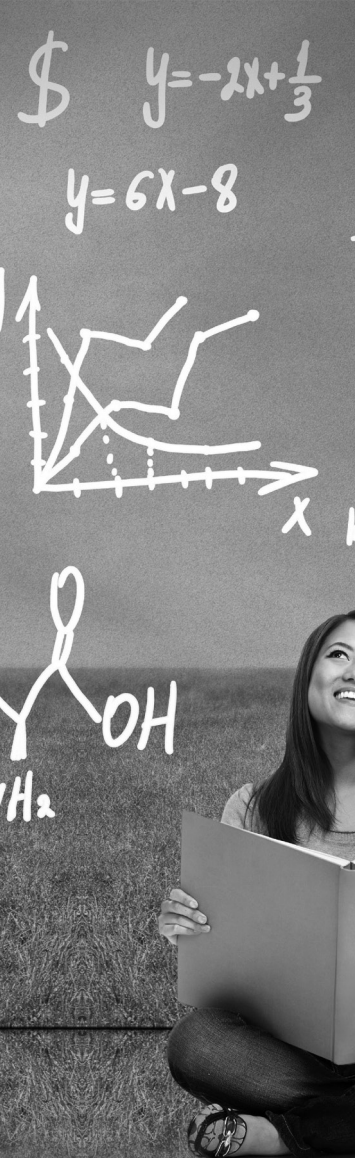

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In conjunction with

Generalitat de Catalunya
Departament
d'Ensenyament

Factors influencing the choice of science, technology and mathematics programs

Views of Students in the 3rd and 4th Year of Compulsory Secondary School and Baccalaureate

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Views of Students in the 3rd and 4th Year of Compulsory Secondary School and Baccalaureate

ÍNDEX

1 Introduction

1.1 Reasons for the study

The main reason behind this study stems from the fact that **the number of young people who choose to study science, technology and mathematics is dropping year after year** (CTM[1]).

This lack of interest in studying STM is quite widespread in a number of developed countries, primarily in the European Union, which included this point in the Lisbon Strategy[2], and in the United States, even though it has the top universities, research centers and businesses in the different related sectors, as well as major organizations devoted to spreading and encouraging interest in science, technology and mathematics.

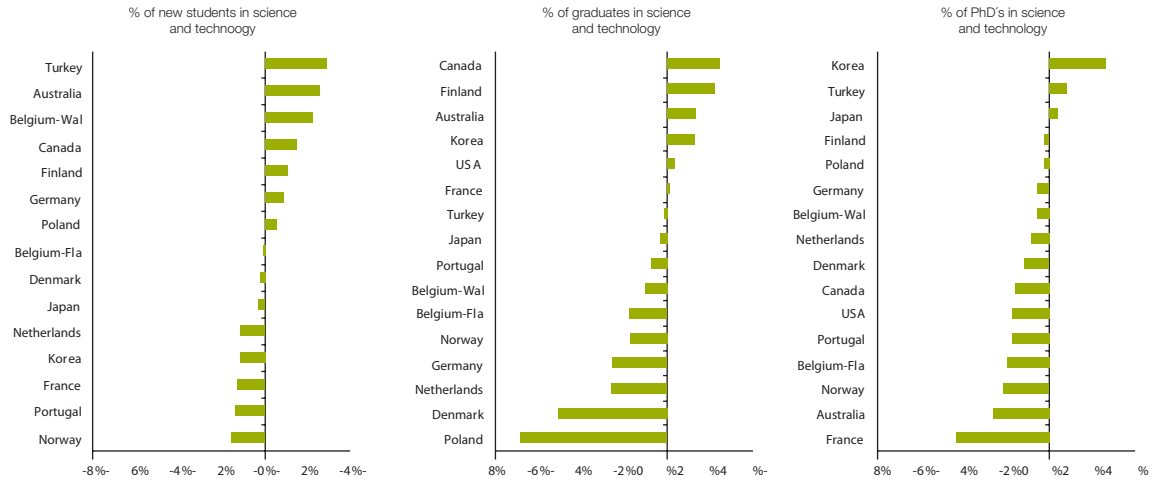


Figure 1: Percentage of students in science and technology – average yearly variation 1993-2003[3]

[1] *In this document, we refer to science, technology and mathematics using the acronym STM, just as UNESCO does in its report: UNESCO – CASTME. Science, Technology and Mathematics Education for Human Development. The document from the International Experts Conference held in Goa (India) from February 20-23, 2001.*

[2] *The European Council in Lisbon (March 23 and 24, 2000) set the strategic objective of turning the European Union's economy into "the most competitive, dynamic, knowledge-based economy in the world by 2010, capable of sustainable economic growth accompanied by quantitative and qualitative improvement in employment and of greater social cohesion".*

[3] *OCDE, Global Science Forum. Evolution of Student Interest in Science and Technology Studies. Policy Report. May 2006.*

The situation in Catalonia is no different, and there was a 19% decline in the number of new students entering baccalaureate programs in the Science and Technology track for the period 2001-02 compared to 2009-10[4]. Spain-wide, this decline is slightly lower, but it still stands at a worrisome 12%.

In relative terms, the percentage of students enrolled in baccalaureate programs who choose the Science and Technology track has dropped by 6% in the same period in Catalonia, as shown in Figure 2.

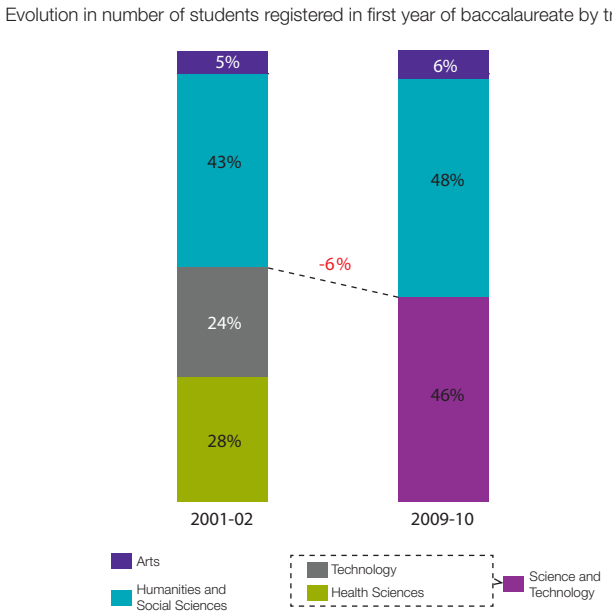


Figure 2: Evolution in the number of students enrolled in the first year of baccalaureate in Catalonia in the period 2001-02 to 2009-10 (everis 2012. The Shortage of ICT Engineers: Current Situation and Prospects)

In this particular case, within the field of STM, there is a major mismatch in the information and communications technologies (ICT) between the supply of workers and job demand which is difficult to explain and understand when closely analyzed. In recent years, enrollment in ICT engineering in Catalonia has dropped a total of 46%, but despite today's economy the ICT industry is still growing and its demand for qualified professionals cannot be met with today's graduates (according to information from the 2010 Summary Report from the job portal Infojobs, the category of IT and telecommunications is the second most requested profession in Catalonia). Thus, we find that around 84% of the students with technical degrees find work within the first three months after graduating, most of them with steady contracts and high wages; more than 60% of the professionals in technical fields have a steady contract and more than 65% earn over 2,000 euros per month, far more than other professional fields[5].

[4] *The Shortage of ICT Engineers: Current Situation and Prospects, everis (2012).*

[5] *University and Work 2011. University Qualification Agency (AQU).*

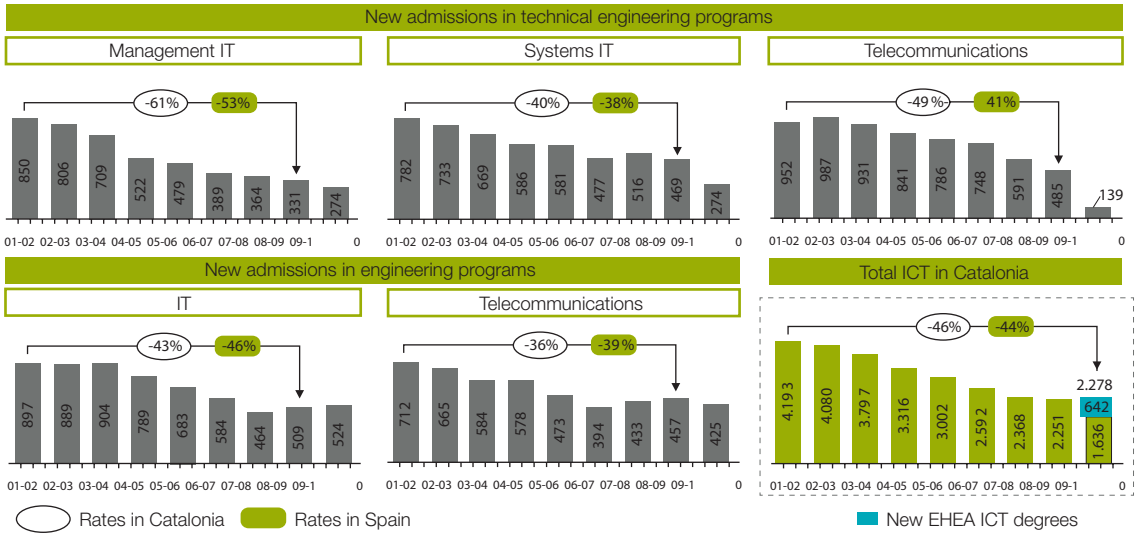


Figure 3: Evolution of new enrollments in ICT Engineering in Catalonia in the period 2001-02 to 2009-10 (everis 2012. The Shortage of ICT Engineers: Current Situation and Prospects)

At the same time, interest in science and technology is rising, especially among young people: the growth stands at 19% in the population as a whole in the past two years and 40% among young people aged 15 to 24 during the same period[6].

Therefore, there is simultaneously a rising interest in science and technology and an industry with an unmet demand for professionals who easily find good jobs, and on the other a steady decline in the number of students who choose the STM track. Therefore, we must ask why.

Given that this situation has been happening continuously for some time, the question regarding the reasons behind it has been examined in a range of studies and reports which point to different causes. The majority of these studies, such as the Rocard[7] Report by the European Commission, point to the planning, curriculum and teaching methodology in STM subjects, as well as to the teacher training, in terms of both the subjects taught and knowledge of STM professions. Also worth noting is the social image of STM professionals, a factor mentioned by F.S. Becker[8] as crucial, along with the range of "easy" study options or ones that seem to require less effort. Sociodemographically, factors related to students' gender and background have also been identified as playing an important role.

All of these studies reveal the views of almost all the stakeholders in the process, especially the experts in different disciplines (education, sociology and psychology) applied to the educational setting. However, to get a complete picture of the matter, what is missing is the views of the most important stakeholders, that is, the **views** of the **students** themselves on their **process of choosing their field of study and the factors that come into play in this choice** (financial aid, pressure, confidence in their choice, etc). This study aims to further examine students' views and address this topic with a quantitative approach in order to go beyond the specific knowledge of everyone who takes part in this decision-making process. This knowledge is heavily permeated with reality and is necessarily individualized, but it is often excessively fragmented, which does not facilitate overall coherent, focused action in the key aspects.

[6] *FECYT. 6th Survey on the Social Perception of Science. 2012.*

[7] *European Commission. Science Education Now: A New Pedagogy for the Future of Europe (Rocard Report). 2007.*

[8] *Becker, F. S. Why Not Opt for a Career in Science and Technology? An Analysis of Potentially Valid Reasons. 2009.*

With the goals of fostering interest in STM studies on the part of students, adding new factors to the debate and contributing to empowering all the stakeholders to influence the process of a comprehensive view of the factors influencing the choice of STM studies, which will help to guide and focus initiatives in the variables with the greatest impact, **everis** is spearheading this study, which was conducted with the technical support of **e-Motiva** and in conjunction with the **Department of Education of the Generalitat de Catalunya**.

2 Objectives

The ultimate objective of this study is to contribute to increasing STM vocations, meaning the willingness or inclination to embark upon a profession or pursue a degree, which is identified as a serious shortcoming for the country's economic development, while also providing factors that can be taken into consideration by education professionals and other stakeholders participating in students' decision-making processes.

The specific objectives include gaining a better understanding of the decision-making process when choosing courses of study at the end of compulsory secondary school and baccalaureate and in particular identifying the unique factors that lead to the choice of STM studies (in baccalaureate, vocational education and the university).

Thus, this study strives to provide a quantitative perspective on:

- The **variables that most come to bear in the shortage of scientific**, technological and mathematical **vocations** among students.

- The key factors in students' **process of choosing a course of study** and professional field: the most influential criteria, critical moments, stakeholders and factors.

- In order to contribute to focusing efforts and expanding **potential avenues of action** that can promote these vocations.

Given that, as outlined in the introduction, the decline in the number of students choosing to study STM can already been seen in university enrollment, this study focuses on the perceptions of students in compulsory secondary school, specifically in their third and fourth years, and students in their first and second year of baccalaureate. The reason for focusing on these grades is that the main choice of courses of study takes place in the fourth year of compulsory secondary school, when students can choose to take their baccalaureate in one of the three tracks currently available (Arts, Sciences and Technology or Humanities and Social Sciences), pursue a mid-level vocational education program or join the workforce. By focusing on these two groups, we will get a glimpse of students just before they make this decision, as well as students who have recently made this decision. Among the latter, we will further analyze the new decision-making process facing those who have chosen the Sciences and Technology baccalaureate, which may lead them to pursue a university degree in a STM field, among other options.

We should note that the data collected in this study can be analyzed in many different ways that have not been tackled in this report, and that they are available to any experts or institutions that wish to use them.

3 Methodology and sample

3.1 Methodology

The starting point is the joint experience of **everis** and **e-Motiva** in studies on workplace climate (internal opinion studies in private companies and public institutions on employees' professional satisfaction and motivation) in which the most innovative qualitative and quantitative social research techniques are used (such as the *e-Map attitudes*® methodology developed by e-Motiva).

For this project, a threefold methodological approach was used:

- **Analysis of data and reports**: This was a quantitative analysis of the data on students and schools, a qualitative analysis of expert studies and reports in the field of STM vocations and studies, and a review of initiatives underway in Catalonia to encourage science, technology and math.

- **Analysis of practices:** Here we study (what is being done and how it is being done) by analyzing the opinion of the student milieu, identifying a map of stakeholders and holding interviews, workshops and focus groups with the most important stakeholders.

- **Análisis de las percepciones**: This was done by administering questionnaires as a way to directly collect students' opinions with a statistically representative sample.

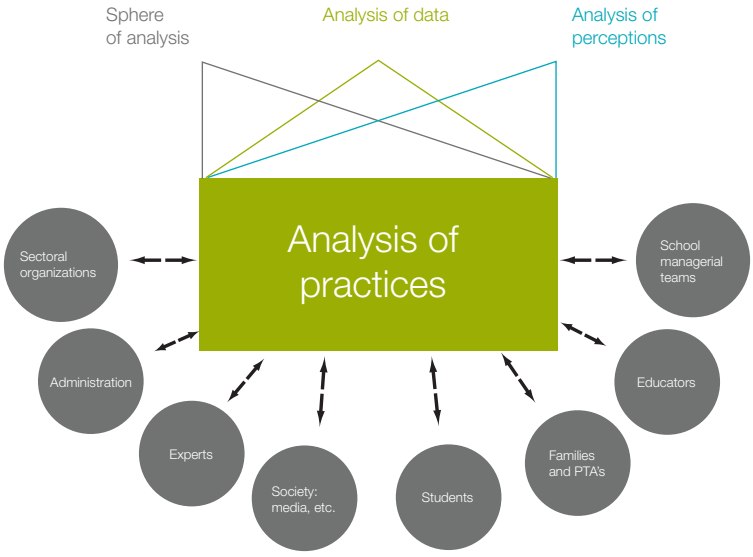


Figure 4: Stages of analysis in the study

The three stages of analysis were conducted via a variety of activities, as outlined below.

3.1.1 Phase I: Analysis of data and documentation

Objectives

The main objective of this phase was to have a sound, accurate overall understanding of the situation and the sphere of analysis.

Activities

To achieve this objective, the following tasks were performed:

- Identification of documents by experts on the situation being studied.
- Compilation of data available from the Regional Department of Education:
    - Students' educational choices according to different variables (marks, school, gender, etc.)
    - Presence of STM courses in the curricula
    - Comparison with other regions and countries
    - Teacher training and knowledge
    - Schools with exceptionally high and low levels of excellence (identification of best practices and factors which bear a negative influence)

3.1.2 Phase II: Analysis of practices

Objectives

To gain a deep understanding of the process: the decision-making on STM vocations and specifically the actions (practices) performed by the different stakeholders. To analyze the influences in the students' milieu (parents, teachers, school, etc.).

To gather enough relevant material to develop a questionnaire targeted at students.

Activities

- Guided, semi-open-ended interviews with the stakeholders in the process: conducting interviews between 1 and 2 hours long with representatives of a group of 30 experts in education from Catalonia's Department of Education, ensuring that all the organizational levels are covered: primary, secondary, baccalaureate, vocational education, university, teaching and school administration and management.

- Workshops with expert groups from a variety of fields: university and non-university teachers, organizations that popularize science, educational reflection and action groups, university and non-university school managers, research and innovation centers and companies in the ICT sector.

- Focus groups with the main stakeholders (students, teachers, school managers) and organizational levels:
    - *Focus groups with students in the 3rd year of compulsory secondary education.*
    - *Focus groups with students in the 4th year of compulsory secondary education.*
    - *Focus groups with students in the 1st year of baccalaureate.*
    - *Focus groups with students in the 2nd year of baccalaureate.*
    - *Focus groups with teachers from secondary schools.*
    - *Focus groups with the directors of secondary schools.*

Description of student focus groups:

- Semi-structured group dynamic combining room for individual reflection with sharing the ideas as a whole group (nominal group technique) and open debate. The metaplan[9] technique was used in order to efficiently gather and record all the material generated in the session.

- Participants: 10-12 students per session, chosen so that they are representative of the diverse situations existing at the school according to academic performance (high-middle-low), sex (male-female) year (3rd/4th year of secondary school, 1st/2nd year of baccalaureate) and choice of studies (STM/non-STM).

- Length: approximately 2 hours per session.

- Venue: held at the schools chosen according to ownership (public/private with public funding) and geographic location (Barcelona/outside Barcelona).

- The sessions were led by specialized consultants from everis and e-Motiva.

3.1.3 Phase III: Analysis of perceptions

Objectives

To analyze students' opinions in order to identify the factors and variables that affect their decision-making process, their differential importance and their specific weight, as well as the action needed to improve it.

Activities

To design and administer a questionnaire to a statistically significant sample of students.

To design an ad hoc questionnaire that will reveal students' perceptions of their own decision-making process and the factors that come into play, as well as the possible impact of demographic variables and the school, with the **following requirements**:

- Inclusion of **key topics** on the issue at hand identified in the interviews and working groups.

- **Inclusion of the key segmentation variables: individual, sociodemographic and school**.

- **Use of language that is understandable and direct and that causes no doubts** in students. (Pilot tests were conducted with students who were not part of the sample.)

- Briefness, with the premise that students should be able to fill it out in 15-20 minutes at most.

