

Bozu, Z., Calduch, I., and Rubio, M. J. (2024). The baccalaureate research work. Students' perspective on the development of competences and attitudes towards research. *Journal of Educational Research*, 42(1), 203-222.
DOI: <https://doi.org/10.6018/rie.548161>

Traducido con  DeepL

The Baccalaureate Research Project. Students' perspective on the development of research skills and attitudes towards research

El Trabajo de Investigación de Bachillerato. Perspectiva del estudiantado sobre el desarrollo de competencias y actitudes hacia la investigación

Zoia Bozu*, Isaac Calduch*¹ and María José Rubio **

*Department of Didactics and Educational Organisation. Faculty of Education. Universitat de Barcelona.

**Department of Research Methods and Diagnosis in Education. Faculty of Education. Universitat Barcelona.

Abstract

It is now widely recognised that it is important for students to develop the necessary skills to carry out research work throughout their schooling. The purpose of this study is to find out and analyse the perception of upper secondary school students about research work. To this end, an ad hoc questionnaire was applied to a sample of 1,496 students in the second year of baccalaureate from different schools in Catalonia, selected by means of non-probabilistic convenience sampling. The results obtained show that students do not tend to attribute too many difficulties to carrying out the different tasks associated with a research project. Likewise, the research project at baccalaureate level facilitates and the development of transversal competences and certain specific research competences. With regard to scientific literacy and attitudes towards research, it should be noted that students value positively the social impact of research after carrying out the research project, but show little interest in the research profession. There is also an influence of gender and other variables on perceptions of the development of competences and attitudes towards

¹ **Correspondence:** Isaac Calduch, icalduch@ub.edu

research. As a general conclusion, the students' assessment of research work in upper secondary education is positive, a fact that should encourage those responsible for educational policies to continue promoting this practice, as well as a more intensive use of research-based teaching methodologies in the different educational stages.

Keywords: research project; secondary education; competence; scientific research.

Resumen

Actualmente, se reconoce ampliamente la importancia de que el estudiantado desarrolle las competencias necesarias para realizar trabajos de investigación a lo largo de su escolarización. Este estudio tiene el propósito de conocer y analizar la percepción del estudiantado de bachillerato acerca del trabajo de investigación. Para ello, se ha aplicado un cuestionario ad hoc a una muestra de 1.496 estudiantes de segundo curso de bachillerato de distintos centros educativos de Catalunya, seleccionados mediante un muestreo no probabilístico por conveniencia. Los resultados obtenidos evidencian que el estudiantado no suele atribuir demasiadas dificultades a la realización de las distintas tareas asociadas a un trabajo de investigación. Así mismo, el Trabajo de Investigación de bachillerato facilita el desarrollo de las competencias transversales y de determinadas competencias específicas de investigación. Con relación a la alfabetización científica y a las actitudes hacia la investigación, cabe destacar que el estudiantado valora positivamente el impacto social de la investigación después de realizar el trabajo de investigación, sin embargo, muestran un bajo interés hacia la profesión investigadora. También se aprecia una influencia del género y de otras variables en las percepciones sobre el desarrollo de competencias y actitudes hacia la investigación. A modo de conclusión general, la valoración que el estudiantado sostiene del trabajo de investigación de bachillerato es positiva, un hecho que debería alentar a las personas responsables de las políticas educativas a seguir promoviendo esta práctica, así como un uso más intensivo de metodologías didácticas basadas en la investigación en las distintas etapas educativas.

Palabras clave: proyecto de investigación; enseñanza secundaria; competencia; investigación científica.

Introduction and objectives

Currently, many Secondary Education, Baccalaureate and Vocational Training institutions promote and encourage scientific research among their students. Along these lines, Royal Decree 243/2022, of 5 April, which establishes the organisation and minimum teaching requirements for the Baccalaureate (post-compulsory secondary education) states among its stage objectives that students should be able to "understand the fundamental elements and procedures of scientific research and methods" (art. 7).

