089	.026	.101	.023	.017
Q95. In S&T, when we have to do experiments or construct/manufacture technical objects, I participate in choosing the problem to solve	.094	.093	.169	.037	.089	**.795**	.075	.056	.167	.062	.073
F7. Desire to spend more time exposed to traditional teaching methods: PREF_TRAD											
Q87. In my S&T class, I would like to spend more time doing exercises in handouts or workbooks	-.039	.032	.024	.055	-.011	.077	**.780**	-.029	.042	-.072	.081
Q93. In my S&T class, I would like to spend more time doing mathematical calculations	.194	.159	-.022	-.006	.086	.113	**.664**	.002	.069	.125	.028
Q86. In my S&T class, I would like to spend more time consulting textbooks or websites	-.010	.089	.110	.052	.094	.075	**.644**	.183	-.027	.160	-.086
Q82. In my S&T class, I would like to spend more time listening to the teacher give explanations at the front of the class	-.062	.033	.223	.058	-.034	-.044	**.578**	.051	.140	-.152	.020
F8. Desire to be exposed to more teaching methods involving external resources: PREF_EXT											
Q90. In my S&T class, I would like for more guests to come talk to us about S&T and related careers	.008	.091	.098	.038	.031	.046	.023	**.801**	.053	.088	-.013
Q91. In my S&T class, I would like to watch more documentaries	.037	-.024	-.017	.019	.027	.033	.156	**.753**	.043	.045	.046
Q89. In my S&T class, I would like to do more field trips (museums, parks, etc.)	.015	.060	.082	.003	.168	.037	-.021	**.737**	-.025	.110	-.033
F9. Utility of school S&T: UTIL_ST_PERS											
Q110. The S&T I learn in school helps me to find out about healthier eating	.008	.116	.101	.035	.101	.118	-.001	.046	**.830**	-.053	.075
Q112. The S&T I learn in school allows me to better understand and manage my sexuality	.052	.080	.045	.077	-.015	.032	.164	.001	**.720**	.044	-.037
Q111. The S&T I learn in school allows me to better preserve the environment	.125	.138	.162	.103	.099	.195	.032	.036	**.716**	.075	.052
F10. Desire to spend more time exposed to teaching practices based on open investigation: PREF_INVEST											
Q83. In my S&T class, I would like to spend more time doing observations, manipulations and experiments	.080	.025	.097	.069	.020	.062	-.054	.126	.051	**.769**	.024
Q88. In my S&T class, I would like to spend more time doing projects.	-.038	-.004	.194	.082	.090	.080	.102	.125	-.001	**.764**	-.111
F11. Degree of student participation in hands-on activities: PARTICIP-HANDS											
Q100. In S&T, when we need to analyze experiment results (or observations)…… (the one who does this is mainly the teacher / mainly me…)	.083	.078	-.039	.047	-.015	.008	.081	.081	.043	-.080	**.821**
Q99. In S&T, when we do experiments or manipulations … (the one who does this is mainly the teacher / mainly me…)	.079	.070	.167	.012	.137	.092	-.032	-.082	.024	.011	**.758**

Appendix 3. Component Matrix, With Varimax Rotation (B version of the questionnaire)