3.2 Sample chosen

Administration of the questionnaire to a **statistically representative sample**, with the following characteristics:

[9] *A system for gathering ideas or a creativity technique applied in groups of people. It was started by Eberhard Schnelle in Hamburg (Germany).*

- **Universe**: schools with students in compulsory secondary education and in one baccalaureate at least.
  - Total schools: 661
  - Total students: 297,720
- Sampling technique: **Stratified sampling**, with strata representing:
  - School ownership/Complexity (public A, public B, public C, publicly funded private/private A and B) [10]
  - Geographic location by district
- To facilitate this project, **we chose the school as the sample unit**
- Within each sample unit, we made a simple random selection
- **Description of the sample and margin of error:**
  - **n=4.704 students from 32 schools**
  - Confidence interval 95%
  - Least favorable hypothesis (p=q=50%)
  - **Margin of error of the sample:**
    - Overall ± 1.44 %
    - 3rd and 4th year of secondary ± 1.92%
    - Baccalaureate ± 2.18%
  - With the following distribution:

Schools Students	PRIVATE		PUBLIC			
Region	A	B	A	B	C	Total
Barcelona	4 536	2 329	4 424	2 292	2 198	14 1.779-38%
Girona		1 183	1 151	1 249	1 120	4 703-15%
Alt Pirineu i Aran				2 414		2 414-9%
LLeida		1 145	1 114	1 224		3 483-10%
Catalunya Central		1 252	1 38	1 30		3 320-7%
Camp de Tarragona		1 276	1 102	1 155		3 533-11%
Terres de l'Ebre				2 371	1 101	3 472-10%
Total	4 536-11%	6 1185-25%	8 829-18%	10 1735-37%	4 419-9%	32 4.704

Schools / Students

Table 1: Distribution of students surveyed by region and kind of school

[10] ***A**: High socioeconomic **level; B**: Middle socioeconomic **level; C**: Low socioeconomic **level**.*

ESO	Males	Females	Public	Private	Total
3rd year	592 50%	597 50%	824 68%	383 32%	1207
4rd year	699 49%	742 51%	1003 69%	456 31%	1459
Total	1291 49%	1339 51%	1827 69%	839 31%	2666
1st year of baccalaureate					Total
Science and technology	261 60%	246 42%	292 49%	284 51%	526 50%
Humanities and social sciences	174 39%	333 56%	298 49%	222 48%	520 48%
Arts	3 1%	17 3%	17 2%	3 1%	20 2%
Total	438 42%	596 58%	607 57%	459 43%	1066
2nd year of baccalaureate					Total
Science and technology	255 59%	216 42%	279 51%	201 48%	480 50%
Humanities and social sciences	170 39%	289 55%	258 46%	206 49%	464 47%
Arts	8 2%	18 3%	12 2%	15 4%	28 3%
Total	433 45%	523 55%	549 57%	423 43%	972
TOTAL	2162 47%	2458 53%	2983 64%	1721 36%	4704

Table 2: Distribution of students surveyed by gender, level and kind of school

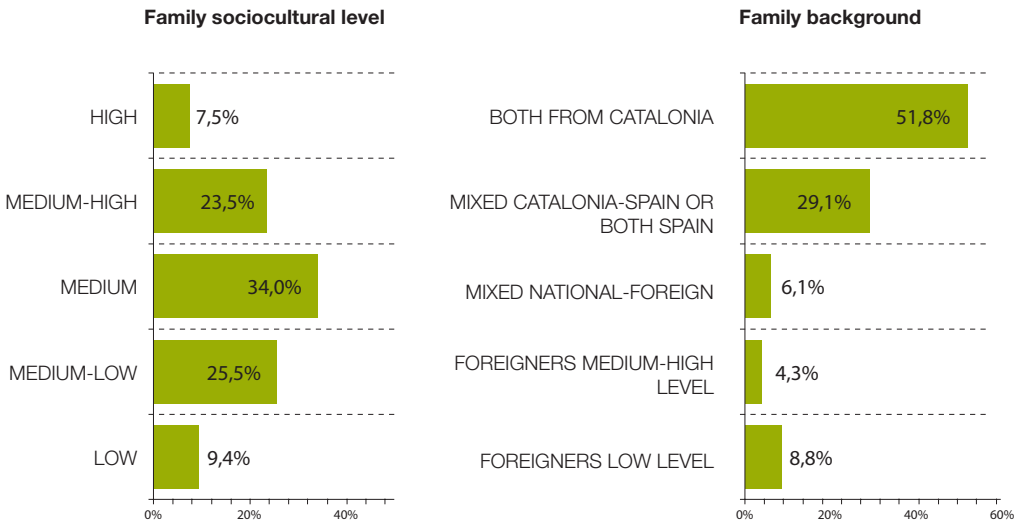


Figure 5: Distribution of students surveyed by sociocultural level and family background

4 Results

4.1 Overview of the study

To conduct this study, the key moments in students' evolution were taken into account:

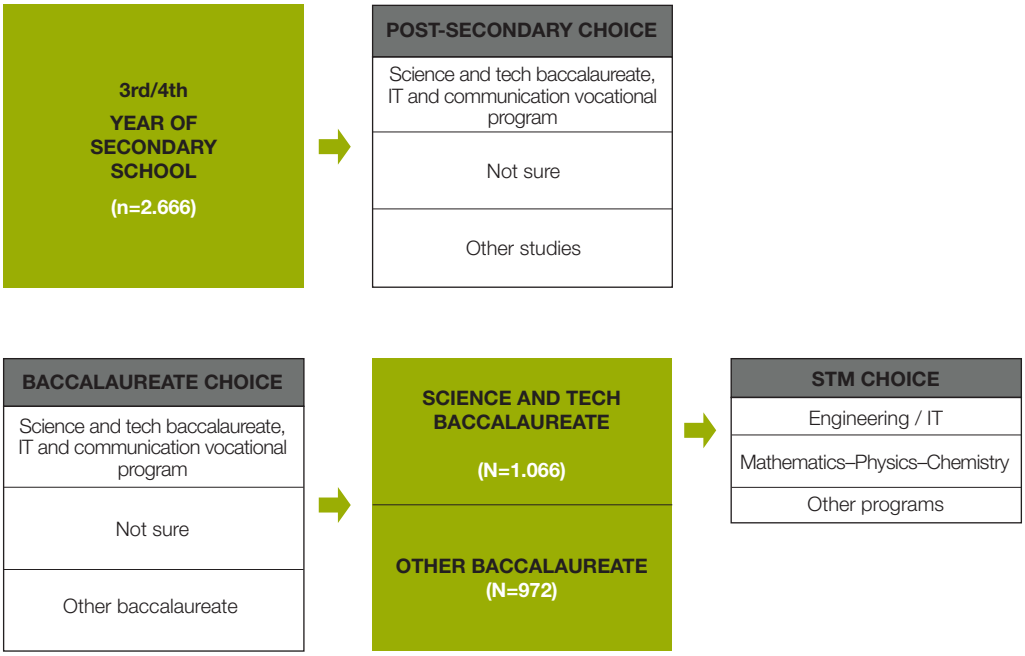


Figure 6: Overview of the study

- Post-secondary school decision: This decision-making moment at the end of secondary school was studied from two perspectives: first, **compulsory secondary school students who have to make a decision about their future**, and secondly, **baccalaureate students who already made this decision** in the recent past.

- Post science and technology baccalaureate: We focused on two areas: first, students who want to study engineering or IT, and secondly, students who want to study math, physics or chemistry.

The analysis was made based on a conceptual framework that relates the **choice** of studies to different factors:

- Individual factors:
    - Satisfaction and perception of the usefulness of the programs
    - Decision-making process:
        - What will the decision be? (at the time of the survey)
        - Degree of confidence at the time the decision is made
        - Who influenced the decision? Who influenced it more and who less? Family, mentors, teachers, friends ...
        - Was there any pressure to study fields in which the student is not interested? Who exerted this pressure?
        - Information (whom they got it from, through which channels or activities, clarity, usefulness, etc.):
        - On different courses of study
        - On university majors
        - On professional opportunities
        - What or who would help them to make the best decision?
    - School subjects and teachers:
        - Liking of school subjects and teachers
        - Overall academic performance
        - Academic performance in STM subjects
    - Relationship with technology:
        - Students' knowledge and use of technology
    - Image of STM careers and professions
- Sociodemographic factors:
    - Sex
    - Birth order
    - Sociocultural level
    - Family background

- Factors related to the school:
    - Kind of school
    - Educational levels taught at the school
    - Region

The relationship among the different factors is shown in the schema below:

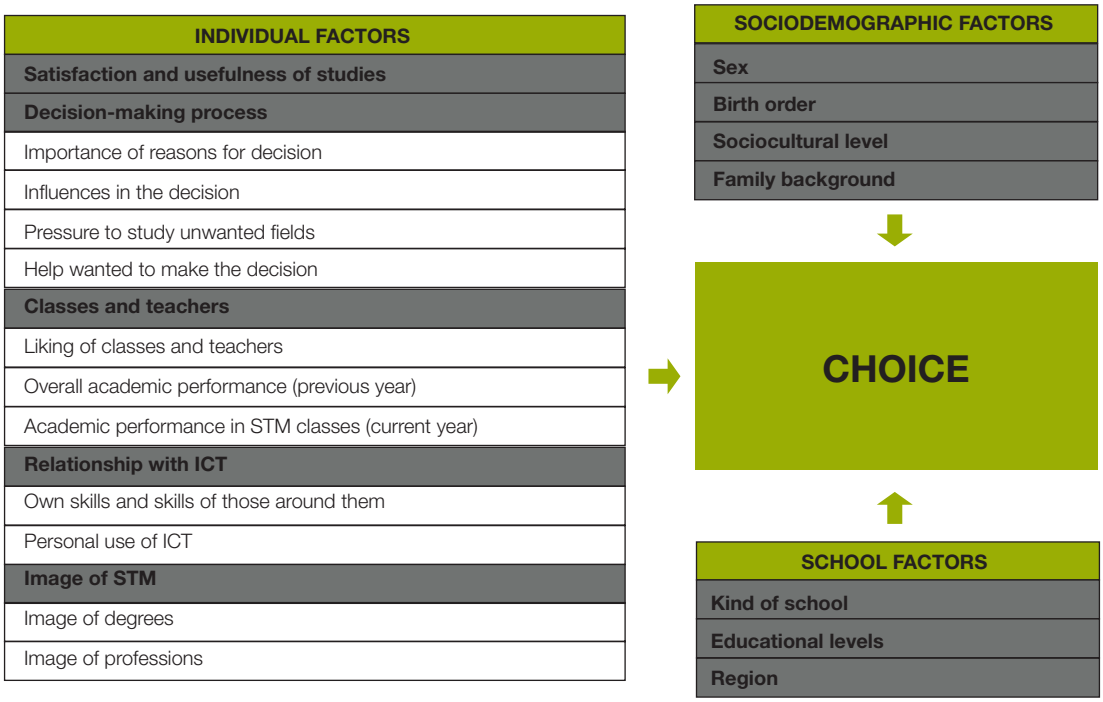


Figure 7: Conceptual framework of analysis

4.2 Results

4.2.1 Format to present the results

The results of the study are presented in different forms, in overall **graphics** or in differential **tables** that show comparative results based on the different segmentation variables.

It should be borne in mind that the values of the segmentation variables (course of study, year, sex, etc.) are variables chosen by the students and were therefore not obligatory. For this reason, there are results that when segmented do not cover the entire sample studied, since some students did not answer the variables that would enable us to perform this segmentation. In each graphic or table, n=number indicates the number of individuals who fulfilled all the requirements for that particular analysis.

Below is a brief explanation of how the results are presented, which can serve as a guide for understanding them.

4.2.1.1 Graphics

The questions on the questionnaire were presented on a **scale from 1 to 5**.

- The **average** of each item is also presented.
- At the bottom of the page we state the **number of participants** (n=XX) and a reminder of the **legend of the graphics**.

- Below is a **sample graphic**:

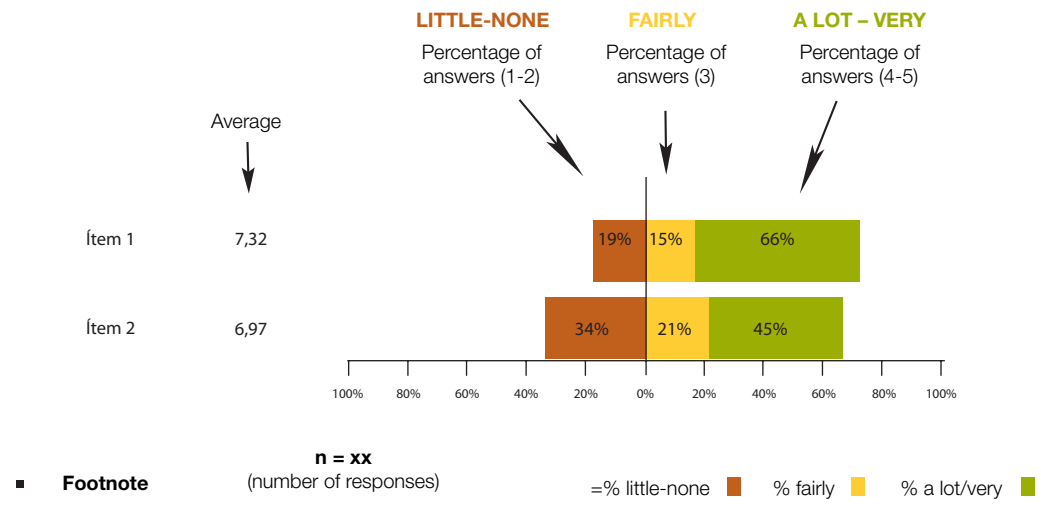


Figure 8: Example of the graphic presentation of the results

4.2.1.2 Comparison table by segments

- This shows the **percentage of people** who answered fairly (3), a lot (4) or very (5).
- The results are **compared by segments** and assessed in relation to the **total**.

Below is a **sample graphic:**:

	Segment 1	Segment 2	Segment 3	TOTAL
Item 1	98	94	61	90
Item 2	100	85	71	91
Item 3	98	92	81	88
Number of people	21	11	31	71

- The meaning of the colors is as follows:

Difference equal to or higher than 10% of the total	Difference between 5 and 9% higher than the total	Insignificant difference (+/- 5%) compared to the total	Difference between 5 and 9% lower than the total	Difference equal to or lower than 10% of the total

- The total number of people (71 in the example) is the sum of all the people from the segments in the table plus the people who did not choose a segment. For reasons of confidentiality, the segments with fewer than 3 responses are not shown, even though those responses are calculated in the total.

Figure 9: Example of the presentation of results in a table comparing segments

4.2.2 Presentation of the results

The sample surveyed, as noted above, is made up of students in the third and fourth year of compulsory secondary education (a total of 2,666 students) and students in the first and second year of baccalaureate (a total of 2,038 students).

Below are the results of the study in the following order of presentation:

- Analysis of the responses of all students together (compulsory secondary education and baccalaureate) on their choice of post-secondary studies. Here we should bear in mind that secondary students responded on their future choice, while baccalaureate students responded on their past choice.

  With regard to the analysis of the choice of post-secondary studies, the results are presented in the following way:

  - Analysis of the responses of all the students surveyed with regard to the factors influencing their decision to pursue a given post-secondary course of study.

- Summary of the questions (using a factorial analysis) for the entire group surveyed and segmentation of results:
  - Analysis of the information provided by all students (secondary and baccalaureate) and segmentation of the results by sociodemographic factors and school-related factors.
  - Analysis of the information provided only considering secondary school students and comparison of results with the total.
  - Analysis of the information provided only considering baccalaureate students and comparison of results with the total.

- Analysis of the responses of students who are currently pursuing a scientific and technological baccalaureate regarding their choice of post-baccalaureate studies.

4.2.2.1 Choice of post-secondary studies

In this section, we present the results regarding students' choice of post-secondary studies, including both secondary school students (future choice) and baccalaureate students (past choice).

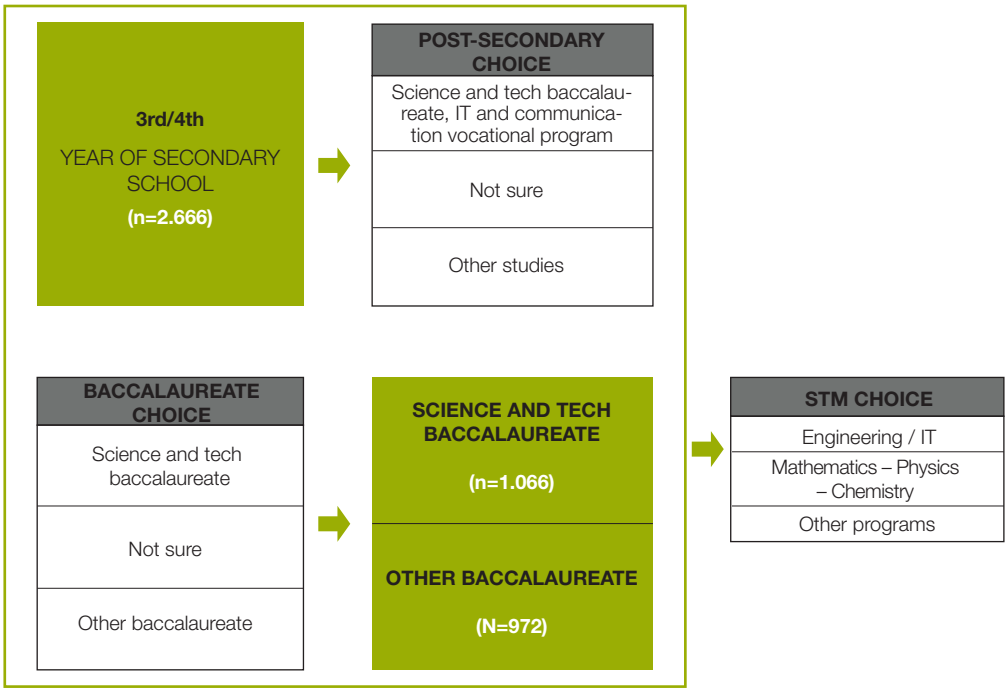


Figure 10: Sphere of results: Choice of post-secondary studies by all respondents

Further on, the study also analyses the decision-making processes of students in the science and technology baccalaureate regarding their post-baccalaureate course of study, especially their choices in the fields of STM.

4.2.2.1.1 *Time of decision-making and degree of confidence*

In order to promote effective actions to increase STM vocations, one of the key factors we must know is when students make the decision on their future studies and the period in which this decision takes shape.

For this reason, we asked students about both their future choice (for secondary students) and their past choice (for baccalaureate students) as well as their degree of confidence in their decision:

Secondary school students

FUTURE STUDIES			
CONFIDENCE IN CHOICE	Science and technology baccalaureate + IT and communication vocational program	Other studies	Total
I'm sure	15,1%	21,8 %	37,0%
	33%	51%	
I have several alternatives	17,7%	29,5%	47,2%
I'm not sure	5,4%	10,4%	15,8 %
	16%		
Total	38,2 %	61,8 %	100%

Baccalaureate students

BACCALAUREATE CHOSEN			
CONFIDENCE IN CHOICE	Science and technology	Other studies	Total
I'm sure	32,5%	26,9%	59,4%
	46%	46%	
I have several alternatives	13,8 %	19,2%	33,0%
I'm not sure	3,1%	4,6%	7,7%
	8%		
Total	49,4%	50,6%	100%

Table 3: Choice of post-secondary studies according to confidence in choice

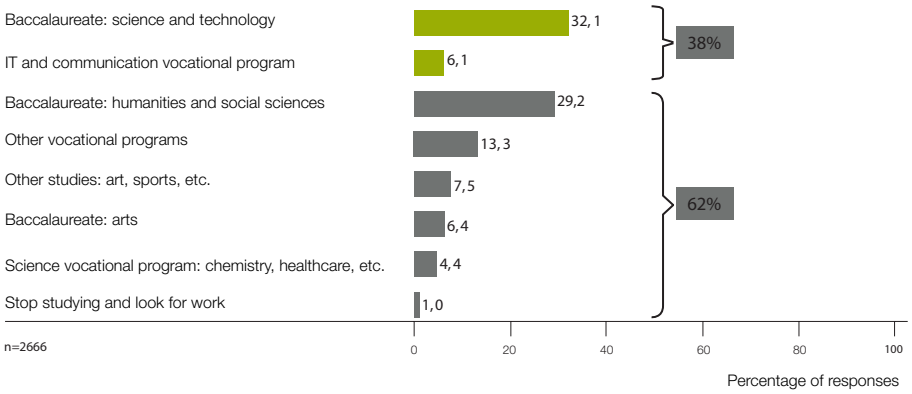
According to the information provided by students:

- Of the students currently enrolled in secondary school who have decided to continue studying afterwards, 37% are confident about which course of study they are going to pursue, while 47.2% have more than one alternative to choose from. Therefore, the vast majority of students (approximately 84%) are quite or very sure what course of study they are going to pursue after secondary school. Of this 84%, around 33% are almost totally confident or have decided that they are going to pursue a baccalaureate or vocational degree in science/technology.

- Regarding the baccalaureate students, 59.4% are confident of what course of study they are going to pursue after secondary school, and 33% have more than one alternative. This means that more than 90% of the students know what they are going to do after secondary school. Only 7.7% of these students are unsure what they were going to study after secondary school.

  The higher confidence in the baccalaureate students' decision probably reflects the fact that many of the undecided students end up choosing alternatives other than baccalaureate, or it could reflect a change in their recollection once they have made the choice.

The figure below illustrates the distribution of students by choice of post-secondary course of study, as well as the evolution of this choice in the third and fourth years of secondary school:



	Science and technology baccalaureate and vocational programs	Not sure	Other studies	Total	Number of people
TOTAL secondary school	33	16	51	100	2638
3rd year of secondary school	33	19	48	100	1197
4th year of secondary school	33	13	54	100	1441

Figure 11: Choice of courses of post-secondary studies – Secondary school students

These results indicate that the inclination to choose STM studies is probably defined beforehand, perhaps early in secondary school or even in primary school. At the start of secondary school, the choice is already largely made: the percentage of students who are not sure what to study is relatively low, while the percentage of students who know that they are not going to choose STM options is high. What is more, the percentage of students who want to study STM does not vary between the third and fourth years of secondary school, since those who had doubts usually choose another course of study.

In the following results sections, the course of study chosen and the degree of confidence in this choice will be applied as a segmentation variable and to enable us to identify the differential factors between STM and non-STM students. Thus, we considered three groups of students:

- **Bacc and chemistry/physics / science/technology**: Students who are quite confident about choosing STM or one of whose alternatives is STM.
- **Not sure**: Students who are unsure which option they will choose.
- **Other courses of study**: Students who are quite confident that they will not choose STM or who have other alternatives.