To achieve this, in Catalonia, the baccalaureate curriculum includes the preparation of a research project (hereinafter, IT), with the aim of developing scientific literacy and research skills. The IT accounts for 10% of the final grade of the educational stage. By way of clarification, it should be noted that in addition to the Catalan region, a pioneer in carrying out this initiative since 1998, there are three other autonomous regions that have also introduced it in their curricular proposals: (a) in Murcia, it was included on an experimental basis in 2007 and became compulsory in 2010; (b) in Castilla y León, it was introduced on an optional basis as a specialised itinerary, from 2012; and (c) in the

Community of Madrid, it was also introduced on an optional basis within the programme of excellence in Bachillerato, from 2012. However, this implies that, in the rest of Spain, research work in baccalaureate is carried out exclusively on the initiative of teachers, either individually or at school level. Everything is left to the express will of the teachers.

According to decree 171/2022, of 20 September, on the organisation of baccalaureate education (in Catalonia), IT consists of a set of structured research activities carried out by students on a specific topic, with the tutoring of the teaching staff (art. 18). In this sense, engaging in a self-directed research process is often one of the best options for developing scientific literacy, as it offers meaningful and authentic possibilities to apply the knowledge, skills and attitudes needed to be competent in the development of research processes (Menoyo, 2013).

Specific research competences, closely linked to scientific literacy (OECD, 2002), problem-solving skills (Queiruga-Dios et al., 2020) or "life skills" (Menoyo, 2020), are usually defined by the specialised literature as the knowledge, skills and attitudes that are deployed to be able to respond to specific problems through research processes (Estrada, 2014). Developing specific research competences is necessary in order to be able to respond to the challenges that students will face in their professional, personal and civic lives, as well as for hypothetical higher education studies. In relation to this last point, it is worth remembering that at university, students also have to present and orally defend a research project when they finish their degree studies. However, and according to current knowledge (Curran et al., 2019; Menoyo, 2020), research training should be encouraged from an early age, i.e. it is necessary to start this scientific initiation from the first years of ESO (or even earlier), providing opportunities that allow a first approach to the contexts, logics and techniques of scientific research. It cannot be relegated as an exclusive responsibility of higher education.

There are a number of studies on how to develop research competence training for students in secondary education. Firstly, most studies consider it appropriate to equip students with specific research competences. Therefore, they suggest breaking these competences down into a subset of operational dimensions that, when interconnected, allow the complex research process to be carried out (Franco-Mariscal, 2015; Rubio et al., 2018; Valdés et al., 2013). In this sense, the proposal by Payá et al. (2018) is particularly interesting due to its relevance and comprehensive nature. They list eight dimensions when dealing with this competence: (1) definition of the research problem; (2) theoretical framing of the problem; (3) design and application of the methodological proposal; (4) organisation of the results; (5) preparation of the conclusions; (6) preparation of the research report; (7) communication of the research results; and (8) application of the social and ethical responsibility of research.

With regard to the learning of these skills, studies such as Mohd and Arsad (2010) show that students' acquisition of specific research skills depends on how thoroughly they have been taught by teachers and the degree of autonomy given to students in performing certain tasks, such as examining a topic of study, making decisions, investigating an idea, synthesising the main ideas or communicating the results of an experiment.

Secondly, for other authors (Cano, 2009; Menoyo, 2020, 2021), it is also advisable to complement the development of *specific research competences* with other *transversal competences*, such as: information competence and critical thinking; technological and

digital competence; cognitive-linguistic competence; competence in methodological rigour and degree of autonomy, regularity, organisation and responsibility, among others.

Another group of studies are those that analyse students' attitudes towards research. According to Mamani (2011), the study of attitudes towards research makes it possible to understand and generate positive conditions oriented towards the adoption of research behaviours and the promotion of interest in research. It also helps to guide those with an interest in research (De la Cruz, 2013) to dedicate their careers to this field and to detect attitudes and skills that need to be strengthened in order to train researchers to carry out and promote research that is of value to society. However, it is an incipient subject and its study is usually limited to the university stage (Olivera, 2020; Palacios, 2021). Those studies carried out in the context of secondary education suggest that the reduced interest in conducting research is due to the predominant use of expository methodologies for teaching, with a technical orientation, little applied and often decontextualised (Munoz et al., 2019; Maria et al., 2017).