	Components										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
F2. Intention to act (pursuing S&T studies or occupations): INTENT_ACT											
Q137. There is no question that I will pursue a career in S&T later on (reversed)	**.839**	.057	.032	-.050	.080	.036	.006	.038	.036	-.057	-.023
Q135. There is no question that I will pursue studies in S&T (reversed)	**.834**	.140	.021	-.009	.098	.087	.033	.055	.038	-.051	-.062
Q136. I intend to have an occupation in S&T later on	**.826**	.146	-.002	.007	.127	.066	.163	.056	-.036	.032	-.048
Q134. I intend to do studies in S&T	**.821**	.162	.014	.012	.105	.129	.154	.031	-.045	.022	-.018
Q130. I intend to learn more about S&T careers	**.704**	.183	.082	.101	.175	.225	.181	.126	.022	-.097	-.002
Q131. I don't want to learn more about S&T careers	**.669**	.085	.094	.084	.031	.136	.152	.017	.108	-.059	-.003
F1. Self-efficacy in S&T (and in school): (SELF_EFFIC)											
Q19. Compared to all the other students, I consider myself (good) at S&T	.142	**.832**	.066	.153	.127	.144	.025	.030	-.040	-.009	-.070
Q20. In terms of the ratings I get in S&T, I am… (satisfied)	.108	**.825**	.093	.113	.077	.017	.002	.019	-.012	-.032	-.016
Q21. Compared to my friends, I understand S&T… (easily)	.184	**.797**	.069	.257	.136	.086	.033	.038	.002	-.020	-.060
Q18. Compared to my friends, I consider myself… (good) at school	.061	**.737**	.169	.022	.103	.102	.019	-.042	-.214	.145	-.070
Q52. For me, the S&T we do in school is… (easy)	.160	**.636**	.011	.446	.127	.025	-.015	.032	.073	-.038	-.027
Q22. When I don't understand something in S&T, I always find a way to understand…	.189	**.509**	.153	.149	.183	.245	.012	.119	.036	.046	.001
Q23. When I don't understand something in S&T, I get discouraged easily (reversed)	.106	**.429**	-.023	.125	.043	.004	.138	-.034	.093	-.057	.304
F4. Frequency of parents' following up on what students are doing in school: PARENT_SCHOOL											
Q7. My parents talk to me about what I'm learning in mathematics	.049	.041	**.888**	.059	.129	.033	-.019	.040	.003	.022	.015
Q8. My parents talk to me about what I'm learning in French	-.020	.077	**.833**	.039	.155	.025	-.095	-.026	-.048	-.023	.083
Q10. My parents talk to me about what I'm learning in social sciences	.027	.072	**.781**	.008	.129	.062	.056	-.131	-.057	.073	-.071
Q9. My parents talk to me about what I'm learning in S&T	.187	.120	**.778**	-.024	.248	.158	.121	.075	.061	.076	-.070
Q6. My parents talk to me about what I'm doing in school	.001	.088	**.768**	-.040	.111	.088	-.040	-.023	.042	-.069	.029
F12. Ease of subject areas in S&T: EASE_ST											
Q61. For me, studying the Material World is… (easy)	.010	.120	.061	**.802**	.003	.064	-.012	.051	-.088	-.055	.008
Q62. For me, studying the Technological World is… (easy)	.021	.181	.030	**.781**	.018	.033	-.077	.003	-.040	-.013	.105
Q60. For me, studying the Earth and Space is…… (easy)	.001	.198	-.033	**.774**	.030	-.047	.023	-.040	.037	.019	-.005
Q59. For me, studying the Living World is… (easy)	.023	.157	-.021	**.732**	.050	.008	-.004	-.001	-.029	.024	-.087
F5. Frequency of family participation in S&T cultural practices: CULT_PARTICIP											
Q14. In my family, I'm encouraged to participate in science-related recreational activities (*Débrouillards* or other science clubs, etc.)	.183	.109	.176	.050	**.691**	-.031	-.019	.053	-.048	-.005	.025
Q15. My parents let me do scientific experiments at home	.021	.056	.051	.058	**.668**	.097	.005	.034	-.072	.021	-.063
Q13. In my family, we visit museums or exhibits related to S&T	.072	.178	.206	.008	**.667**	.000	-.023	-.014	.027	.059	-.036
Q12. In my family, we like newspapers and magazines that talk about S&T	.135	.120	.251	-.052	**.632**	.078	.204	-.020	.081	-.157	.025
Q11. In my family, we like TV programs that talk about S&T	.268	.178	.204	.087	**.517**	.223	.113	-.007	.149	-.037	-.041
F13. Utility of S&T in society: USEF_ST_SOC											
Q26. S&T… Causes health problems / Promotes good health	.177	.001	.038	.026	.031	**.787**	.071	-.039	.040	.018	-.060
Q25. S&T… Causes environmental problems / Helps the environment	.116	.021	.130	-.036	.047	**.744**	-.034	.069	-.039	.084	.079
Q27. The government should spend more money on scientific research	.188	.226	.057	.036	.091	**.602**	.157	.006	.104	-.125	-.021
Q24. For human beings, S&T… leads to more problems / more advantages	.056	.195	.089	.040	.080	**.578**	.234	.069	.071	-.005	-.046
F14. Subjects with higher status than S&T: STAT_SUBJ											
Q41. At school, S&T is less/more important than French	.172	.063	-.034	-.012	.030	.096	**.825**	.069	.038	.040	-.039
Q39. At school, S&T is less/more important than English	.229	.002	.032	.014	.100	.110	**.742**	.072	-.039	-.225	.023
Q42. At school, S&T is less/more important than mathematics	.150	.024	-.013	-.091	.016	.143	**.730**	.037	.182	.121	-.119

F15. Relationship to social sciences (REL_SS)											
Q49. At school, I prefer social sciences over S&T / I prefer S&T	.177	.199	-.055	.101	.099	.015	.045	**.839**	.054	-.073	-.032
Q43. At school, S&T is less/more important than social sciences	.223	.052	-.006	.030	.023	.185	.272	**.658**	.160	.101	-.015
Q53. For me the social sciences we study at school are… (easy)	.155	.344	.053	.216	.100	.088	.086	**-.604**	.204	.133	.154
F16. Relationship to mathematics (REL_M)											
Q48. In school, I prefer mathematics over S&T / I prefer S&T	.142	.066	-.012	-.012	.065	.112	.184	.085	**.857**	.036	-.048
Q50. For me, the mathematics we do at school are… (easy)	.082	.459	-.005	.194	.094	-.045	.021	.024	**-.646**	.046	.093
F17. Relationship to English (REL_ENG)											
Q54. For me, English at school is… (easy)	-.007	.194	.030	.009	.010	.057	.106	.037	.065	**.866**	.054
Q45. At school, I prefer English over S&T / I prefer S&T	.285	.285	-.032	.061	.078	.079	.254	.173	.099	**-.674**	-.008
F18. Relationship to physical education (REL_PHYSED)											
Q55. For me, physical education at school is… (easy)	.011	.036	.004	.027	-.037	.035	-.052	-.019	-.026	.078	**.873**
Q44. At school, I prefer physical education over S&T / I prefer S&T	.322	.218	-.011	.086	.093	.119	.157	.133	.148	.024	**-.666**