Below are the results of the analysis of the individual student factors:

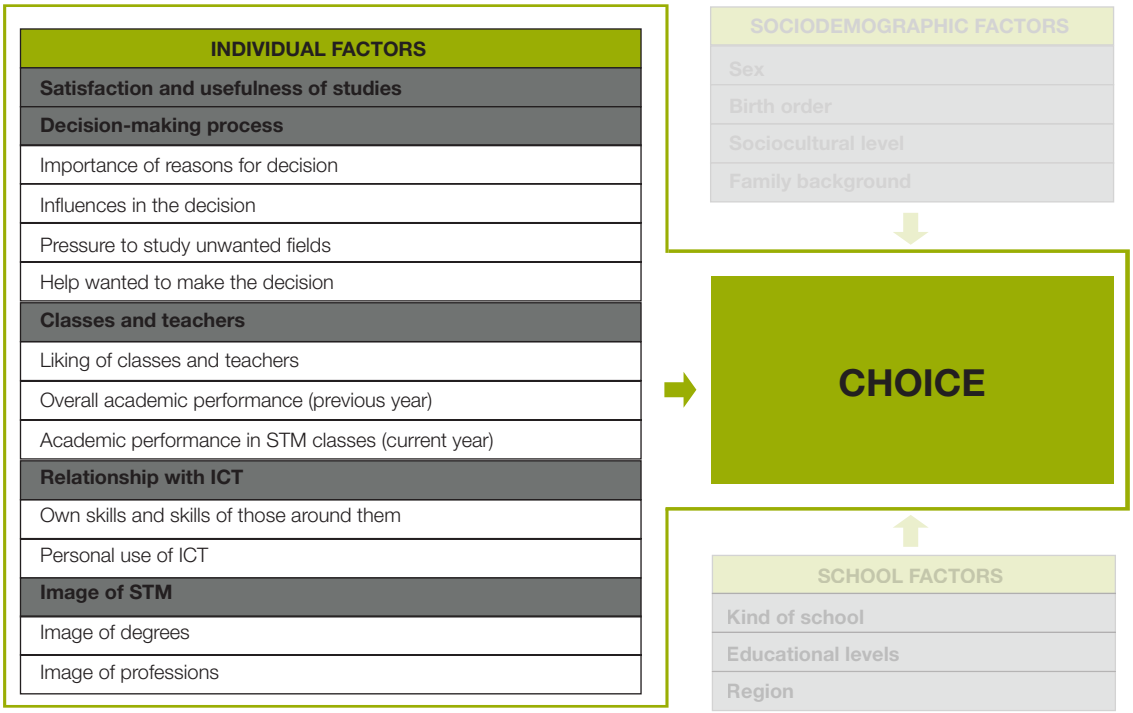


Figure 12: Conceptual framework of analysis: Individual factors

4.2.2.1.2 Satisfaction, performance and usefulness of the studies

In this section we present the results on students' degree of satisfaction with the course of study they are currently enrolled in (secondary school or baccalaureate), regardless of the course of study they have chosen or wish to choose.

The results of the survey show that:

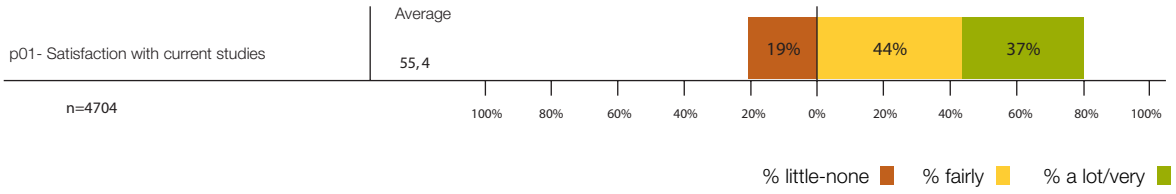


Figure 13: Satisfaction with current studies

Of the students surveyed, 37% were very satisfied (score of 5) or satisfied (score of 4) with their current studies, 44% were fairly satisfied (score of 3) and 19% were not very satisfied (score of 2) or dissatisfied (score of 1) with their current programs.

With regard to the usefulness of studying and how it can help them in the future, the results indicate the following:

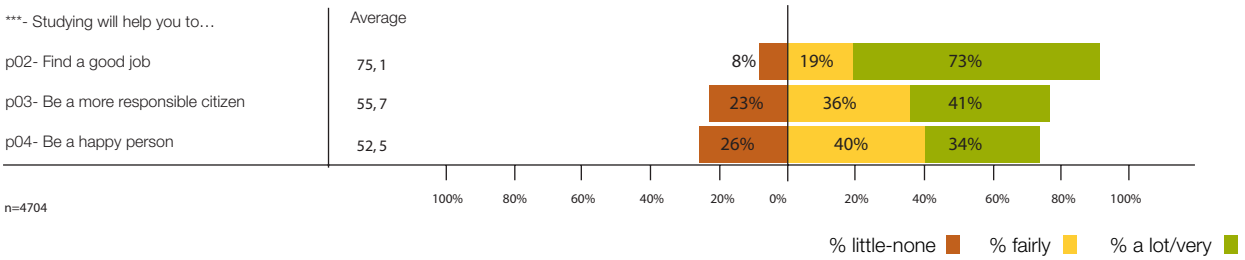


Figure 14: Usefulness of studies

Most students have a view of the usefulness of their studies that is closely focused on finding a good job. To a lesser extent, albeit mostly positive, the course of study is perceived to a lesser degree as a means to becoming a more responsible or happy person.

With regard to the knowledge students have of the course of study they would pursue or have chosen when making the decision, the results are the following:

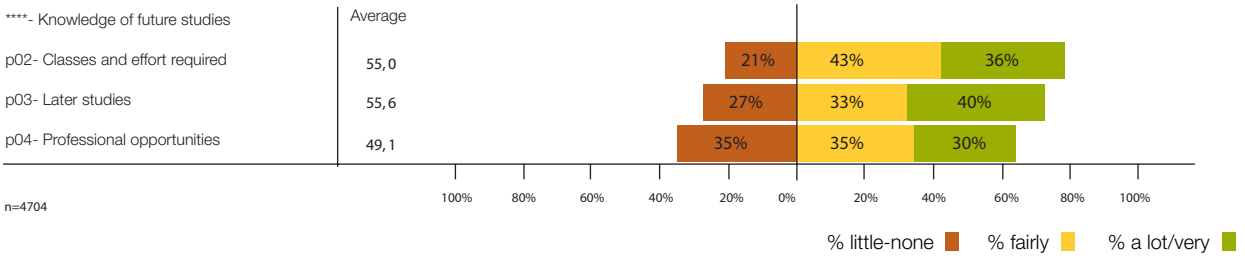


Figure 15: Knowledge of course of study to pursue

We noted that students know more about what is more immanent: they are more confident about what the subjects and subsequent programs will be than the career possibilities of these programs. These results are expected, but they may reveal a lack of knowledge about certain professional fields.

If we group these responses using the factorial analysis technique to facilitate a comparative analysis of the different segmentation variables we get the following:

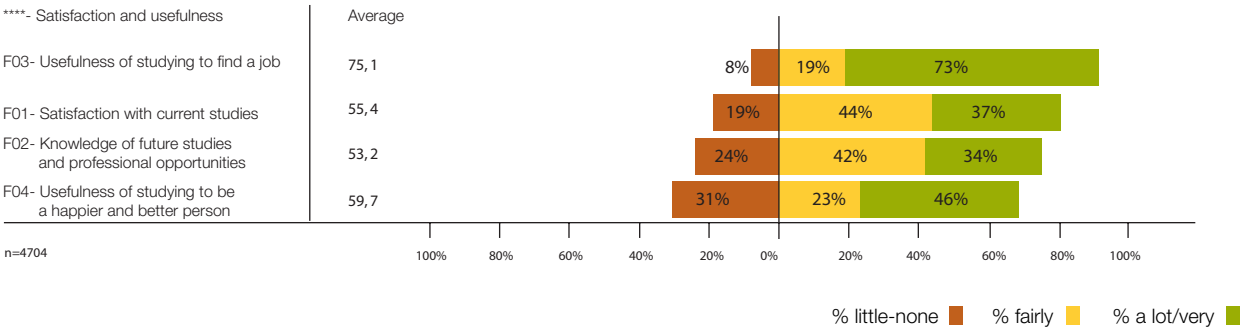


Figure 16: Satisfaction and usefulness of studies

Considering solely the responses of secondary school students segmented by the decision on post-secondary studies and their degree of confidence in this choice, we get:

	Science and technology baccalaureate and vocational program	Not sure	Other studies	Total
****- Satisfaction and usefulness				
F01- Satisfaction with current studies	85	68	77	78
F04- Usefulness of studying to be a happier and better person	76	64	70	71
F02- Knowledge of future studies and professional opportunities	79	44	74	71
F03- Usefulness of studying to find a job	96	88	95	94
Number of people	865	418	1355	2666

Percentage fairly-a lot-very

Table 4: Satisfaction and usefulness of studies – Secondary school students

STM students show a higher degree of satisfaction with their course of study, as well as a better perception of the usefulness of studying than the other students. Students with a lower degree of confidence in their future choice show levels of satisfaction with their current studies and knowledge of their future studies that are considerably lower than the overall average.

If we only consider the responses of baccalaureate students, we get:

	Science and technology baccalaureate and vocational program	Not sure	Other studies	Total
****- Satisfaction and usefulness				
F02- Knowledge of future studies and professional opportunities	86	60	80	81
F01- Satisfaction with current studies	88	57	86	84
F03- Usefulness of studying to find a job	92	80	90	90
F04- Usefulness of studying to be a happier and better person	69	47	69	67
Number of people	931	154	925	2038

Percentage fairly-a lot-very

Table 5: Satisfaction and usefulness of studies – Baccalaureate students

Generally speaking, there are no substantial differences between the responses of secondary and baccalaureate students. Once again, the undecided students show lower levels on all the items evaluated.

4.2.2.1.2.1 Reasons for choosing certain courses of study

The different reasons students cited for choosing their course of study included the following:

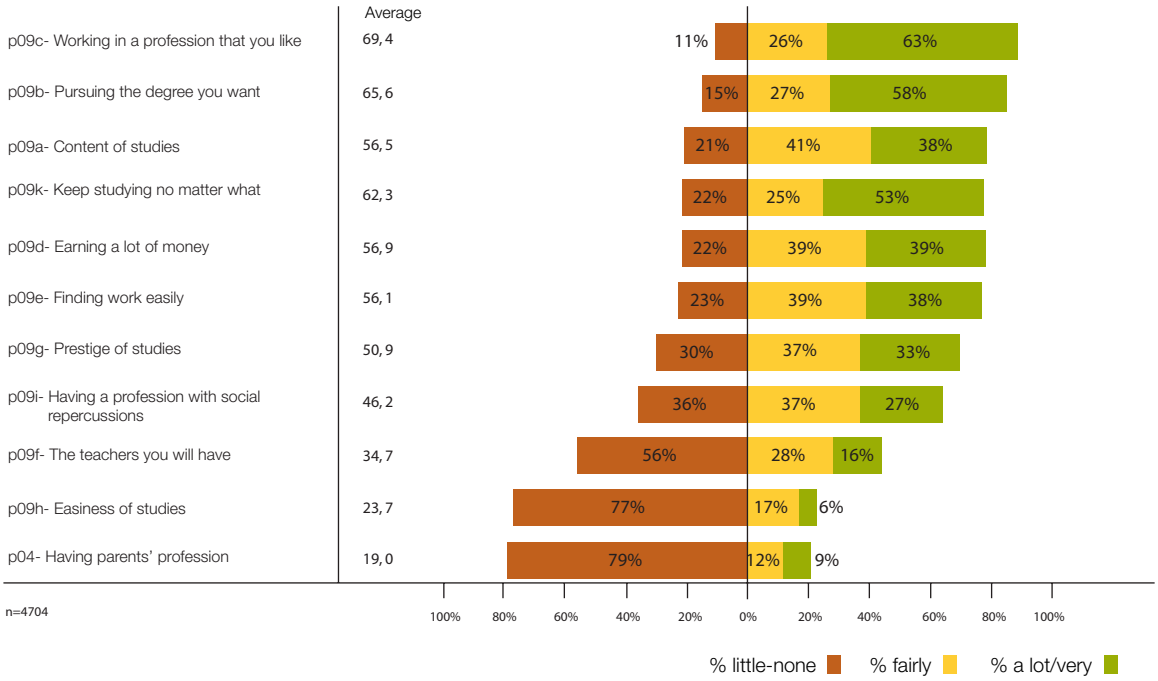


Figure 17: Importance of reasons in post-secondary choice

According to the results, the main factors that motivated students' post-secondary course of study, in both secondary school (future decision) and baccalaureate students (past decision), was their professional future (working in their desired profession, pursuing the major they want) and continuing the content of the studies (I like it and I'm good at it).

Bearing these responses in mind, the motivations for choosing a given course of study can be grouped as follows:

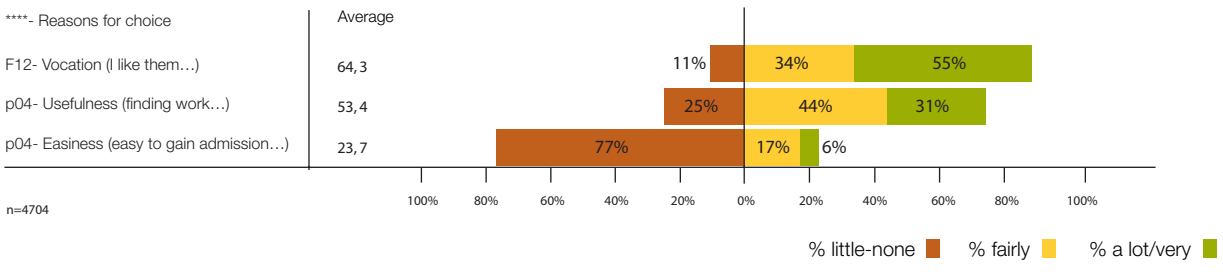


Figure 18: Students' motivation in post-secondary choice of study - Overall

That is, most students choose a given course of study because of vocation and, secondarily, for practical reasons. A small minority admits that their future course of studies is easy for them.

However, these responses may be heavily conditioned by what is regarded as socially correct or acceptable, since in any culturally close group the responses to given question are modulated within a shared behavioral framework.

In the differential synthesis, the results provide new information:

	Science and technology baccalaureate and vocational program	Not sure	Other studies	Total
****- Reasons for choice				
F12- Vocation (I like them…)	95	79	90	90
F13- Usefulness (finding work…)	87	77	85	85
F4- Easiness (easy to gain admission…)	16	23	27	23
Number of people	865	418	1355	2666

Percentage fairly-a lot-very

Table 6: Students' motivation in post-secondary choice of study – Secondary school students

The responses are similar in baccalaureate students:

	Science and technology baccalaureate and vocational program	Not sure	Other studies	Total
****- Reasons for choice				
F12- Vocation (I like them…)	94	60	87	88
F13- Usefulness (finding work…)	62	60	62	62
F4- Easiness (easy to gain admission…)	15	30	31	24
Number of people	931	154	925	2038

Percentage fairly-a lot-very

Table 7: Students' motivation in post-secondary choice of study –Baccalaureate students

If we analyze this information on STM versus other students, we can see that even though the vocational and usefulness motives are the most highly rated, they are not key factors when choosing an STM course of study. In contrast, **the ease of studies is a differential factor among STM and non-STM students**, since the percentage of students who cite this reason in the groups of undecided students and other students is almost double that of the group of STM students.

4.2.2.1.2.2 Influences and pressures in the choice

In order to better understand students' decision-making process, we asked about the influences the students had received when making their decision:

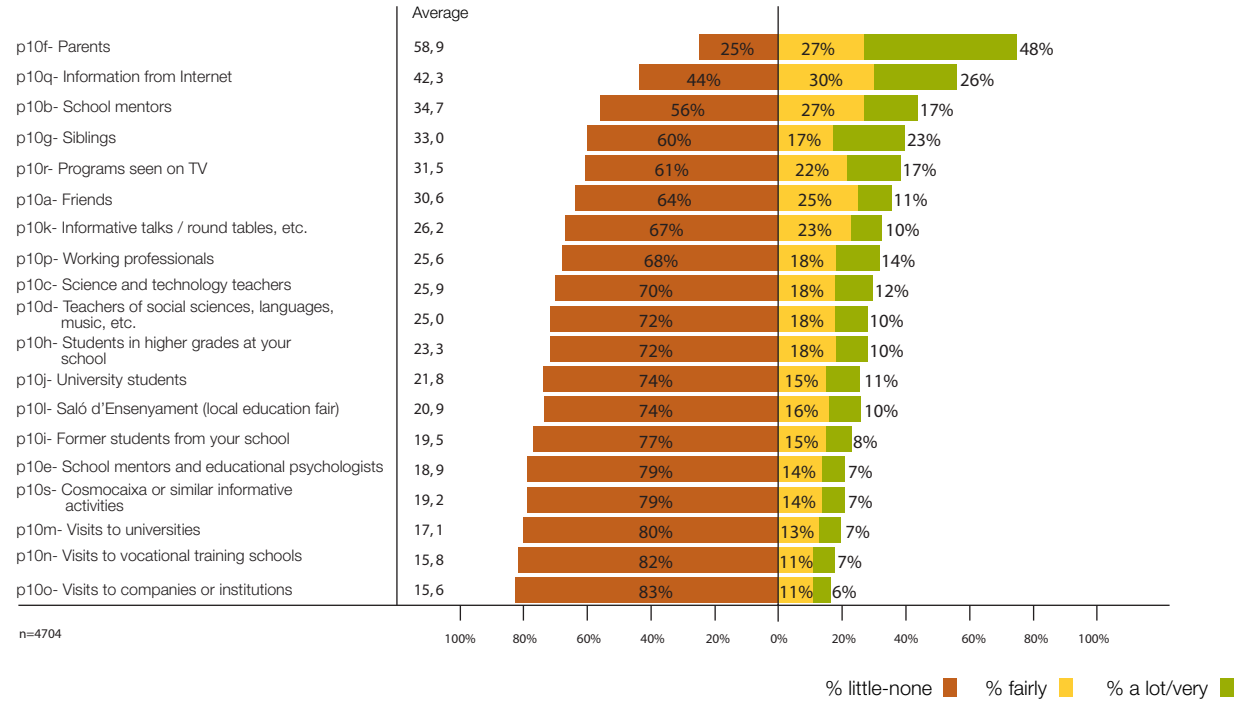


Figure 19: Influences in the post-secondary choice

Below we shown the aforementioned influences grouped according to the factorial analysis:

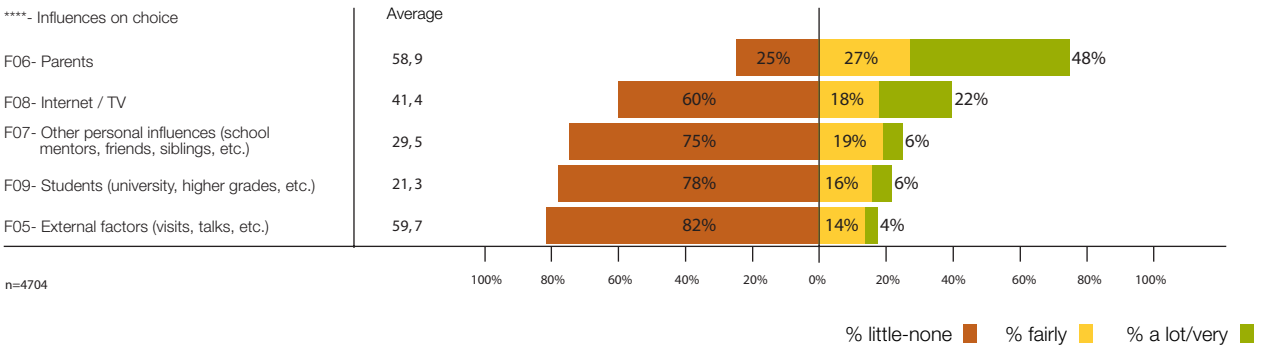


Figure 20: Influences in the post-secondary choice - Grouping

From the graph above we can see how the factors that influence the students the most when deciding what to do after secondary school are their parents, followed by the information they get on the Internet and from their teachers at school. Friends and siblings, whom we assumed would be the most influential, come in last.

If we analyze this by students who are currently in secondary school, segmented by the course of study chosen, we find:

	Science and technology baccalaureate and vocational program	Not sure	Other studies	Total
****- Influences on choice				
F08- Internet / TV	50	42	49	48
F05- External factors (visits, talks, etc.)	20	18	21	21
F07- Other personal influences (school mentors, friends, siblings, etc.)	29	27	32	30
F06- Parents	80	77	83	81
F09- Students (university, higher grades, etc.)	22	21	27	24
Number of people	865	418	1355	2666

Percentage fairly-a lot-very

Table 8: Influences in the post-secondary choice – Secondary school only

If we only consider the responses from students who are already in baccalaureate, also segmented by course of study chosen, who indicate which influences were the most important when choosing their course of study, we find the following results:

	Science and technology baccalaureate and vocational program	Not sure	Other studies	Total
****- Influences on choice				
F08-- Internet / TV	33	22	27	29
F07- Other personal influences (school mentors, friends, siblings, etc.)	19	18	18	19
F01- External factors (visits, talks, etc.)	14	12	19	15
F09- Students (university, higher grades, etc.)	18	16	21	19
F06- Parents	66	67	70	68
Number of people	931	154	925	2038

Percentage fairly-a lot-very

Table 9: Influences in the post-secondary choice – Baccalaureate only

As we can see, the influences in the post-secondary school decision are not a differential factor among the different groups. Nonetheless, we should bear them in mind when designing and planning initiatives aimed at encouraging vocations in either STM or other fields.