Finally, a review of the literature shows that the issue of scientific literacy and the development of research competence at pre-university levels, both nationally and internationally, has been attracting increasing interest in the academic and school community in recent years (Cano, 2009; Cañal, 2012; Castillo et al., 2018; Franco-Mariscal, 2015; Roso, 2010; Sánchez and Viejo, 2012). However, at the baccalaureate stage, it is an issue that has not yet been sufficiently studied in depth, with few studies focusing exclusively on IT, among other reasons probably due to its specificity and autonomous nature (Alturo, 2021; Ferrés et al., 2015; Menoyo, 2017, 2020).

Taking all of the above into consideration, we have shown the relevance and pertinence of focusing our work on IT in order to contribute empirical evidence to the field of study of scientific literacy training and research competence in secondary education. The general purpose of this research is to know and analyse the perception of high school students about IT, responding to the following specific objectives:

1. Identify the difficulties that students report having in carrying out research work.
2. To find out the students' perception of the development of transversal competences and specific research competences due to the IT project.
3. To analyse students' attitudes towards research after completing the IT .
4. To explore the impact of the variables of gender, school ownership, type of baccalaureate and performance on students' perceptions of IT.

Method

This study uses a quantitative methodology. In this sense, the interest of the work was descriptive and exploratory in nature, proposing a survey study by means of a questionnaire, aimed at students in the second year of the baccalaureate in Catalonia.

Population and Sample

The study population was the students in the second year of baccalaureate, who were studying in the Catalan education system. The sample was non-probabilistic by convenience, although the selection of schools took into account criteria of

representativeness of the whole territory. The sample consisted of 1,496 students from schools in the four provinces of Catalonia, whose socio-demographic and contextual characteristics are shown in Table 1.

Table 1

Socio-demographic and contextual variables of the sample

Variable	Categories	Score
Age	Media	17 years
	Female	61%
Gender	Male	36.6%
	Non-binary	2.4%
	Ownership	
Ownership	Public	73%
	Subsidised or private	27%
Modality	Humanistic-social	44.1%
	Scientific and technological	49.8%
	Artistic	6.1%
IT academic performance	Excellent	48.3%
	Notable	31.5%
	Approved	16.3%
	Suspense	3.9%
Geographical distribution	"Àrea Metropolitana de Barcelona" (Barcelona Metropolitan Area)	47.2%
	"Comarques de Girona".	23.5%
	"Camp de Tarragona	8.8%
	"Catalunya Central" (Central Catalonia)	7%
	"Comarques de Ponent	3.9%
	"Terres de l'Ebre	0.6%
	"Alt Pirineu and Aràn".	0%

Instrument

Due to the absence of a tradition of research on the object of study, we have opted for the construction of an *ad hoc* questionnaire, whose dimensions have been designed based on the review of the existing literature on specific research competences (Menoyo, 2020; Payá et al., 2018; Rubio et al., 2018) and attitudes towards research (EACIN scale by Aldana et al., 2020; TOSRA scale by Navarro et al., 2016).

A preliminary version of the questionnaire consisting of 4 scales and contextual and socio-demographic questions was developed. The scales are five-point Likert-type scales (5 is strongly agree, 4 is agree, 3 is neither agree nor disagree, 2 is disagree and 1 is strongly disagree).

- Scale 1. Perceived difficulties in performing IT.
- Scale 2. Transversal Competences that are perceived to be more developed with IT.
- Scale 3. Research competences that are perceived to be more developed with IT.
- Scale 4. Attitudes towards Research after IT.

In the contextual questions, the contrast variables for the phenomenon studied were requested. The summary can be found in Table 1.