With regard to **pressure to choose courses of study that the students do not want to pursue**, the results were as follows:

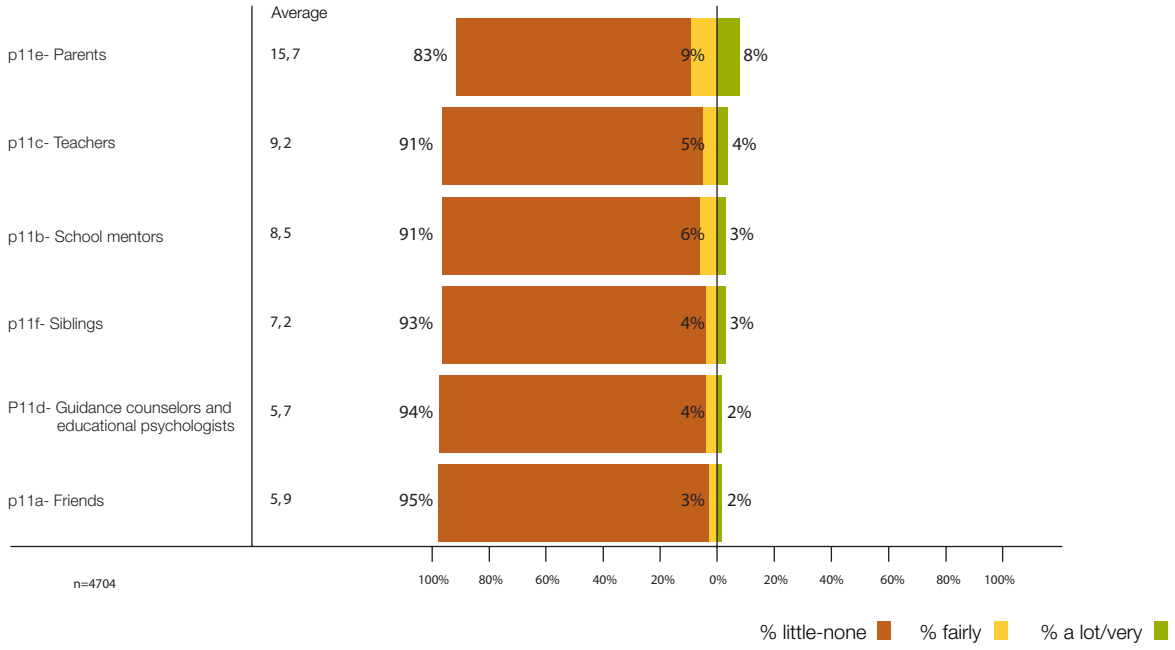


Figure 21: Pressure to pursue undesired post-secondary courses of study

We can see that the students do not feel pressured to choose courses of study they do not want to pursue. Just as in the previous case, the factor that can bear the most influence on changes in the choice and choosing an undesired course of study are the parents.

4.2.2.1.2.3 Help wanted to make the decision

Although it is true that, according to the results above, the vast majority of students who reach their third year of secondary school have already decided which course of study to pursue, there are factors that indicate that they could be helped to make the best decision on their future education:

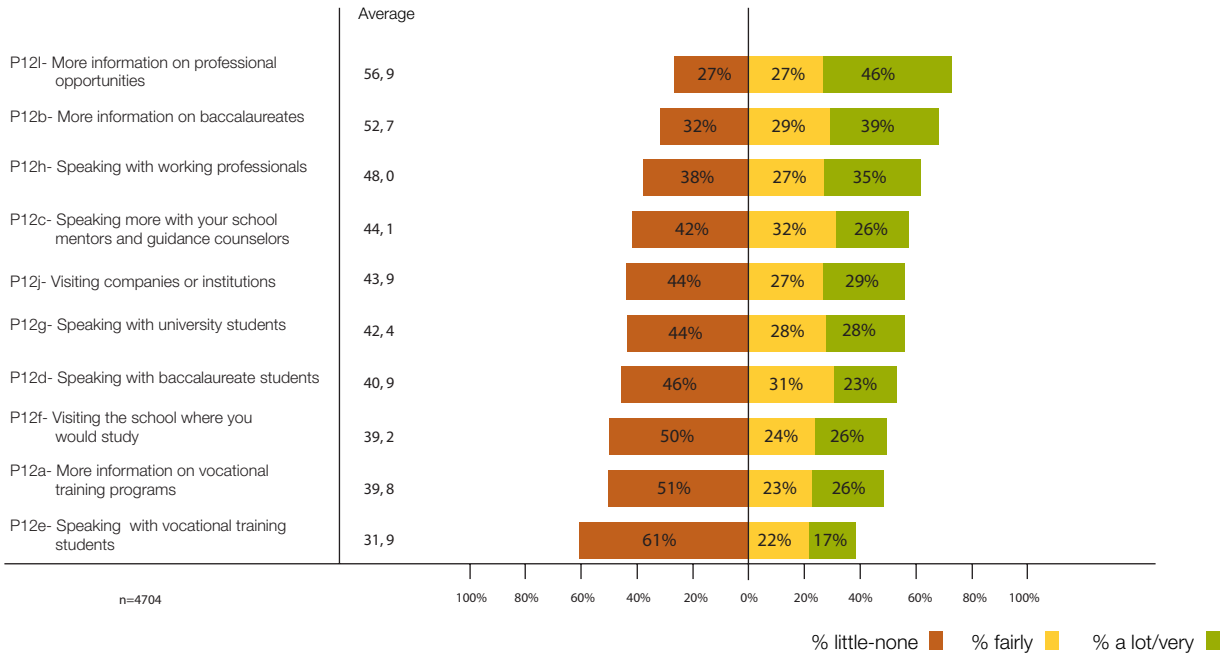


Figure 22: Help wanted to make the decision in secondary school

The help requested the most often to make the post-secondary school decision include: having more information about professional opportunities, having more information on baccalaureates and being able to talk to working professionals.

4.2.2.1.2.4 Classes and teachers

Given that the vocational factor is extremely important in making the decision, it is important to analyze students' perceptions of their classes and teachers in secondary school:

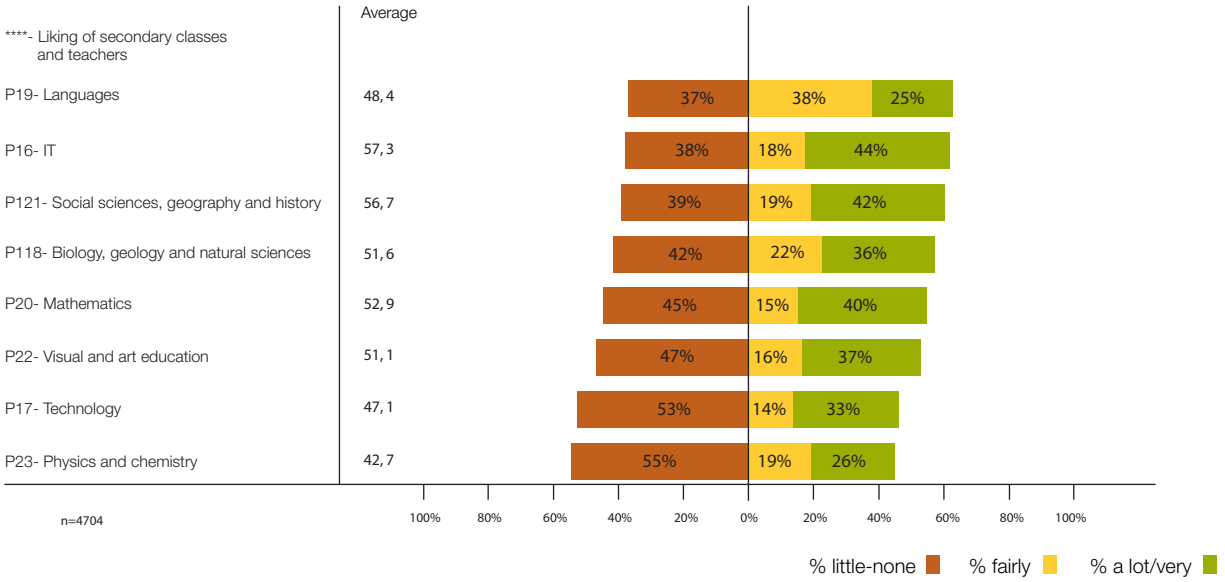


Figure 23: Liking of classes and teachers in secondary school

We can see that the classes and teachers within STM that the most students have rated as liking a lot are IT. Mathematics, which in the data analysis and analysis of practices stage was the subject that placed the most limits on boosting the number of STM students, is close to the level of biology, geology and the natural sciences. In contrast, technology, physics and chemistry were identified as the classes in which more work is needed to make them interesting to secondary school students.

The differential synthesis in secondary school confirms that students' liking of STM classes and teachers is a factor that determines whether a student will choose a course of study in STM:

	Science and technology baccalaureate and vocational program	Not sure	Other studies	Total
****- Liking of secondary classes and teachers				
F23- Physics and chemistry	69	42	30	45
F20- Mathematics	73	45	43	53
F18- Biology, geology and natural sciences	70	52	47	56
F17- Technology	60	48	42	49
F16- IT	66	64	63	64
F21- Social sciences, geography and history	61	52	62	60
F22- Visual and art education	47	52	55	52
F19- Languages	61	57	69	65
Number of people	865	418	1355	2666

Percentage fairly-a lot-very

Table 10: Liking of secondary school classes and teachers – Secondary school only

With regard to students' liking of the other classes and teachers, the differences are hardly significant or are insignificant.

The information on baccalaureate students is similar to that of secondary school students, although there is a greater difference in language and humanities classes and teachers:

	Science and technology baccalaureate and vocational program	Not sure	Other studies	Total
****- Liking of secondary classes and teachers				
F23- Physics and chemistry	67	28	24	45
F20- Mathematics	75	38	42	57
F18- Biology, geology and natural sciences	74	56	47	60
F17- Technology	57	40	33	45
F16- IT	61	66	56	59
F22- Visual and art education	50	57	57	54
F21- Social sciences, geography and history	57	61	68	62
F19- Languages	55	45	67	60
Number of people	931	154	925	2038

Percentage fairly-a lot-very

Table 11: Liking of secondary school classes and teachers – Baccalaureate only

To conclude the questions regarding classes, we asked the students about the ones that they believed encouraged the most interest in engineering and IT:

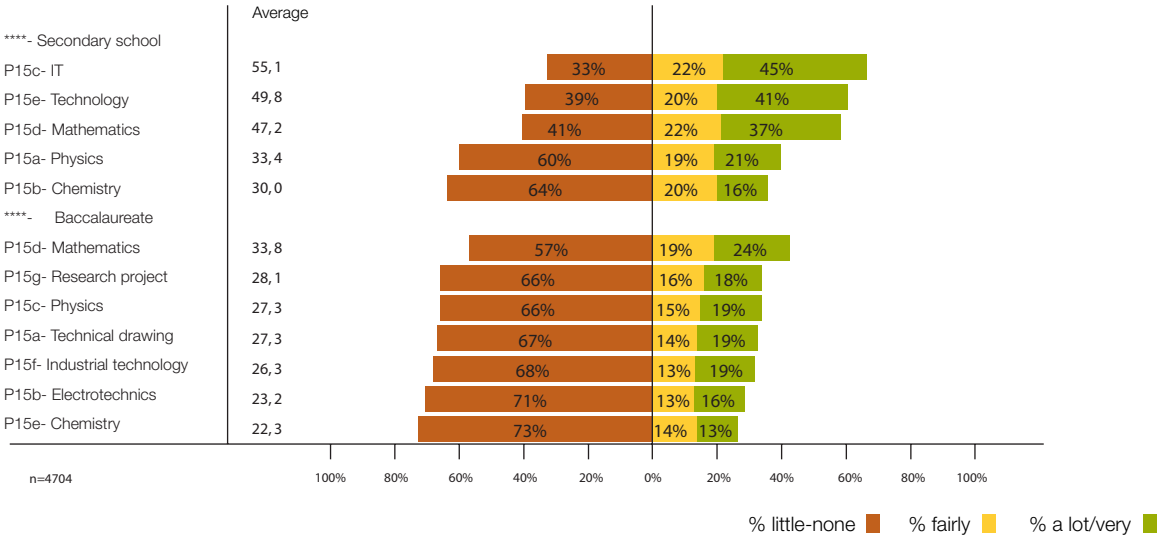


Figure 24: Ratings of classes and to what extent they promote engineering and IT

The differences between the responses in secondary school and baccalaureate were significant: while in secondary school IT and technology stand out, in baccalaureate mathematics and the research project stood out as the classes identified as having the most potential to encourage interest in engineering and IT.

4.2.2.1.2.5 *Academic record and performance*

When we asked students about their academic record, the overall results were:

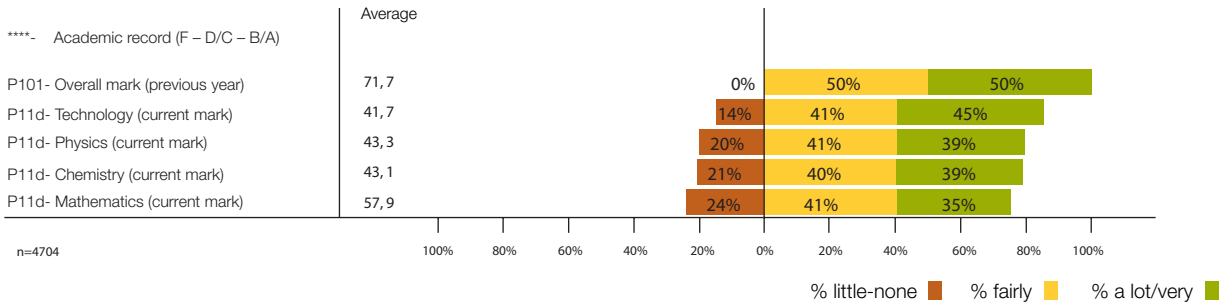


Figure 25: Students' academic record

The differential synthesis illustrates how the inclination towards STM studies is conditioned by good marks in the classes in this field:

	Science and technology baccalaureate and vocational program	Not sure	Other studies	Total
****- Academic record (A-B)				
F104- Chemistry (current mark)	59	30	25	38
F103- Physics (current mark)	55	34	25	38
F102- Mathematics (current mark)	53	26	23	33
F105- Technology (current mark)	62	38	35	45
F101- Overall mark (previous year)	65	38	39	47

Percentage fairly-a lot-very

Table 12: Academic record of secondary school students (Post-secondary school choice)

Fifty-nine percent of secondary school students who have decided to pursue a CF or science and technology baccalaureate have earned A's or B's in chemistry (considering their current grade), compared to only 25% of students pursuing other courses of study. This difference can be found in both STM classes and their overall academic record.

The situation in baccalaureate is similar:

	Science and technology baccalaureate and vocational program	Not sure	Other studies	Total
****- Academic record (A-B)				
F105- Technology (current mark)	60	35	35	47
F104- Chemistry (current mark)	49	20	29	41
F103- Physics (current mark)	48	24	29	41
F101- Overall grade (previous year)	63	32	46	53
F102- Mathematics (current mark)	42	26	36	38

Percentage fairly-a lot-very

Table 13: Academic record of baccalaureate students (Post-secondary school choice)

In baccalaureate, we can see that a good academic record makes it more likely for students to choose STM, while students with lower academic performance have more doubts when choosing what to study.

4.2.2.1.2.6 *Relationship with ICT*

Below are the results when we asked students about their personal IT skills and their perception of the IT skills of the people around them:

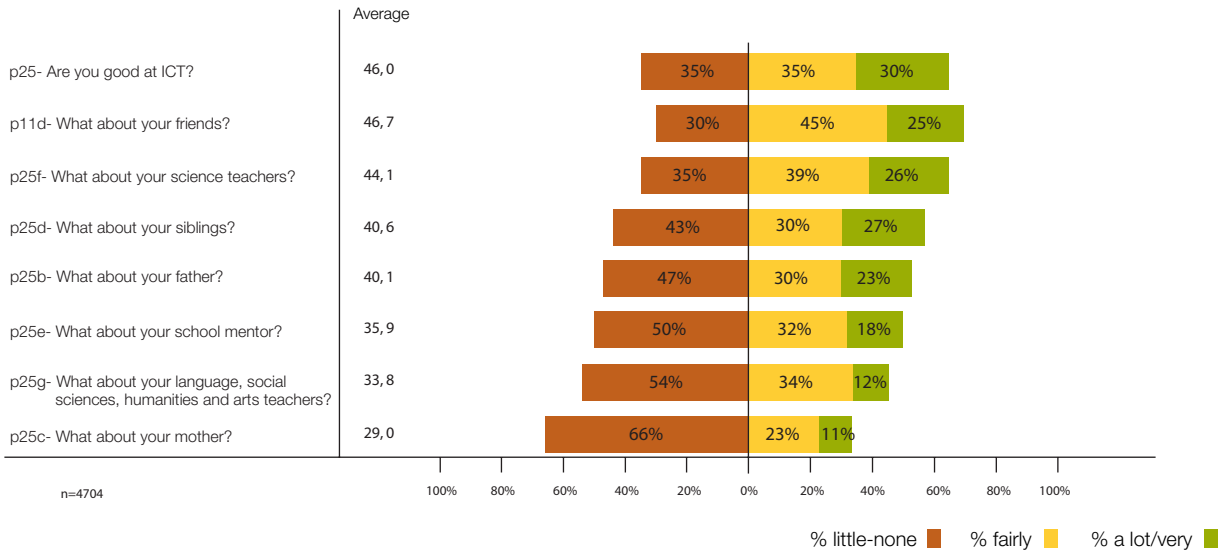


Figure 26: Personal IT skills and IT skills of people around them

What especially stands out is the students' perception of the lack of ICT use among their mothers, most of whom are regarded as not very skilled or unskilled in the use of ICT.

Additionally, students were asked about how they use ICT, with the following responses:

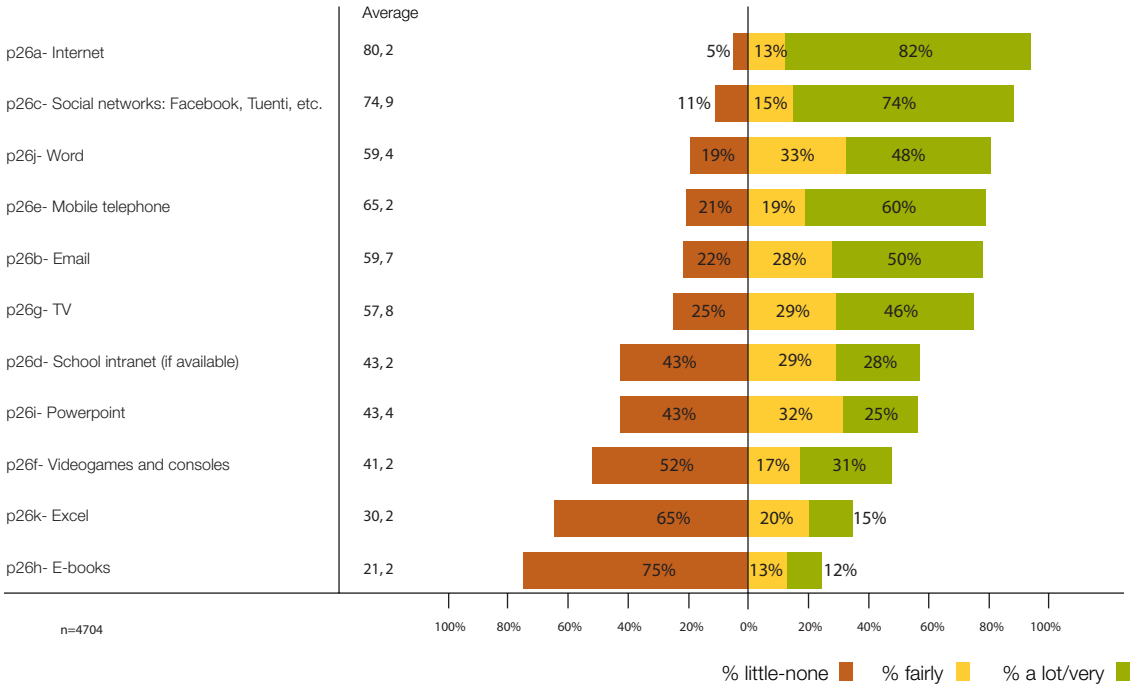


Figure 27: Personal use of ICT

The students primarily interact with ICT through their general use of the Internet and the social media.

The results grouped by factorial analysis are:

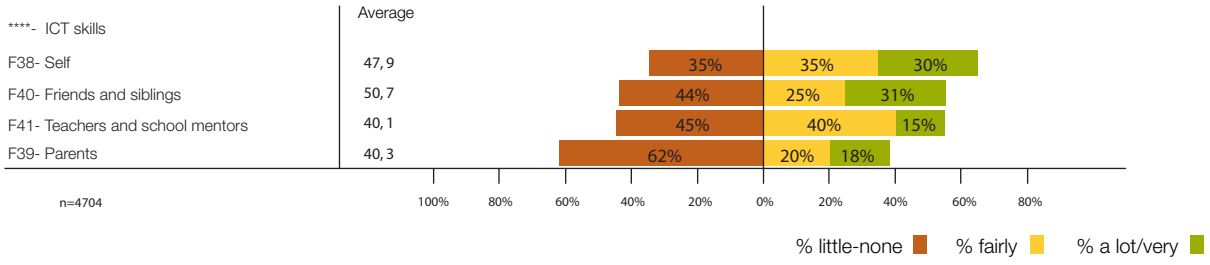


Figure 28: Skill with ICT

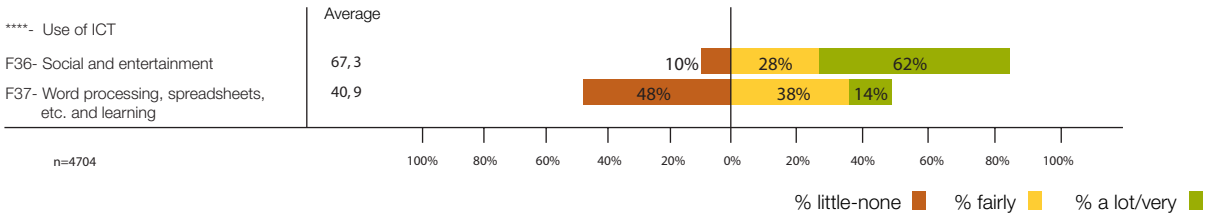


Figure 29: Use of ICT

If we examine the results of the differential synthesis, we get the following results:

	Science and technology baccalaureate and vocational program	Not sure	Other studies	Total
****- ICT skills				
F38- Self	75	62	62	66
P39- Parents	45	35	40	41
F41- Teachers and school mentors	60	57	56	58
F40- Friends and siblings	56	55	53	54
****- Use of ICT				
F36- Social and entertainment	92	86	89	89
F37- Word processing, spreadsheets, etc. and learning	55	48	55	54
Number of people	865	418	1355	2666

Percentage fairly-a lot-very

Table 14: Skill and use of ICT– Secondary school students

	Science and technology baccalaureate and vocational program	Not sure	Other studies	Total
****- ICT skills				
F38- Self	69	56	59	63
P39- Parents	37	25	33	34
F40- Friends and siblings	59	50	57	58
F41- Teachers and school mentors	51	51	49	50
****- Use of ICT				
F37- Word processing, spreadsheets, etc. and learning	52	40	51	51
F36- Social and entertainment	91	87	90	90
Number of people	931	154	925	2038

Percentage fairly-a lot-very

Table 15: Skill and use of ICT– Baccalaureate students

Students' beliefs about their skill in using ICT are a differential factor between STM and non-STM students. The way students use ICT, mainly for social and entertainment purposes, is not an important factor in their choice of THE course of study.

4.2.2.1.3 *Image of Science, Technology and Mathematics*

Below we show students' picture of the degrees and professional opportunities in STM, where we distinguished between engineering and IT on the one hand and mathematics, physics and chemistry on the other.

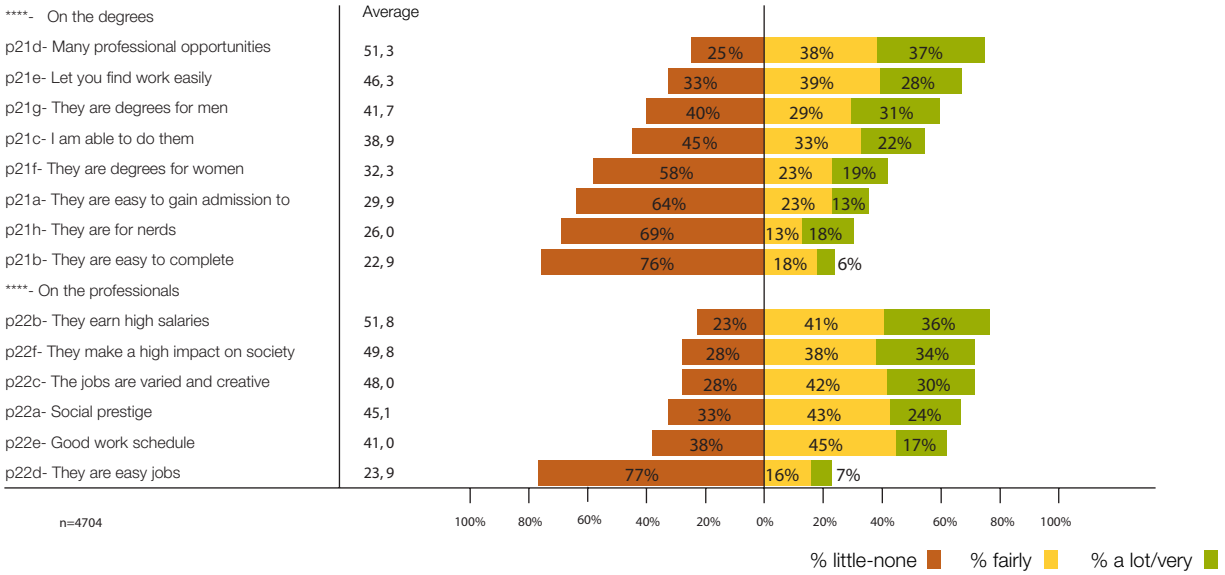


Figure 30: Image of engineering and IT

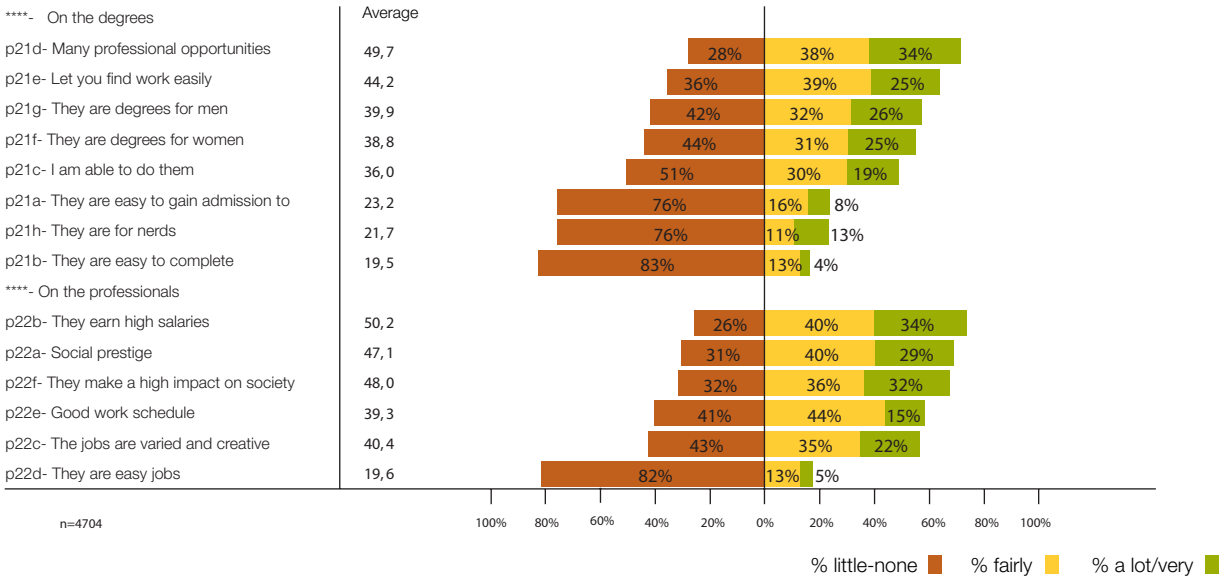


Figure 31: Image of mathematics, physics and chemistry

Even though students believe that STM degrees offer many professional opportunities which enable them to easily find work and earn high salaries, they also believe that these degrees are difficult to complete and they associate them with jobs that are not easy to perform. More than 60% of the students surveyed considered it very difficult to gain admission to STM programs, and more than 75% believe it is very difficult to complete them. One important figure worth highlighting is the fact that around 50% of the **respondents do not feel that they are capable of pursuing STM degrees**. This figure is 45% for engineering and IT and 51% for mathematics, physics and chemistry.

The marks needed to gain admittance into university degree programs in most of these fields are actually low. However, students seem to have internalized a vision of the difficulty surrounding everything about STM, so that they do not relate the question on the ease of gaining admittance to these programs with the marks required, if they are aware of this.

The results grouped in relation to the image of STM are as follows:

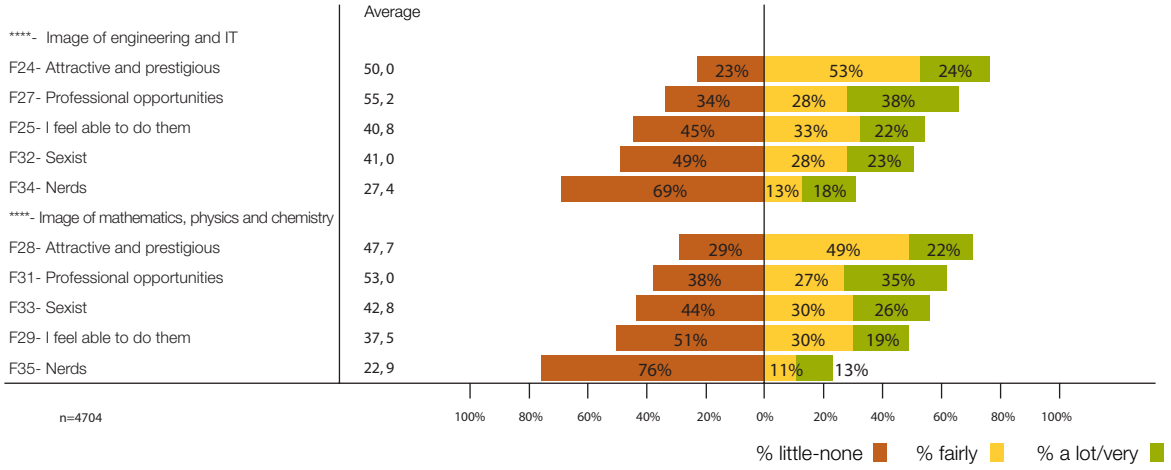


Figure 32: Image of STM degree programs

The results of the differential synthesis reveal the following:

	Science and technology baccalaureate and vocational program	Not sure	Other studies	Total
****- Image of engineering and IT				
F25- I feel able to do them	80	58	50	61
F27- Professional opportunities	75	62	61	66
F24- Attractive and prestigious	85	73	75	78
F32- Sexist	57	46	52	53
F34- Nerds	25	33	30	29
****- Image of mathematics, physics and chemistry				
F29- I feel able to do them	76	46	39	52
F31- Professional opportunities	75	60	64	67
F28- Attractive and prestigious	81	64	72	74
F33- Sexist	65	50	58	59
F35- Nerds	19	29	22	22
Number of people	865	418	1355	2666

Percentage fairly-a lot-very

Table 16: Image of STM degree programs – Secondary school students

Even though we can see differences between STM and non-STM students in the majority of factors analyzed, what stands out particularly is their **self-perceived capacity**. While the overall results show that around 50% of the students do not view themselves as capable of pursuing STM degrees, we can now see how this is the most prominent differential factor among STM and non-STM students. **Failure to choose STM studies** is determined by **students' perceptions that they will be unable** to successfully complete these courses of study.

This closes the circle of the liking of subjects and teachers and information from the academic record. STM students are the ones that respond "I like them", "I'm good at them" and "I feel able to do them" regarding STM classes and studies.

Another important factor to bear in mind is the negative view of gender in relation to women and technology, especially among STM students. On the other hand, other stereotypes such as that idea that STM professions are for "nerds" did not arise.

The results for the baccalaureate students are similar to those for the secondary school students:

	Science and technology baccalaureate and vocational program	Not sure	Other studies	Total
****- Image of engineering and IT				
F25- I feel able to do them	64	41	28	47
F27- Professional opportunities	73	50	58	65
F24- Attractive and prestigious	81	65	71	75
F32- Sexist	51	47	44	48
F34- Nerds	33	31	34	33
****- Image of mathematics, physics and chemistry				
F29- I feel able to do them	63	25	27	44
F28- Attractive and prestigious	72	54	64	67
F31- Professional opportunities	58	51	53	55
F33- Sexist	55	49	51	53
F35- Nerds	28	25	27	27
Number of people	931	154	925	2038

Percentage fairly-a lot-very

Table 17: Image of STM degree programs – baccalaureate only

The baccalaureate students who decided to pursue a course of study in STM, just like those in secondary school, are the ones that most believe they are capable of completing degrees like engineering and IT, or mathematics, physics or chemistry. However, it is interesting that STM students' perception of their ability to pursue this kind of degree drops 10 to 15 percentage points in baccalaureate compared to secondary school.

In short, the perception of STM careers as attractive and high-prestige drops from secondary school to baccalaureate. The students who are not sure of what they want to study are the ones who view these degrees as the least attractive and prestigious.

We detected negative gender stereotypes/models regarding women and technology; however, we did not perceive other kinds of stereotypes (degrees for "nerds").

Most of the students have a positive perception of STM careers and professionals. Despite this, there is a large percentage of students who are unaware of this reality: in baccalaureate, 50% of the students who are not sure what to study believe that engineering and IT have little to no professional future, while only 58% of baccalaureate students who have chosen the science-technology track believe that careers in mathematics, physics and chemistry have promising job outlooks.

4.2.2.1.4 Secondary school students – Other influential factors

Following the conceptual framework of analysis defined for this study, we now present the results of the choice of post-secondary studies obtained from non-individual factors, which we have grouped into sociodemographic factors and school factors (kind of school).

Below are the results for secondary school students:

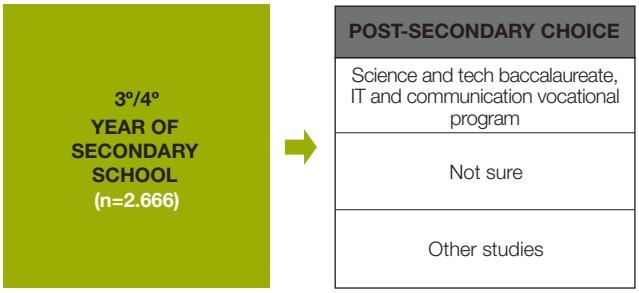


Figure 33: Sample of students analyzed

4.2.2.1.4.1 *Influence of sociodemographic factors*

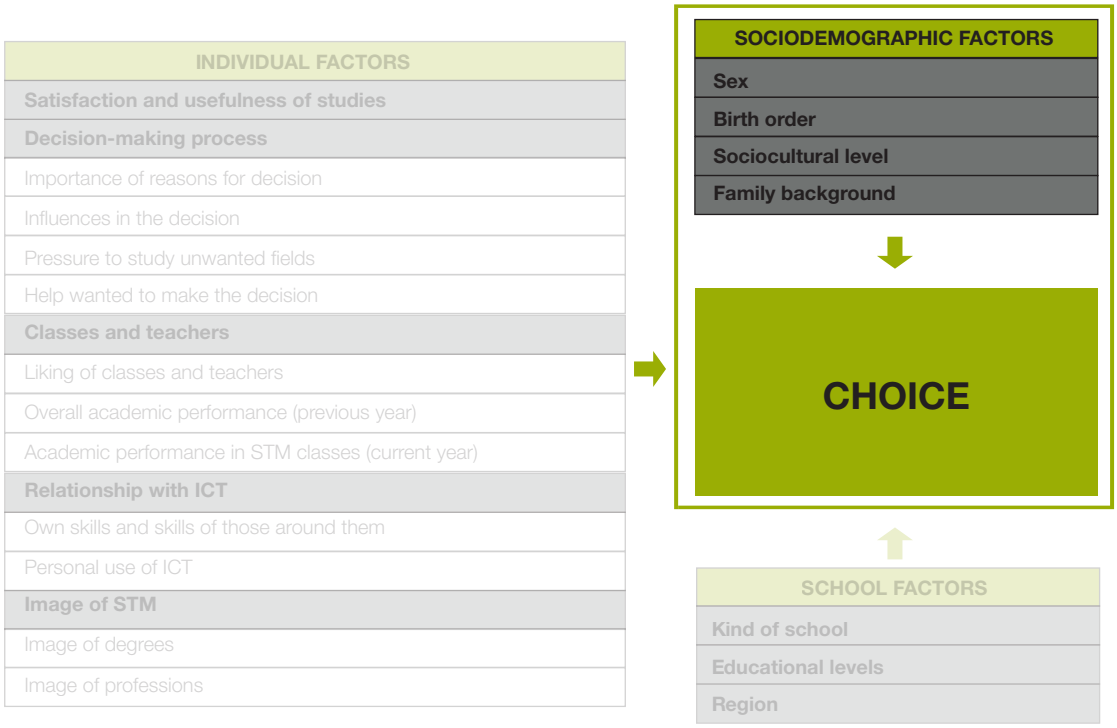


Figure 34: Conceptual framework – Factors analyzed: sociodemographic

4.2.2.1.4.1.1 *Figure 34: Conceptual framework – Factors analyzed: sociodemographic*

	Bach y CF CyT	No lo tengo nada claro	Otros estudios	Total	Número de personas
Total secondary school	33	16	51	100	2638
Males	40	17	43	100	1279
Females	26	15	59	100	1325

Values expressed in percentage of people
The colors show significant differences compared to the total

Table 18: Composition by SEX

This first table shows that there is a 14-percentage point difference between males and females when choosing a chemistry/physics or science and technology baccalaureate. Females are less likely to choose studies related to STM.

Note that the sample analyzed encompasses 2,638 secondary school students, when the sample actually surveyed encompassed 2,666 secondary school students. This difference is due to the fact that there are students who did not answer the gender questions, and we were unable to take their responses into account when making this segmentation.

4.2.2.1.4.1.2 *Breakdown of results – Composition by siblings*

	Science and technology baccalaureate and vocational program	Not sure	Other studies	Total	Number of people
Total males	40	17	43	100	1279
Only child (son)	37	18	45	100	170
Oldest son	44	15	41	100	490
Middle son	33	18	49	100	135
Youngest son	38	18	44	100	459

Values expressed in percentage of people
The colors show significant differences compared to the total

Table 19: Composition by SIBLINGS – Males

	Science and technology baccalaureate and vocational program	Not sure	Other studies	Total	Number of people
Total females	26	25	59	100	1325
Only child (daughter)	28	10	62	100	170
Oldest daughter	29	15	56	100	449
Middle daughter	23	16	61	100	191
Youngest daughter	25	16	59	100	498

Values expressed in percentage of people
The colors show significant differences compared to the total

Table 20: Composition by SIBLINGS – Females

The influence of having siblings, as well as the respondents' birth place among their siblings, does not seem to have a significant effect on the choice of STM studies. Only for middle sons can we see a difference that might be considered significant.

4.2.2.1.4.1.3 Breakdown of results – Composition by family sociocultural level

	Science and technology baccalaureate and vocational program	Not sure	Other studies	Total	Number of people
Total secondary school	33	16	51	100	2638
High	44	12	44	100	174
Medium-high	34	14	52	100	569
Medium	38	14	48	100	794
Medium-low	29	17	54	100	595
Low	24	19	57	100	258

Values expressed in percentage of people
The colors show significant differences compared to the total

Table 21: Composition by FAMILY SOCIOCULTURAL LEVEL

The family sociocultural level is a decisive factor in the choice of STM studies. There is up to 20 percentage points of difference between the highest and lowest levels.

The combination of this factor with gender is devastating for females from families with a low sociocultural level:

	Science and technology baccalaureate and vocational program	Not sure	Other studies	Total	Number of people
Total males	40	17	43	100	1279
High	51	17	32	100	83
Medium-high	40	15	45	100	287
Medium	44	15	41	100	382
Medium-low	37	19	44	100	292
Low	30	19	51	100	120

Values expressed in percentage of people
The colors show significant differences compared to the total

Table 22: Composition by FAMILY SOCIOCULTURAL LEVEL – Males

	Science and technology baccalaureate and vocational program	Not sure	Other studies	Total	Number of people
Total females	26	15	59	100	1325
High	38	8	54	100	90
Medium-high	28	13	59	100	281
Medium	32	14	54	100	409
Medium-low	21	16	63	100	303
Low	20	19	61	100	137

Values expressed in percentage of people
The colors show significant differences compared to the total

Table 23: Composition by FAMILY SOCIOCULTURAL LEVEL – Females

There is a difference of up to 31 percentage points in the choice of STM studies between males from families with a high sociocultural level and females from families with a low sociocultural level.

These results tell us that there is room to improve the number of STM vocations by spearheading initiatives that respond to the needs and particularities of these groups.

4.2.2.1.4.1.4 Breakdown of results – Composition by family background

	Science and technology baccalaureate and vocational program	Not sure	Other studies	Total	Number of people
Total males	33	16	51	100	2638
Both from Catalonia	34	15	51	100	1212
Mixed Catalonia or Spain	35	14	51	100	697
Mixed national-foreigner	29	17	54	100	166
Foreigners high level	40	9	51	100	136
Foreigners low level	24	24	52	100	285

Values expressed in percentage of people
The colors show significant differences compared to the total

Table 24: Composition by FAMILY BACKGROUND

However, family background is not a differential factor. Only in the case of foreigners, when the sociocultural level is also taken into account, do we once again see the differences noted in the previous point.