The scales were subjected to content validation by expert judgement. Five university professors in the area of Research Methods from three universities in Catalonia and three secondary school teachers from two secondary schools in Barcelona were selected. A template was used to assess the clarity, relevance and pertinence of the items, and qualitative comments from the experts were also solicited. The validation allowed each scale to be adjusted, redefining or improving the wording of some items, and items where there was agreement among the evaluators that they were of little relevance for the purposes of the research were eliminated.

Similarly, the instrument resulting from the previous validation was pilot tested with 31 students in the second year of high school in a public high school in Barcelona, who had finished IT (45.2% boys and 54.8% girls, average age 17). These students were not part of the final sample. The application lasted 15 minutes and at the end the students were asked to rate the time, ease or difficulty in understanding the items and in answering them. The pilot test made it possible to assess that the vocabulary of the instrument was generally adequate for the students, and only 6 items were modified in their wording for better understanding.

For the construct validity of the scales, an Exploratory Factor Analysis (EFA) was applied, using the Maximum Likelihood extraction method and Equamax rotation. The number of factors was previously set according to the expected factors (Lloret-Segura et al., 2014), and items with loadings higher than 0.4 were considered. Spearman's correlation matrix showed correlations no higher than 0.7 for the scales. The final versions of the scales are shown in Tables 2, 3, 4 and 5.

The first scale "Perceived difficulties in conducting IT" contains 15 items and is organised into four factors: (1) oral presentation of IT; (2) analysis and interpretation of information; (3) planning and formal aspects of IT; and (4) focus of interest of IT. Table 2 shows the factor loadings of this first scale.

Table 2

Factor loadings of the items of the "Perceived Difficulties in Performing IT" Scale

	Factor			
	1	2	3	4
Choosing a relevant topic	.165	.087	.184	.495
Identify project objectives	.088	.160	.035	.982
Follow a work plan	.154	.241	.431	.342
Data processing	.167	.537	.387	.166
Analyse the results obtained	.181	.946	.099	.113
Formulate conclusions	.202	.540	.166	.256
Meeting delivery deadlines	.200	.194	.478	.197
Establish external contacts to collect data	.165	.195	.409	.182
Designing a comprehensive index	.157	.227	.509	.196
Have a global vision of the work	.224	.274	.537	.227
Drafting the IT	.289	.265	.497	.163
Formatting the bibliography	.217	.131	.495	.179
Preparing the oral presentation	.771	.179	.134	.157
Using digital resources for oral presentation	.648	.189	.216	.164
Making a good oral presentation	.744	.180	.164	.175

The second scale "Transversal Competences perceived to be more developed with IT" contains 13 items and is organised into four factors: (1) ethics and responsibility; (2) problem solving; (3) entrepreneurship; and (4) self-regulation. Table 3 shows the factor loadings of this second scale.

Table 3

Factor loadings of the items of the Scale "Transversal competences perceived to be more developed with IT".

	Factor			
	1	2	3	4
Creativity	,264	,215	,452	,298
Initiative	,259	,297	,683	,320
Leadership	,231	,304	,670	,269
Argumentation skills	,240	,251	,427	,473
Self-study	,207	,268	,352	,547
Critical thinking	,219	,265	,240	,790
Self-confidence	,267	,524	,302	,266
Decision-making	,291	,788	,245	,251
Troubleshooting	,325	,643	,282	,319
Responsibility	,729	,338	,223	,213
Commitment to the tasks	,789	,267	,238	,213
Adaptation to new circumstances	,486	,369	,314	,307
Ethics	,488	,225	,264	,370

The third scale "Research competences perceived to be more developed with IT" contains 14 items and is organised into two factors: (1) actions of the research process; and (2) oral presentation of the research. Table 4 shows the factor loadings of this third scale.

Table 4

Factor loadings of the items of the Scale "Research Competences perceived to be more developed with IT".