The breakdown by gender shows the same results:

	Science and technology baccalaureate and vocational program	Not sure	Other studies	Total	Number of people
Total males	40	17	43	100	1279
Both from Catalonia	40	17	43	100	571
Mixed Catalonia or Spain	41	14	45	100	350
Mixed national-foreigner	39	19	42	100	90
Foreigners high level	64	8	28	100	61
Foreigners low level	32	27	41	100	140

Values expressed in percentage of people
The colors show significant differences compared to the total

Table 25: Composition by FAMILY BACKGROUND – Males

	Science and technology baccalaureate and vocational program	Not sure	Other studies	Total	Number of people
Total females	26	15	59	100	1325
Both from Catalonia	29	13	58	100	639
Mixed Catalonia or Spain	29	15	56	100	344
Mixed national-foreigner	16	16	68	100	75
Foreigners high level	21	9	70	100	75
Foreigners low level	17	21	62	100	144

Values expressed in percentage of people
The colors show significant differences compared to the total

Table 26: Composition by FAMILY BACKGROUND – Females

4.2.2.1.4.2 Influence by kind of school

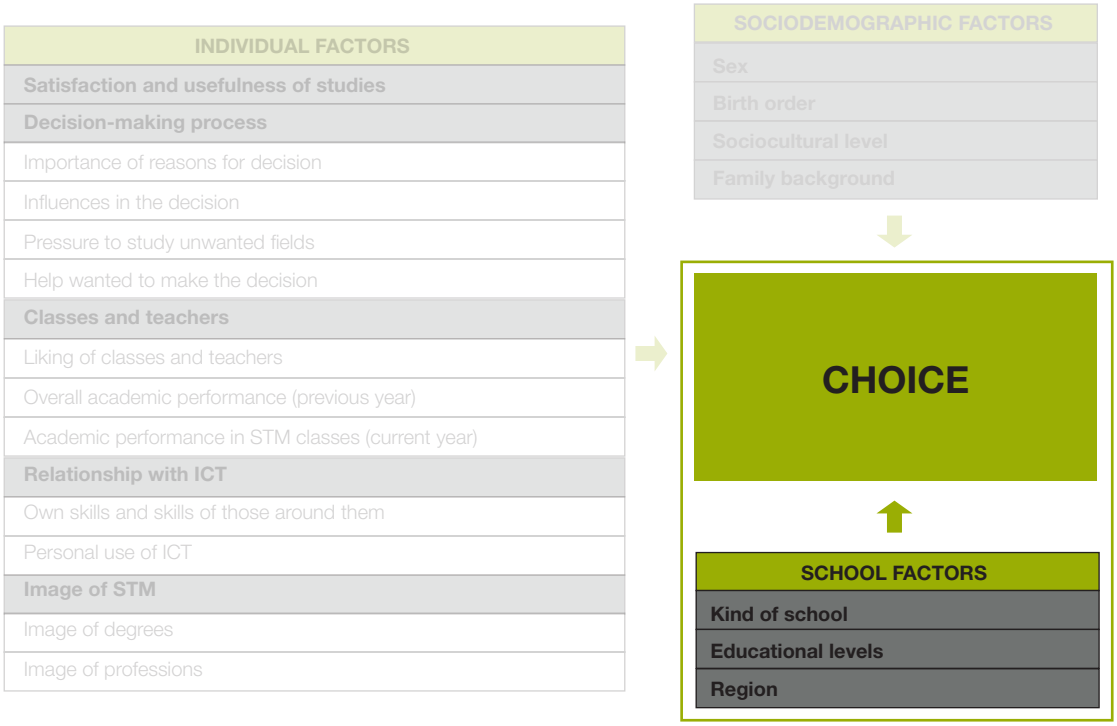


Figure 35: Conceptual framework – Factors analyzed: School

4.2.2.1.4.2.1 Breakdown of results – Composition by kind of school, region and educational levels

	Science and technology baccalaureate and vocational program	Not sure	Other studies	Total	Number of people
Total secondary school	33	16	51	100	2638
Public A	33	18	49	100	479
Public B	32	16	52	100	1007
Public C	30	15	55	100	320
Private A	35	15	50	100	201
Private B	35	15	50	100	631

Values expressed in percentage of people
The colors show significant differences compared to the total

Table 27: Composition by KIND OF SCHOOL

	Science and technology baccalaureate and vocational program	Not sure	Other studies	Total	Number of people
Total ESO	33	16	51	100	2638
Barcelona	32	17	51	100	964
Girona	30	15	55	100	351
Alt Pirineu y Aran	31	18	51	100	213
Lleida	34	14	52	100	271
Cataluña Central	37	17	46	100	179
Camp de Tarragona	31	13	56	100	326
Terres de l'Ebre	37	16	47	100	334

Values expressed in percentage of people
The colors show significant differences compared to the total

Table 28: Composition by REGION OF THE SCHOOL

	Science and technology baccalaureate and vocational program	Not sure	Other studies	Total	Number of people
Total ESO	33	16	51	100	2638
Pre-K, primary, secondary and baccalaureate	36	14	50	100	781
Secondary and baccalaureate	31	17	52	100	445
Secondary, baccalaureate and vocational training	32	16	52	100	1412

Values expressed in percentage of people
The colors show significant differences compared to the total

Table 29: Composition by EDUCATIONAL LEVELS AT THE SCHOOL

We can glean from the study that the characteristics of the school bear very little influence on secondary school students' decision to choose STM studies. The differences shown by the results of kind of school, region and educational level of the school are minimal.

4.2.2.1.5 *Baccalaureate students – Other influential factors*

Below are the results for baccalaureate students:

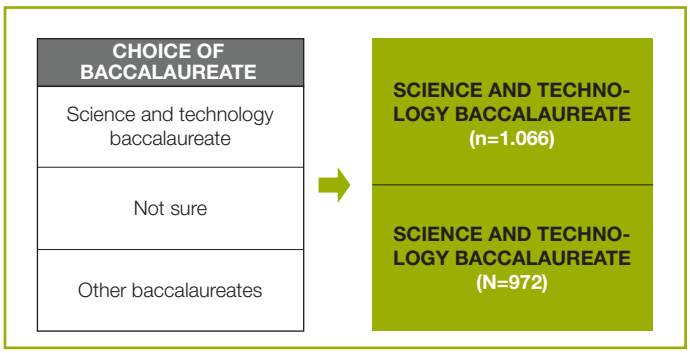


Figure 36: Sample of students analyzed

4.2.2.1.5.1 *Influence of sociodemographic factors*

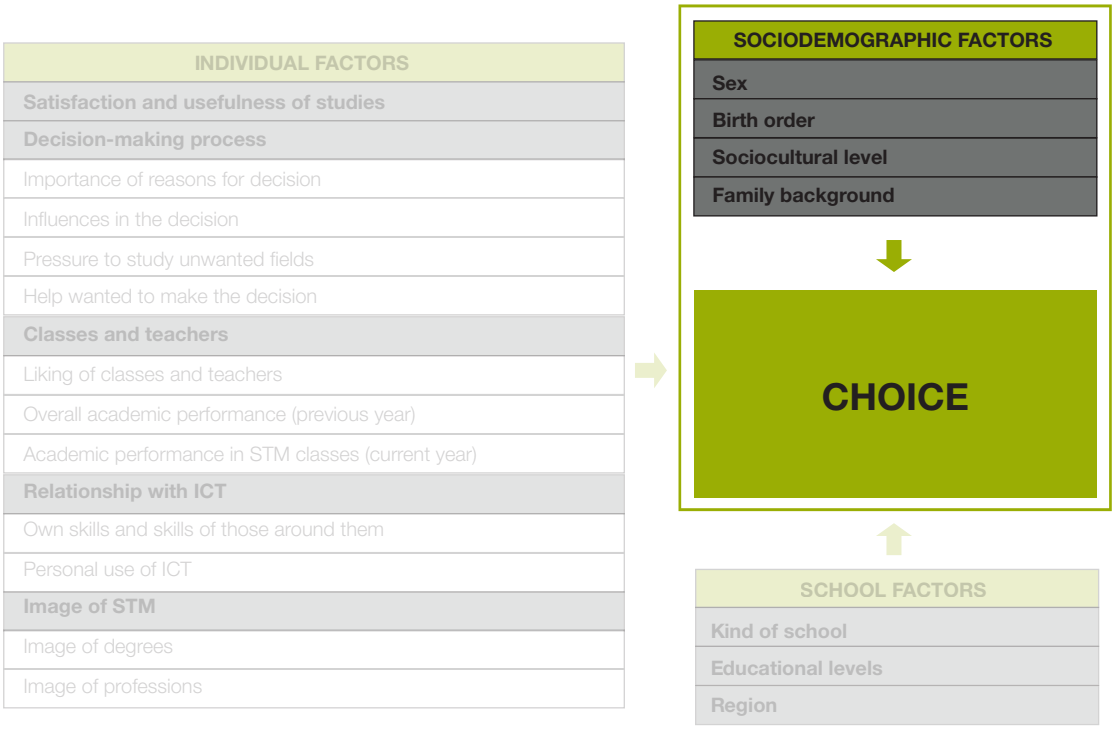


Figure 37: Conceptual framework – Factors analyzed: sociodemographic

4.2.2.1.5.1.1 Breakdown of results – Composition by gender

	Science and technology baccalaureate and vocational program	Not sure	Other studies	Total	Number of people
Total baccalaureate	46	8	46	100	2010
Males	55	9	36	100	860
Females	39	7	54	100	1110

Values expressed in percentage of people
The colors show significant differences compared to the total

Table 30: Composition by SEX

This first graph shows that there is a 16-percentage point difference between males and females when choosing a chemistry/physics or science and technology baccalaureate. Females are less likely to choose studies related to STM. This figure concurs with the information on secondary school students.

Note that the sample analyzed encompasses 2,010 baccalaureate students, when the sample actually surveyed encompassed 2,038 baccalaureate students. This difference is due to the fact that there are students who did not answer the gender questions, and we were unable to take their responses into account when making this segmentation.

4.2.2.1.5.1.2 Breakdown of results – Composition by siblings

	Science and technology baccalaureate and vocational program	Not sure	Other studies	Total	Number of people
Total males	55	9	36	100	860
Only child (son)	51	8	41	100	103
Oldest son	56	10	34	100	367
Middle son	54	8	38	100	84
Youngest son	55	8	37	100	295

Values expressed in percentage of people
The colors show significant differences compared to the total

Table 31: Composition by SIBLINGS – Males

	Science and technology baccalaureate and vocational program	Not sure	Other studies	Total	Number of people
Total females	39	7	54	100	1110
Only child (daughter)	41	3	56	100	172
Oldest daughter	41	6	53	100	389
Middle daughter	30	10	60	100	124
Youngest daughter	39	7	54	100	411

Values expressed in percentage of people
The colors show significant differences compared to the total

Table 32: Composition by SIBLINGS – Females

Once again, as seen in the results for secondary school students, generally speaking the influence of having siblings and birth order does not seem significant. We should note the case of middle sisters, which should be analyzed in greater depth and with a larger sample to determine whether this is a factor that influences the choice of STM studies.

4.2.2.1.5.1.3 Breakdown of results – Composition by family sociocultural level

	Science and technology baccalaureate and vocational program	Not sure	Other studies	Total	Number of people
Tota Chicos	46	8	46	100	2010
High	44	9	47	100	140
Medium-high	47	8	45	100	433
Medium	51	5	44	100	661
Medium-low	44	8	48	100	485
Low	43	9	48	100	145

Values expressed in percentage of people
The colors show significant differences compared to the total

Table 33: Composition by FAMILY SOCIOCULTURAL LEVEL

In baccalaureate, the influence of the family's sociocultural level is no longer significant in most cases, since the choice was made back in the transition from secondary school.

4.2.2.1.5.1.4 *Breakdown of results – Composition by family background*

	Science and technology baccalaureate and vocational program	Not sure	Other studies	Total	Number of people
Total baccalaureate	46	8	46	100	2310
Both from Catalonia	46	7	47	100	1083
Mixed Catalonia or Spain	46	7	47	100	588
Mixed national-foreigner	42	7	51	100	97
Foreigners high level	51	13	36	100	55
Foreigners low level	49	13	38	100	100

Values expressed in percentage of people
The colors show significant differences compared to the total

Table 34: Composition by FAMILY BACKGROUND

As seen in secondary school students, in baccalaureate the parents' background does not have a significant influence on students' choice of studies. Only in the case of foreigners, when the sociocultural level is also taken into account, do we see significant differences.

4.2.2.1.5.2 *Influence by kind of school*

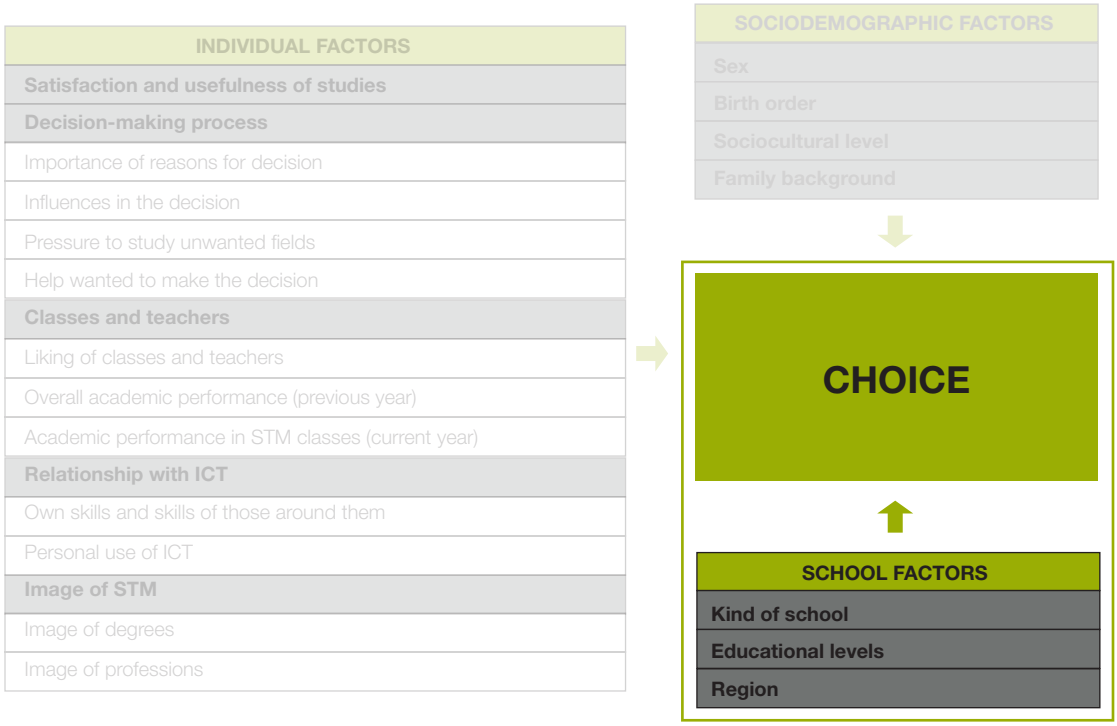


Figure 38: Conceptual framework – Factors analyzed: School

4.2.2.1.5.2.1 Breakdown of results – Composition by kind of school, region and educational levels

	Science and technology baccalaureate and vocational program	Not sure	Other studies	Total	Number of people
Total baccalaureate	46	8	46	100	2010
Public A	49	7	44	100	334
Public B	45	8	47	100	711
Public C	47	12	41	100	93
Private A	51	6	43	100	330
Private B	44	7	49	100	542

Values expressed in percentage of people
The colors show significant differences compared to the total

Table 35: Composition by KIND OF SCHOOL

	Science and technology baccalaureate and vocational program	Not sure	Other studies	Total	Number of people
Total baccalaureate	46	8	46	100	2010
Barcelona	46	8	46	100	793
Girona	48	6	46	100	343
Alt Pirineu y Aran	45	10	45	100	197
Lleida	46	8	46	100	203
Cataluña Central	40	7	53	100	137
Camp de Tarragona	48	7	45	100	203
Terres de l'Ebre	46	11	43	100	134

Values expressed in percentage of people
The colors show significant differences compared to the total

Table 36: Composition by REGION OF THE SCHOOL

	Science and technology baccalaureate and vocational program	Not sure	Other studies	Total	Number of people
Total Bach.	46	8	46	100	2010
Pre-K, primary, secondary and baccalaureate	46	7	47	100	780
Secondary and baccalaureate	47	8	45	100	378
Secondary, baccalaureate and vocational training	46	8	46	100	852

Values expressed in percentage of people
The colors show significant differences compared to the total

Table 37: Composition by EDUCATIONAL LEVELS AT THE SCHOOL

According to this study, we can glean that the characteristics of the school has very little influence on baccalaureate students' choice of STM studies, just as with secondary school students. The differences shown by the results of kind of school, region and educational level of the school are minimal. By kind of school, again similar to secondary school students, students from type A schools tend to choose STM studies slightly more than students from other kinds of schools.

4.2.2.2 Choice of post-baccalaureate studies

The second strand of analysis in this study focuses on the decision-making process of students in science and technology baccalaureate in their post-baccalaureate course of study.

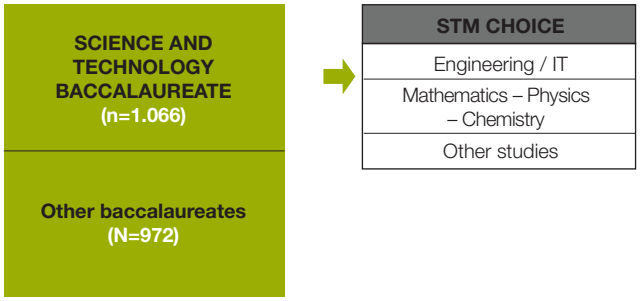


Figure 39: Sphere of results: Choice of post-baccalaureate studies by students in the science and technology baccalaureate

Similar to the analysis performed for the decision-making process on post-secondary studies, we reviewed the time the decision was made and the degree of confidence, as well as individual and sociodemographic factors and the characteristics of the school.

4.2.2.2.1 Time of decision-making and degree of confidence

Students in the science and technology baccalaureate surveyed on their future decision, told us:

PREFERENCE OF FUTURE STUDIES				
CONFIDENCE IN CHOICE	Engineering / IT	Mathematics – Physics – Chemistry	Other studies	Total
I'm sure	11,0%	2,0 %	22,2 %	35,2 %
I have several alternatives	11,8%	2,9 %	32,0 %	46,7%
I'm not sure	4,0%	2,0 %	12,1 %	18,1%
Total	26,8%	6,9%	66,3%	100%

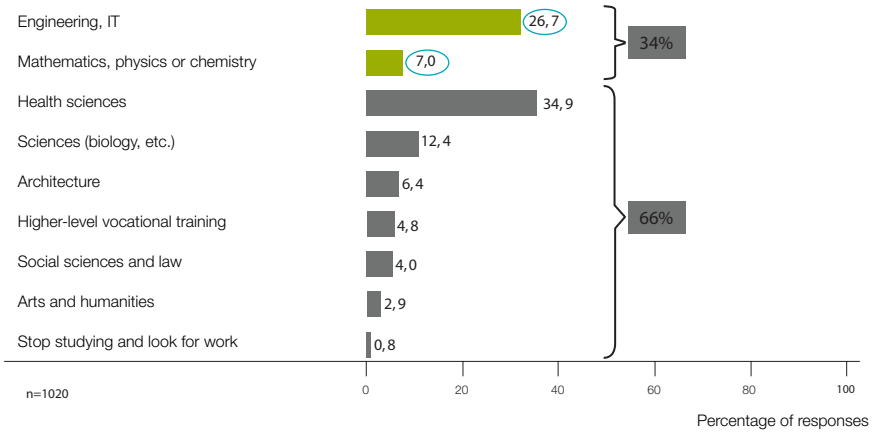
27% 7% 66%

Table 38: Choice of post-baccalaureate studies by confidence in the choice

According to this information provided by the students who are current pursuing a science and technology baccalaureate, only 27% prefer engineering or IT, although of this percentage around 4% of the students are not sure. In the case of mathematics, physics or chemistry degrees (henceforth MPC), the percentage of students who are thinking about or sure of pursuing these degrees drops to 7%.

This lower degree of choosing STM can be seen in the shift from secondary school to baccalaureate, and it drops drastically from the science and technology baccalaureate to engineering and IT, and especially to degrees in mathematics, physics or chemistry. Sixty-six percent of students pursuing a science and technology baccalaureate choose other degrees, as outlined below.

Below we show the distribution of students by the post-baccalaureate studies chosen, as well as the evolution of this choice in the 1st and 2nd year of baccalaureate:



	Science and technology baccalaureate and vocational program	Not sure	Other studies	Total	Number of people
Total science and technology baccalaureate	27	7	66	100	978
1st year of baccalaureate	24	8	68	100	511
2nd year of baccalaureate	30	6	64	100	467

Values expressed in percentage of people.
The colors show significant differences compared to the total.

Figure 40: Choice of post-baccalaureate studies – Students in the science and technology baccalaureate

In the science and technology baccalaureate, the choice is practically made; it is very difficult for a person who wanted to become a doctor to end up studying mechanical engineering. However, a small percentage of students who believe that they will pursue other studies in the 1st year of baccalaureate change their minds in the second year of baccalaureate and decide to pursue STM studies.

In the following sections on results, the choice of studies and the degree of confidence in this choice will be applied as a segmentation variable. Thus, we considered three groups of students:

- **Engineering and IT**
- **Mathematics, Physics and Chemistry**
- **Other studies**

4.2.2.2.2 *Influence of individual factors*

Below are the results of the differential synthesis grouped by the individual factors analyzed.

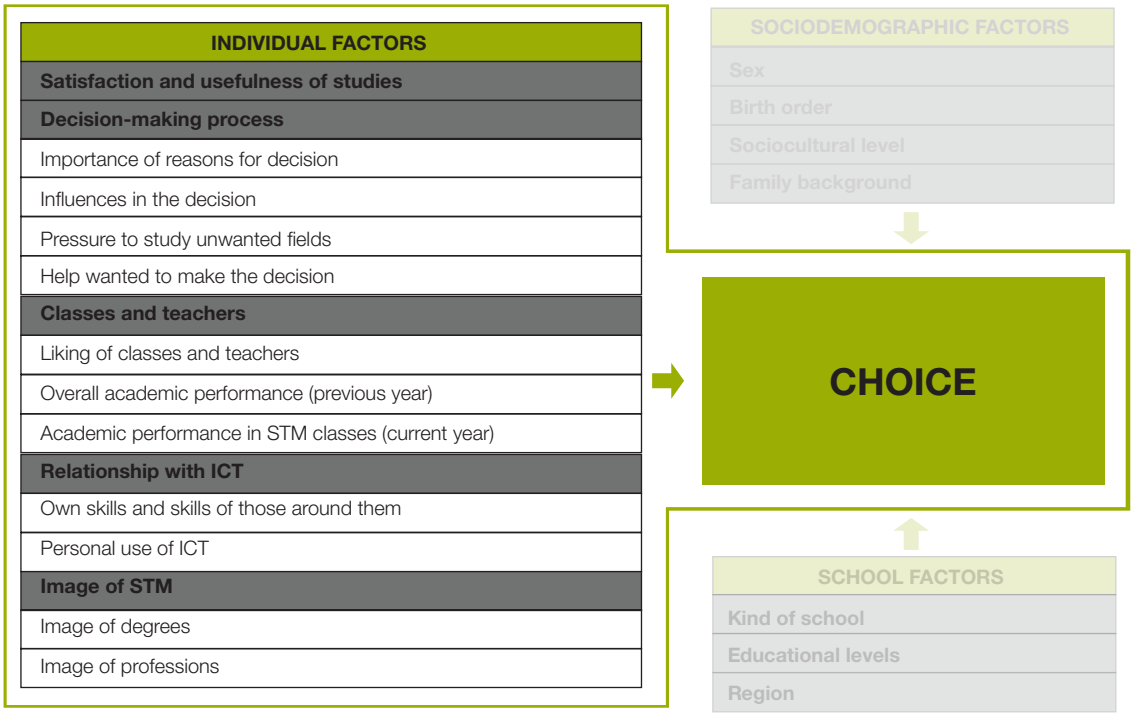


Figure 41: Conceptual framework of analysis: Individual factors

4.2.2.2.2.1 *Satisfaction with and usefulness of studies*

Results on current studies (science and technology baccalaureate):

	Engineering, IT	Mathematics, physics or chemistry	Other studies	Total
****- Satisfaction and usefulness				
F01- Satisfaction with current studies	86	99	84	85
F02- Knowledge of future studies and professional opportunities	84	87	84	84
F03- Usefulness of studying to find work	91	96	91	91
F04- Usefulness of studying to be a happier and better person	62	75	68	67
Number of people	260	69	649	1006

Percentage fairly - a lot - very

Table 39: Satisfaction with and usefulness of studies – Students in the science and technology baccalaureate

We should note that the students in the science and technology baccalaureate who have decided to continue studying mathematics, physics or chemistry are the ones who are the most satisfied in general with both their current programs and with what they believe they will do once they finish baccalaureate.

We can also note that the students who have chosen to pursue a degree in engineering or IT are less convinced about these degrees' ability to make them happier and better people.

4.2.2.2.2.2 Image of STM

	Engineering, IT	Mathematics, physics or chemistry	Other studies	Total
****- Image of engineering and IT				
F25- I am capable of doing them	90	81	51	64
F27- Professional opportunities	91	78	64	73
F24- Attraction and prestige	91	83	75	80
F32- Sexist	58	37	50	51
F34- Nerds	33	24	34	33
****- Image of mathematics, physics and chemistry				
F35- Nerds	39	20	23	27
F29- I am capable of doing them	61	90	59	61
F28- Attraction and prestige	70	84	69	71
F33- Sexist	57	40	56	55
F31- Professional opportunities	52	76	58	58
Number of people	260	69	649	1006

Percentage fairly – a lot - very

Table 40: Image of STM degrees – Science and technology baccalaureate

The students who are already pursuing a science and technology baccalaureate and have decided to pursue a degree in engineering or IT rate these degrees very positively: they view themselves as capable of doing them, and they believe these degrees offer good professional opportunities and that they are attractive and prestigious. In this case, we can detect negative gender stereotypes/models in relation to women and technology; however, we did not perceive any other stereotypes (degrees for “nerds”). With regard to degrees in mathematics, physics and chemistry, this same groups believe that they are “nerdier” than the average and do not believe that they offer such good professional opportunities.

What is particularly noteworthy is the fact that the students who do not choose STM degrees assess their ability to pursue engineering and IT degrees as quite low, and especially that they do not view themselves as capable of completing these degrees. Once again, this is the differential factor among the different groups, which may be largely determining a failure to choose engineering, IT, mathematics, physics and chemistry.

With regard to students who have decided to pursue degrees in mathematics, physics and chemistry, they have a better image of these degrees than of engineering and IT.

4.2.2.2.2.3 Classes and teachers

Results on questions regarding classes and teachers:

	Engineering, IT	Mathematics, physics or chemistry	Other studies	Total
****- Liking of classes and teachers in baccalaureate				
F61- Industrial technology	71	32	19	35
F57- Electrotechnics	61	20	14	28
F56- Technical drawing	66	25	23	37
F58- Physics	76	84	47	58
F59- Mathematics	74	88	60	65
F62- Research project	59	64	62	61
F60- Chemistry	44	85	59	57
F55- Biology, earth sciences	27	53	72	50
Number of people	260	69	649	1006

Percentage fairly - a lot - very

Figure 41: Conceptual framework of analysis: Individual factors

As we can see, the students who have decided to pursue degrees in engineering or IT more highly rate the teachers and classes associated with these studies, including industrial technology, electrotechnics and technical drawing, than the other students. To the contrary, they rate the chemistry, biology and earth sciences classes and teachers lower than the average.

The students who have decided to pursue MFC studies rate the physics, mathematics and chemistry classes and teachers higher than the average. And the students who have decided to pursue other studies not included in STM are the ones that rate the biology and earth sciences teachers and classes the highest.

We should stress the huge difference in ratings within the classes considered part of engineering and IT, since the students who have decided on this course of study rate them quite highly, at around 70%, while the remaining students rate them below or far below the average, at around 35%.

The liking of classes and teachers is highly correlated with the choice of post-baccalaureate studies.

4.2.2.2.2.4 *Academic record and performance*

The information reported by students on their academic record indicates the following:

	Engineering, IT	Mathematics, physics or chemistry	Other studies	Total
****- Academic record (B-A)	67	43	53	60
P105- Technology (current mark)	45	67	37	41
P102- Mathematics (current mark)	64	71	61	62
P101- Overall mark (previous year)	44	76	44	47
P104- Chemistry (current mark)	44	73	44	47
Number of people	260	69	649	1006

Percentage fairly - a lot - very

Table 42: Academic record of students in the science and technology baccalaureate

Generally speaking, students who choose degrees in engineering or IT have a better academic record in technology. To the contrary, students who want to pursue degrees related to mathematics, physics and chemistry have a better academic record than average in these classes and only have academic records lower than the other students in technology.

Once again, as noted in the post-secondary decision-making process between STM and other courses of study, the MFC options are perceived as extremely difficult, and only students with the best academic records and a liking of these classes choose to study university degrees in mathematics, physics and chemistry.

4.2.2.2.2.5 *ICT skills and use*

	Engineering, IT	Mathematics, physics or chemistry	Other studies	Total
****- Habilidad de las TIC				
F38- Self	88	75	60	68
F40- Friends and siblings	64	63	57	59
F39- Parents	42	29	35	36
F41- Teachers and school mentors	55	46	51	51
****- Use of ICT				
F37- Word processing, spreads heets, etc. and learning	54	51	51	52
F36- Social and entertainment	93	88	91	91
Number of people	260	69	649	1006

Percentage fairly - a lot - very

Table 43: ICT skills and use – Science and technology baccalaureate

Just like the overall analysis of secondary school and baccalaureate students, students who decided to pursue STM studies after baccalaureate believe that they are quite skilled with ICT; however, students who choose other courses of study view themselves as less skilled with ICT. Among the STM students, engineering and IT students stand out from the others in their perception of their ICT use and skills.

4.2.2.2.2.6 *Reasons for choosing certain courses of study*

Of the motives grouped by factorial analysis (vocation, usefulness, ease), the students in the science and technology baccalaureate reported the following:

	Engineering, IT	Mathematics, physics or chemistry	Other studies	Total
****- Reasons for choice				
F52- Usefulness (finding work…)	88	65	78	79
F54- Easiness (easy to gain admission…)	23	15	18	19
F53- Vocation (I like them…)	88	94	93	91
Number of people	260	69	649	1006

Percentage fairly - a lot - very

Table 44: Motivation of students in their post-baccalaureate choice: Science and technology baccalaureate

Just like in secondary school, vocation is still a very important motivation; however, for students who have decided to pursue a degree in engineering or IT, the usefulness of these degrees for their professional future is what motivates them the most. In contrast, this motive is not important in the decisions made by students pursuing degrees in MFC.

4.2.2.2.2.7 *Influences in the choice*

The results are shown broken down by groups:

	Engineering, IT	Mathematics, physics or chemistry	Other studies	Total
F08- Internet / TV	35	29	31	32
F06- Parents	67	53	66	66
F05- External factors (visits, talks, etc.)	13	13	13	14
F07- Other personal influences (school mentors, friends, siblings, etc.)	18	13	19	19
F09- Students (university / higher grades, etc.)	18	12	19	18
Number of people	260	69	649	1006

Percentage fairly - a lot - very

Table 45: Influences in the choice of post-baccalaureate course of study: Science and technology baccalaureate

The influence of parents, which is the most important in all groups, loses relative weight in the case of MFC students, who also declare that their decision is more based on vocation, as we saw in the previous section.

4.2.2.2.3 *Influence of sociodemographic factors*

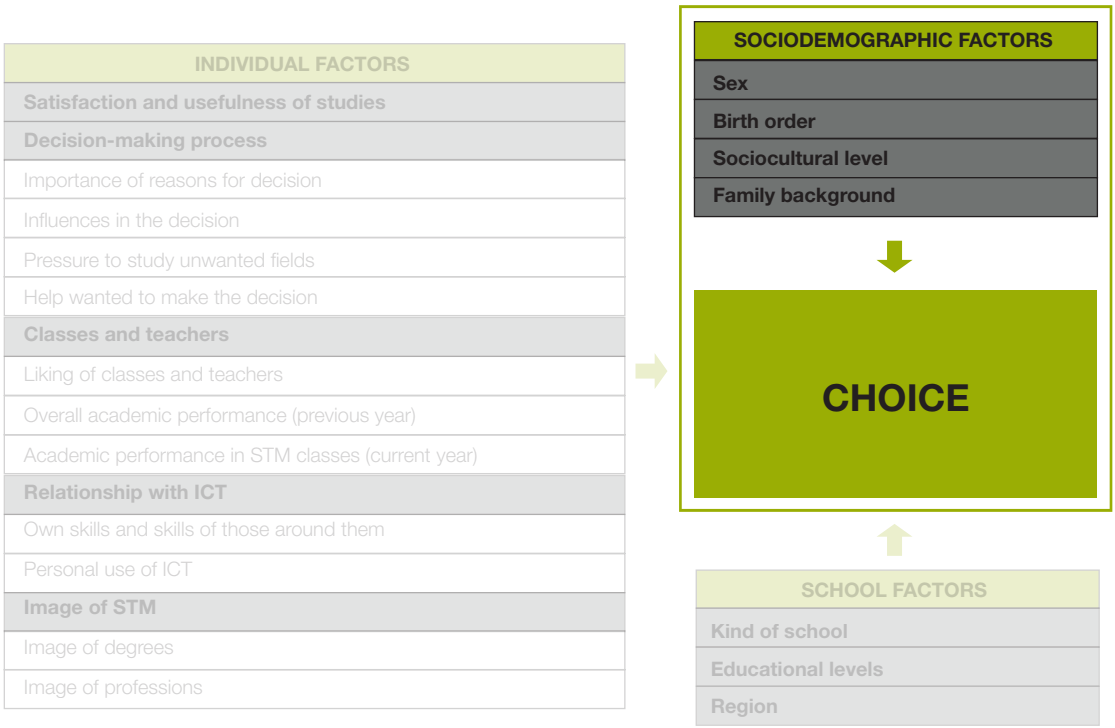


Figure 42: Conceptual framework – Factors analyzed: sociodemographic

4.2.2.2.3.1 *Breakdown of results – Composition by gender*

	Engineering, IT	Mathematics, physics or chemistry	Other studies	Total	Number of people
Total B. CyT	27	7	66	100	978
Males	41	8	51	100	507
Females	10	6	84	100	453

Values expressed in percentage of people.
The colors show significant differences compared to the total.

Table 46: Composition by SEX

It is important to note the huge gulf between males and females when choosing to pursue degrees in engineering or IT. Males choose these degrees more, and females are more likely to pursue studies outside of STM. Where there is barely a difference is in the case of mathematics, physics and chemistry: in this case gender bears hardly any influence.

Note that the sample analyzed encompasses only 1,006 science and technology baccalaureate students, when the entire sample actually surveyed encompassed 1,066 s science and technology baccalaureate students. This difference is due to the fact that there are students who did not answer the gender questions, and we were unable to take their responses into account when making this segmentation.

4.2.2.2.3.2 *Breakdown of results – Composition by siblings*

	Engineering, IT	Mathematics, physics or chemistry	Other studies	Total	Number of people
Total males	41	8	51	100	507
Only child (son)	38	6	56	100	55
Oldest son	42	9	49	100	227
Middle son	51	4	45	100	47
Youngest son	37	8	55	100	170

Values expressed in percentage of people
The colors show significant differences compared to the total

	Engineering, IT	Mathematics, physics or chemistry	Other studies	Total	Number of people
Total females	10	6	84	100	453
Only child (daughter)	8	15	77	100	72
Oldest daughter	12	5	83	100	166
Middle daughter	10	2	88	100	42
Youngest daughter	9	5	86	100	168

Values expressed in percentage of people
The colors show significant differences compared to the total

Table 47: Composition by SIBLINGS

Generally speaking, the number of siblings and birth order are not influential factors.

4.2.2.2.3.3 *Breakdown of results – Composition by family sociocultural level*

	Engineering, IT	Mathematics, physics or chemistry	Other studies	Total	Number of people
Total science and technology baccalaureate	27	7	66	100	978
High	35	4	61	100	69
Medium-high	26	6	68	100	212
Medium	25	8	67	100	345
Medium-low	28	6	66	100	224
Low	29	14	57	100	65

Values expressed in percentage of people.
The colors show significant differences compared to the total.

	Engineering, IT	Mathematics, physics or chemistry	Other studies	Total	Number of people
Total science and technology baccalaureate	41	8	51	100	507
High	50	5	45	100	38
Medium-high	43	7	50	100	111
Medium	38	7	55	100	172
Medium-low	41	9	50	100	128
Low	46	12	42	100	33

Values expressed in percentage of people
The colors show significant differences compared to the total

	Engineering, IT	Mathematics, physics or chemistry	Other studies	Total	Number of people
Total science and technology baccalaureate	10	6	84	100	453
High	16	3	81	100	31
Medium-high	8	4	88	100	99
Medium	10	9	81	100	170
Medium-low	9	2	89	100	96
Low	13	13	74	100	31

Values expressed in percentage of people
The colors show significant differences compared to the total

Table 48: Composition by FAMILY SOCIOCULTURAL LEVEL

Even though a high family sociocultural level is still a factor that influences the post-baccalaureate decision, it is less important than in the post-secondary school decision, especially in terms of low family sociocultural levels.

4.2.2.2.3.4 *Breakdown of results – Composition by family background*

The family background does not seem to determine this decision.

	Engineering, IT	Mathematics, physics or chemistry	Other studies	Total	Number of people
Total science and technology baccalaureate	27	7	66	100	978
Both from Catalonia	25	8	67	100	523
Mixed Catalonia or Spain	29	5	66	100	288
Mixed national-foreigner	28	12	60	100	43
Foreigners high level	23	14	63	100	30
Foreigners low level x	21	6	73	100	53

Values expressed in percentage of people.
The colors show significant differences compared to the total.

Table 49: Composition by FAMILY BACKGROUND

4.2.2.2.3.5 *Influence by kind of school*

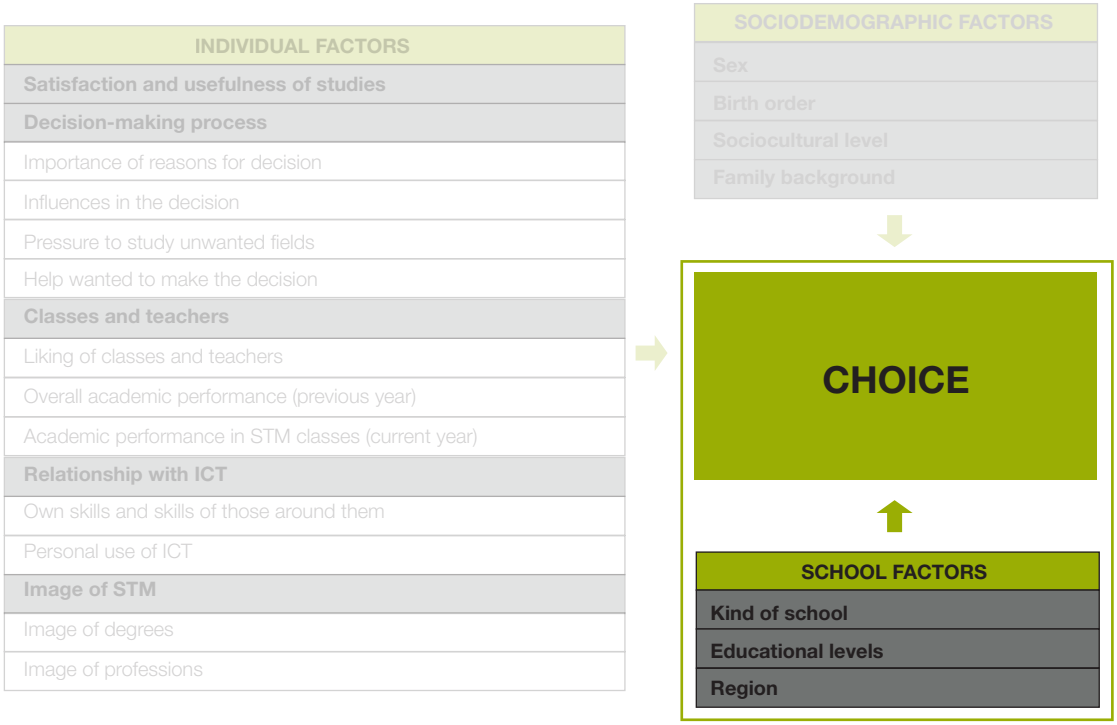


Figure 43: Conceptual framework – Factors analyzed: School

4.2.2.2.3.6 Breakdown of results – Composition by kind, region and educational levels of school

Unlike the results for the post-secondary school decision, the school's socioeconomic level is in fact crucial in the choice of engineering and IT courses of study.

	Engineering, IT	Mathematics, physics or chemistry	Other studies	Total	Number of people
Total science and technology baccalaureate	27	7	66	100	978
Public A	34	6	60	100	175
Public B	21	9	70	100	328
Public C	14	6	80	100	50
Private A	36	6	58	100	175
Private B	24	7	69	100	250

Values expressed in percentage of people
The colors show significant differences compared to the total

Table 50: Composition by KIND OF SCHOOL

Just as in the post-secondary school decision, we can see no major influence by the kind of school in the choice of science or math studies, but we do find that it bears an influence in the choice of engineering and IT degrees. The Public A and Private A school categories (high socioeconomic level) do seem to encourage students to choose these courses of study.

With regard to region, we did note differences which should be analyzed in further detail; they are not the subject of this study yet they might point to the influence of the industrial/economic sector present in each region:

	Engineering, IT	Mathematics, physics or chemistry	Other studies	Total	Number of people
Total science and technology baccalaureate	27	7	66	100	978
Barcelona	33	5	62	100	390
Girona	27	7	66	100	178
Alt Pirineu y Aran	22	9	69	100	89
Lleida	21	6	73	100	96
Cataluña Central	33	4	63	100	57
Camp de Tarragona	8	14	78	100	102
Terres de l'Ebre	26	9	65	100	66

Values expressed in percentage of people
The colors show significant differences compared to the total

Table 51: Composition by REGION OF THE SCHOOL

By educational levels offered at the school, we can see that in those that offer the option of vocational education programs, the percentage of students in engineering and IT drops considerably.

	Engineering, IT	Mathematics, physics or chemistry	Other studies	Total	Number of people
Total science and technology baccalaureate	27	7	66	100	978
Total science and technology baccalaureate	30	6	64	100	381
Pre-K, primary, secondary and baccalaureate	29	9	62	100	191
Secondary and baccalaureate	22	7	71	100	406

Values expressed in percentage of people
The colors show significant differences compared to the total

Table 52: Composition by EDUCATIONAL LEVELS AT THE SCHOOL

5 Conclusions

5.1 Satisfaction with studies and perception of their usefulness

- The students reported that they are very satisfied (37%) or fairly satisfied (44%) with the course of study they are pursuing. Only 19% of the students reported that they are not very satisfied or dissatisfied with their current course of study.
- The students highly rated the usefulness of studying to get a good job (92% marked fairly or very useful). The perception of the usefulness of studying for personal enrichment is more moderate but not negligible (69% marked fairly or very useful).

5.2 Image of STM degrees and professions and the relationship with ICT

- The majority of students have a positive image of degrees and professions related to engineering and IT. Seventy-seven percent believe that they are attractive and prestigious, while 66% believe that they offer good job opportunities. However, there is still a large percentage of students who are unaware of this fact.
- Students also have a positive view of degrees and professions related to mathematics, physics and chemistry, with no noticeable differences compared to their views of engineering and IT.
- There is a perception that it is very difficult to gain admittance into and complete STM studies.
- Especially in secondary school, we can see a worrisome attitude of self-limitation ("I'm unable") regarding students' ability to pursue degrees in STM.
- This reveals the fact that there are still negative gender models regarding women and technology.
- A high percentage of students believe that they are skilled at using ICT (65%), more than their teachers (55%) and much more than their parents (38%). However, a vast majority state that they use ICT for social and entertainment purposes (90%) more than for management and learning applications.

5.3 Most important variables when making decisions

- To the student respondents, **working in their chosen profession and pursuing their chosen degree** is the main motive (89% marked extremely, very or fairly important) in their choice of future studies.
- To choose the baccalaureate track, **the degree of identification with the content and the way the teachers handle the subjects** is a decisive factor (79% marked extremely, very or fairly important) when choosing the course of study.

- **The students' most influential referents** in the process of choosing their course of study are:

  1. **The family**: discussing and exchanging with parents (75% marked very or fairly important)

  2. **Internet**: information from websites and social media (56% marked very or fairly important)

  3. **Teachers**: guidance from teachers (44% marked very or fairly important)

- To make the decision easier, the students asked for:

  1. More information on **courses of study and professional opportunities** (73% marked very or fairly important)

  2. Seeing the **content and professional opportunities** of the programs (68% marked very or fairly important)

  3. Establishing **exchanges with working professionals** (62% marked very or fairly important)

5.4 Time when the decision is made

- The majority of students in their last two years of secondary school have already largely made the decision: 37% are quite confident and 47.2% have alternatives to choose from. Only 15.8% state that they are not sure what they will choose.

- Thirty-three percent of students finish secondary school and have decided to choose scientific, technology or mathematical vocations (STM university degrees or ICT vocational training programs). This percentage remains steady from the third to the fourth year of secondary school. Fifty-one percent choose other programs, and 16% have a hard time choosing.

- Therefore, this choice is made between primary school and the beginning of secondary school, or perhaps the factors that may come into player later do not influence this decision.

- The low number of students with STM vocations can be seen throughout secondary school and in the transition from secondary to vocational education and/or baccalaureate.

5.5 Differential factors in STM

- The unique profile of students who choose to study STM has the following characteristics:
    - The students have good marks throughout secondary school.
    - They like STM classes.
    - They admit to having a serious vocation for STM.
    - They are skilled in the use of ICT and have a positive image of the degrees and professionals in the sector, which positively influences them.

- The study also highlighted elements for reflection which will help us to understand students' failure to choose STM academic tracks:

  Students' academic self-perception is a crucial factor in their choice.

  Forty-five percent of students believe that they are incapable of pursuing this kind of course of study, which inhibits almost half of the school population and substantially lowers the chances of increasing the number of STM vocations unless we manage to change this view and students' attitudes.

  The perception of the classes and their difficulty is also decisive.

  The classes with the lowest student ratings are chemistry, physics and technology. More than half of the students rate them very negatively, and only one-quarter rate them positively.

  Therefore, the view of the difficulty of these programs (77% of the students surveyed see them as very difficult) is a differential factor despite the fact that the majority of students view them as useful for finding work and recognize the importance of having a vocation when choosing these programs.

- The combination of the gender perspective and sociocultural level is devastating:

  44% of the students from a high sociocultural background choose STM studies in their post-compulsory secondary school choice in contrast to 24% of the students from a low sociocultural background. This is 20 percentage points, a very significant difference.

  The gender perspective further skews these decisions. The percentage of males from high sociocultural backgrounds who choose STM studies is 51%, compared to 38% of females from the same background. In contrast, just 20% of females from a low sociocultural background choose STM programs. There is a 31-point difference which reveals vast room for improvement among these groups.

  These figures tell us that there is a great deal of room for improvement in the percentages of students from lower sociocultural backgrounds and female students who choose STM programs, since the profile of males from high sociocultural backgrounds is already quite satisfactory.

5.6 Differential factors in the choice of engineering and IT programs

- The students from the science and technology baccalaureate who choose engineering or IT are characterized by the following:
    - They have higher marks in technology, although there are no significant differences in the other classes.
    - They are fonder of industrial technology, electrotechnics, technical drawing, physics and mathematics.
    - They are less fond of chemistry, biology and earth sciences.
    - Their reasons for choosing their degree are clearly pragmatic: to find work and earn money, without vocation being a differential factor.
    - They have a positive image of STM professions. They believe that the field is prestigious, attractive and offers sound job opportunities.
- The study stresses factors for reflection that can help us to understand the failure to make this choice:
    - Gender stereotypes which discourage more females from choosing this kind of program must be abandoned.
    - It is important to improve students' motivation and convey a clear message that they are capable of pursuing this course of study. There are still many students who abandon these options because of a lack of confidence or low expectations of their own chances for success.

5.7 Challenges to increasing STM vocations

Based on the results of the study, we have identified 4 major challenges to increasing the number of STM vocations:

- **Increasing the interest and motivation in STM in primary school** and making mathematics, technology, physics and chemistry more attractive in secondary school.
- **Improving the orientation** on STM programs in secondary school. In addition to the families' role, we must also enhance the positive influence of teachers, school mentors, visits, etc.
- In both primary and secondary school **breaking the** self-limiting ***Pygmalion effect*** ("you aren't capable") and encouraging the zeal for learning STM, encouraging the circle of "I like them", "I'm good at them", and "I feel able to do them".
- **Changing the male stereotype of engineering and IT studies** Making female models and referents in these fields more visible.

6 Appendixes

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6.2 List of contributors to the study

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Schools participating in the focus groups

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Escola Pia of Vilanova i la Geltrú

Escola Arrels of Barcelona

La Salle Congrés of Barcelona

Schools participating in the survey

BARCELONA

Institut Montserrat

Institut La Mallola

Institut Martí Dot

Institut Severo Ochoa

Institut Llavaneres

Institut Thos i Codina

Institut Eduard Fontserè

Institut Manuel de Cabanyes

Jesuïtes Gràcia - Kostka

Mare de Déu dels Àngels

Sil

La Mercè

Àgora

Escola Pia de Granollers

Maristes Champagnat

Institut Lacetània

Institut Pere Vives i Vich

Escorial

GIRONA

Institut Montilivi

Institut Vallvera

Institut Jaume Vicens Vives

Vedruna

LLEIDA

Institut d'Aran

Institut Joan Brudieu

Institut Ronda

Institut Guindàvols

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David Bueno

Joan Busquets

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Joan Francesc Córdoba

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Joana Ferrer

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Salvador Vidal

6.3 Questionnaires

6.3.1 Questionnaire for students in the third and fourth year of compulsory secondary school

CONTENT SCHEMA AND CONSIDERATIONS

- Initial questions
- Choice of studies
- Classes and teachers
- Engineering and IT
- Technology habits
- Open-ended comments

Application by Internet
Choice of current course to show the corresponding model of the questionnaire (secondary school / baccalaureate):

- 3rd year of secondary school
- 4th year of secondary school
- 1st year of baccalaureate: sciences and technology
- 1st year of baccalaureate: humanities and social sciences
- 1st year of baccalaureate: arts
- 2nd year of baccalaureate: sciences and technology
- 2nd year of baccalaureate: humanities and social sciences
- 2nd year of baccalaureate: arts

INITIAL QUESTIONS (4)

- Not at all – little – fairly – a lot – very

1) Are you happy with your current course of study?
2) Do you think that studying will help you to find a good job?
3) Do you think that studying will help you to be a more responsible citizen?
4) Do you think that studying will help you to be a happy person?

CHOICE OF STUDIES (9 + open-ended comments)

5) Have you already decided what you want to do when you finish secondary school?

- I'm not very confident – I have several alternatives – I am confident

6) If you had to decide right now, what would you choose?

- Baccalaureate: sciences and technology
- Baccalaureate: humanities and social sciences
- Baccalaureate: arts
- Vocational training in IT and communications
- Vocational training in science: chemistry, healthcare, etc.
- Other vocational training programs
- Other programs: art, sports, etc.
- Stop studying and look for work

Regarding the program which you said you would pursue: *(If the student has chosen "stop studying", these questions will not appear and students will move directly to the section on "Classes and teachers")*

7) Are you familiar with the classes and the effort they require?

- Not at all – little – fairly – a lot – very

8) Are you familiar with the further studies you can pursue after you finish (university, higher-level vocational, etc.)?

- Not at all – little – fairly – a lot – very

9) Are you familiar with the job possibilities?

- Not at all – little – fairly – a lot – very

10) How important are the following motives in your choice?

- Not at all – little – fairly – a lot – very

a. You like the content of the programs
b. They will let you pursue the university degree you want
c. You will be able to work in a profession that you like
d. Earning lots of money
e. Finding a job easily
f. The teachers you will have
g. The prestige of the degree
h. Te permitirán tener la misma profesión que tus padres
i. They will allow you to have a socially prestigious profession
j. You think that these subjects are easy
k. You have to keep studying no matter what

11) Even though you will make the final decision, which of the following are helping you to decide?

- Not at all – little – fairly – a lot – very

a. Your friends
b. Your school mentors
c. Your science (mathematics, physics, biology, etc.) teachers
d. Your teachers in social sciences, language, music, etc.
e. Guidance counselors and educational psychologists
f. Your parents
g. Your siblings
h. Students in higher grades at your school
i. Former students from your school
j. University students
k. Informative talks, round tables, etc.
l. Saló de l'ensenyament (a local education fair)
m. Visits to universities
n. Visits to vocational training schools
o. Visits to companies or institutions
p. Working professionals
q. Information on the Internet
r. Programs you have seen on TV
s. Cosmocaixa or similar informative activities

12) Do the following pressure you to pursue a course of study that you don't want?

- Not at all – little – fairly – a lot – very

a. Your friends
b. Your school mentors
c. Your teachers
d. Guidance counselors and educational psychologists
e. Your parents
f. Your siblings

13) Would the following help you to make a better decision?

- Not at all – little – fairly – a lot – very

a. Having more information on vocational training programs
b. Having more information on baccalaureate programs
c. Speaking more with your tutors and guidance counselors
d. Speaking more with baccalaureate students
e. Speaking more with vocational education students
f. Visiting the school where you would study (if it is different than your current school)
g. Speaking with university students
h. Speaking with working professionals
i. Having more information on professional opportunities
j. Visiting companies or institutions

OPEN-ENDED COMMENTS:

What else would help you to make a better decision?

CLASSES AND TEACHERS (2)

14) Do you like the following classes?

- Not at all – little – fairly – a lot – very

a. Biology and geology
b. Natural sciences
c. Social sciences, geography and history
d. Visual and art education
e. Physics
f. Chemistry
g. IT
h. Catalan language and literature
i. Spanish language and literature
j. Foreign language
k. Mathematics
l. Technology

15) Do these classes spark your interest in studying engineering and IT?

- Not at all – little – fairly – a lot – very

a. Physics
b. Chemistry
c. IT
d. Mathematics
e. Technology

16) Generally speaking, do you like the teachers of these classes?

- Not at all – little – fairly – a lot – very

a. Biology and geology
b. Natural sciences
c. Social sciences, geography and history
d. Visual and art education
e. Physics
f. Chemistry
g. IT
h. Catalan language and literature
i. Spanish language and literature
j. Foreign language
k. Mathematics
l. Technology

ENGINEERING AND IT (2)

17) What is your opinion about degrees in engineering and IT?

- Not at all – little – fairly – a lot – very

a. It is easy to gain admission to them
b. It is easy to complete them
c. I am capable of doing them
d. They offer many professional opportunities
e. They make it easy to find a job
f. They are degrees for women
g. They are degrees for men
h. They are for “nerds”

18) What do you think about engineers and IT professionals?

- Not at all – little – fairly – a lot – very

a. They are socially prestigious
b. They earn high salaries
c. Their jobs are varied and creative
d. Their jobs are easy
e. They have good work schedules
f. Their jobs have a high impact on society

MATHEMATICS, PHYSICS AND CHEMISTRY (2)

19) What is your opinion about these science degrees?

- Not at all – little – fairly – a lot – very

g. It is easy to gain admission to them
h. It is easy to complete them
i. I am capable of doing them
j. They offer many professional opportunities
k. They make it easy to find a job
l. They are degrees for women
m. They are degrees for men
n. They are for "nerds"

20) What do you think about mathematics, physics and chemistry?

- Not at all – little – fairly – a lot – very

o. They are socially prestigious
p. They earn high salaries
q. Their jobs are varied and creative
r. Their jobs are easy
s. They have good work schedules
t. Their jobs have a high impact on society

TECHNOLOGY HABITS (2)

21) Are you good at information and communication technologies (ICT)?

- Not at all – little – fairly – a lot – very

a. What about your friends?
b. What about your father?
c. What about your mother?
d. What about your siblings?
e. What about your tutor?
f. What about your science teachers?
g. What about your language, social sciences, humanities and arts teachers?

22) How do you use the following information and communication technologies (ICT)?

- Not at all – little – fairly – a lot – very

a. Internet
b. Email
c. Social media: Facebook, Tuenti...
d. School intranet (if available)
e. Mobile phone
f. Videogames and consoles
g. TV
h. E-books
i. PowerPoint
j. Word
k. Excel

OPEN-ENDED COMMENTS

Please use this space to write any comments you may have on this survey.

CLASSIFICATION INFORMATION (students)

1) Age
   a. 14
   b. 15
   c. 16
   d. 17
   e. 18
   f. Older than 18

2) Sex

   a. Male
   b. Female

3) **Father's / mother's educational level** (separate questions)

   a. University degree
   b. Secondary school (secondary school diploma / baccalaureate / vocational degree, etc.)
   c. Primary school
   d. No official diploma

4) **Father's / mother's profession** (separate questions)

   a. Entrepreneur / Freelance professional / Self-employed
   b. Director / Manager
   c. Technician / Qualified professional
   d. Administrative assistant / Laborer...

5) Father's / mother's current work status

   a. Working
   b. Not working right now

6) **Father's / mother's place of birth** (separate questions)

   a. Catalonia
   b. Rest of Spain
   c. Rest of the world *(to be determined whether the system allows respondents to indicate / choose the country)*

7) Tell us about your relationship with your siblings:

   a. I am the oldest
   b. I am the youngest
   c. I am neither the oldest nor the youngest
   d. I have no siblings

8) Academic record:

   a. Grade point average (previous year)
   b. Current marks in mathematics, physics, chemistry, technology

6.3.2 Questionnaire for baccalaureate students

CONTENT SCHEMA AND CONSIDERATIONS

- Initial questions
- Choice of current program
- Classes and teachers
- Choice of future programs
- Engineering, IT and mathematics
- Technology habits
- Open-ended comments

Application by Internet

Choice of current course to show the corresponding model of the questionnaire (secondary school / baccalaureate):

- 3rd year of secondary school
- 4th year of secondary school
- 1st year of baccalaureate: sciences and technology
- 1st year of baccalaureate: humanities and social sciences
- 1st year of baccalaureate: arts
- 2nd year of baccalaureate: sciences and technology
- 2nd year of baccalaureate: humanities and social sciences
- 2nd year of baccalaureate: arts

INITIAL QUESTIONS (4)

- Not at all – little – fairly – a lot – very

23) At the time when you decided to pursue a baccalaureate:
24) Do you think that studying will help you to find a good job?
25) Do you think that studying will help you to be a more responsible citizen?
26) Do you think that studying will help you to be a happy person?

CHOICE OF CURRENT PROGRAM (8 + open-ended comments)

27) At the time when you decided to pursue a baccalaureate:

- You were not very confident – You vacillated between several alternatives – You were very confident

28) Were you familiar with the classes you are taking and the effort they would require?

- Not at all – little – fairly – a lot – very

29) Were you aware of what further educational programs you could pursue (university, higher-level vocational education, etc.)?

- Not at all – little – fairly – a lot – very

30) Were you aware of the professional job opportunities?

- Not at all – little – fairly – a lot – very

31) How important were the following motives in your decision?

- Not at all – little – fairly – a lot – very

a. You liked the content of the program
b. They would let you pursue the university degree you want
c. You could work in a profession that you like
d. Earning lots of money
e. Finding a job easily
f. The teachers you would have
g. The prestige of the degree
h. It would allow you to remain in the same profession as your parents
i. They will allow you to have a socially prestigious profession
j. You thought that these subjects were easy
k. You had to keep studying no matter what

32) To what extent did the following help you to make your decision?

- Not at all – little – fairly – a lot – very

a. Your friends
b. Your school mentors
c. Your science (mathematics, physics, biology, etc.) teachers
d. Your teachers in social sciences, language, music, etc.
e. Guidance counselors and educational psychologists
f. Your parents
g. Your siblings
h. Students in higher grades at your school
i. Former students from your school
j. University students
k. Informative talks, round tables, etc.
***l. Saló de l'ensenyament* (a local education fair)**
m. Visits to universities
n. Visits to vocational training schools
o. Visits to companies or institutions
p. Working professionals
q. Information on the Internet
r. TV programs you had seen
s. Cosmocaixa or similar informative activities

33) Were you pressured to pursue a course of study that you didn't want?

- Not at all – little – fairly – a lot – very

a. Your friends
b. Your school mentors
c. Your teachers
d. Guidance counselors and educational psychologists
e. Your parents
f. Your siblings

34) Would the following help you to make a better decision?

- Not at all – little – fairly – a lot – very

a. Having had more information on vocational training programs
b. Having had more information on baccalaureate programs
c. Having spoken more with your school mentors and guidance counselors
d. Having spoken more with baccalaureate students
e. Having spoken more with vocational education students
f. Having visited the school where you were going to study (if it is different than the school where you used to study)
g. Having spoken with university students
h. Having spoken with working professionals
i. Having had more information on professional opportunities
j. Having visited companies or institutions

OPEN-ENDED COMMENTS:
What else would have helped you to make a better decision?

CLASSES AND TEACHERS (4)

35) Did you like these classes in secondary school?

- Not at all – little – fairly – a lot – very

a. Biology and geology
b. Natural sciences
c. Social sciences, geography and history
d. Visual and art education
e. Physics
f. Chemistry
g. IT
h. Catalan language and literature
i. Spanish language and literature
j. Foreign language
k. Mathematics
l. Technology

36) Did you like the teachers of these classes in secondary school?

- Not at all – little – fairly – a lot – very

a. Biology and geology
b. Natural sciences
c. Social sciences, geography and history
d. Visual and art education
e. Physics
f. Chemistry
g. IT
h. Catalan language and literature
i. Spanish language and literature
j. Foreign language
k. Mathematics
l. Technology

37) Do you like these classes in baccalaureate? (only science and technology baccalaureate)

- Not at all – little – fairly – a lot – very

a. **Biology**
b. **Earth sciences and environment**
c. **Technical drawing**
d. **Electrotechnics**
e. **Physics**
f. **Mathematics**
g. **Chemistry**
h. **Industrial technology**
i. **Research project**

38) Do these classes spark your interest in studying engineering and IT?

- Not at all – little – fairly – a lot – very

a. **Technical drawing**
b. **Electrotechnics**
c. **Physics**
d. **Mathematics**
e. **Chemistry**
f. **Industrial technology**
g. **Research project**

39) Do you like the teachers of these classes in baccalaureate? (only science and technology baccalaureate)

- Not at all – little – fairly – a lot – very

a. **Biology**
b. **Earth sciences and environment**
c. **Technical drawing**
d. **Electrotechnics**
e. **Physics**
f. **Mathematics**
g. **Chemistry**
h. **Industrial technology**
i. **Research project**

CHOICE OF FUTURE STUDIES (5 + open-ended comments)

40) Have you already decided what you want to do when you finish baccalaureate?

- I'm not very confident – I have several alternatives – I am confident

41) If you had to decide right now, what would you choose?

- Engineering, IT
- Mathematics, physics and chemistry
- Architecture
- Arts and humanities
- Sciences
- Health sciences
- Social sciences and law
- Higher-level vocational education programs
- Stop studying and look for work

42) How important were the following motives in your decision? (If the student has chosen "stop studying", these questions will not appear and students will move directly to the next section)

- Not at all – little – fairly – a lot – very

a. You like the content of the programs
b. You will be able to work in a profession that you like
c. Earning lots of money
d. Finding a job easily
e. You think that these subjects are easy
f. Do you believe it is important to have a complete education?
g. You have to keep studying no matter what

43) Do the following pressure you to pursue a course of study that you don't want?

- Not at all – little – fairly – a lot – very

a. Your friends
b. Your school mentors
c. Your teachers
d. Guidance counselors and educational psychologists
e. Your parents
f. Your siblings

44) Would the following help you to make a better decision?

- Not at all – little – fairly – a lot – very

a. Having more information on degrees
b. Having more information on professional opportunities
c. Speaking more with your school mentors and guidance counselors
d. Speaking with university students
e. Speaking with working professionals
f. Visiting the university where you want to study
g. Visiting companies or institutions
h. Having more information on higher-level vocational education programs

OPEN-ENDED COMMENTS:

What else would help you to make a better decision?

ENGINEERING AND IT (2)

45) What is your opinion about degrees in engineering and IT?

- Not at all – little – fairly – a lot – very

q. It is easy to gain admission to them
r. It is easy to complete them
s. I am capable of doing them
t. They offer many professional opportunities
u. They make it easy to find a job
v. They are degrees for women
w. They are degrees for men
x. They are for "nerds"

46) What do you think about engineers and IT professionals?

- Not at all – little – fairly – a lot – very

m. They are socially prestigious
n. They earn high salaries
o. Their jobs are varied and creative
p. Their jobs are easy
q. They have good work schedules
r. Their jobs have a high impact on society

MATHEMATICS, PHYSICS AND CHEMISTRY (2)

47) What do you think about these science degrees?

- Not at all – little – fairly – a lot – very

y. It is easy to gain admission to them
z. It is easy to complete them
aa. I am capable of doing them
bb. They offer many professional opportunities
cc. They make it easy to find a job
dd. They are degrees for women
dd. They are degrees for men
ee. They are for "nerds"
ff.

48) What do you think about mathematics, physics and chemistry?

- Not at all – little – fairly – a lot – very

s. They are socially prestigious
t. They earn high salaries
u. Their jobs are varied and creative
v. Their jobs are easy
w. They have good work schedules
x. Their jobs have a high impact on society

TECHNOLOGY HABITS (2)

49) Are you good at information and communication technologies (ICT)?

- Not at all – little – fairly – a lot – very

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i. What about your father?
j. What about your mother?
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o. School intranet (if available)
p. Mobile phone
q. Videogames and consoles
r. TV
s. E-books
t. PowerPoint
u. Word
v. Excel

OPEN-ENDED COMMENTS

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d. 17
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a. Grade point average (previous year)
b. Current marks in mathematics, physics, chemistry, technology

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