	Factor	
	1	2
Formulating questions relevant to a scientific-professional field	.540	.326
Designing information-gathering instruments	.512	.258
Reflect on the results obtained	.655	.323
Search for information from a variety of sources	.734	.252
Search for rigorous and scientific information	.727	.189
Select valid information from the sources consulted	.721	.237
Using different digital platforms	.627	.286
Use office software	.543	.288
Writing coherent texts	.621	.472
Use a formal linguistic register	.638	.468
Writing scientific reports without mistakes	.455	.440
Presenting ideas orally	.380	.767
Controlling emotions in oral presentations	.199	.810
Defend arguments orally	.358	.781

The fourth scale "Attitudes towards research after IT" contains 13 items and is organised into three factors: (1) social valuation of research; (2) adoption of research behaviours; and (3) interest in the research profession. Table 5 shows the factor loadings of this fourth scale.

Table 5

Factor loadings of the items of the scale "Attitudes towards research after IT".

	Factor		
	1	2	3
Research contributes to improving the quality of life	.730	.291	.202
Research can help make the world a better place	.866	.301	.162
Research contributes to solving social problems	.777	.342	.162
All practitioners should know how to research	.505	.491	.222
Countries should invest more money in research	.519	.476	.168
I am curious about the world we live in	.391	.710	.264
I like to inform myself about current issues	.316	.732	.228
I often consult scientific information	.187	.379	.536
I can think of ideas to solve problems	.276	.477	.497

Persistence contributes to achieving goals	.431	.544	.226
I would like to have a job where I can do research	.166	.175	.859
I am interested in the research	.246	.362	.735
I would like to teach research	.052	.046	.681

For the reliability of the scales, the internal consistency index Crombach's Alpha was applied, showing a high score for all scales (Nunnally and Bernstein, 1994), as shown in Table 6.

Table 6
Summary of the data collection instrument

Dimensions	Items	Scale of measurement
Socio-demographic and contextual data	Gender	Categorical
	Age	Climb
	Centre ownership	Categorical
	Baccalaureate Modality	Categorical
	Academic performance in IT	Categorical
	Geographical distribution	Categorical
Scale of difficulties	15 items	Scalar (1 to 5) Alpha: 0.89
Scale of perception of transversal competences	3 items	Scalar (1 to 5) Alpha: 0.93
Research skills perception scale	14 items	Scalar (1 to 5) Alpha: 0.92
Attitudes towards research scale	13 items	Scalar (1 to 5) Alpha: 0.92

Data collection and analysis procedure

The questionnaire was administered online to the entire cohort during the period September-December 2021. Respondents were informed of the objectives of the research and the anonymity of their answers and the use of the data for research purposes only were guaranteed.

For the descriptive analysis, indices of central tendency and proportions were calculated. To investigate the influence of certain variables on the results of the scales, comparisons of means were used, using non-parametric tests due to the fact that the data distributions do not follow the normal law. The analyses were carried out with the SPSS v24 statistical package.

Results and discussion

The results of the scales and the contrasts with the variables: gender, school ownership, baccalaureate mode and academic performance in IT are presented below.

Scale of perceived difficulties in IT implementation

The sample surveyed expressed moderate agreement with regard to the perceived difficulties in carrying out the IT, with an average of 2.73 on the total scale, as shown in Table 7. The main difficulties are concentrated on choosing the topic of interest, following a work plan, establishing contacts to obtain data, identifying objectives and writing the IT.

Along the same lines, other studies also point to these difficulties encountered by students in conducting IT (Alturo, 2021; Ferrés et al, 2015; Menoyo; 2017). In the initial phase of the research, the most common difficulties relate to the selection and delimitation of the research topic, the identification of research questions and the formulation of hypotheses, the lack of experience in research planning, as well as the false belief that a paper has to be original. Once the research process has started, the main difficulties relate to time management and data collection and management, or the writing of first drafts. And in the final stages of the research, the more specific difficulties manifest themselves mainly in the application of research communication skills.

Table 7

Items on the scale of perceived difficulties in IT implementation (ordered by score)

Item	Media	Standard deviation
Choosing a relevant topic	2.94	1.203
Follow a work plan	2.94	1.100
Establish external contacts to collect data	2.89	1.249
Identify project objectives	2.88	1.065
Drafting the IT	2.86	1.091
Have a global vision of the work	2.82	1.086
Making a good oral presentation	2.81	1.236
Data processing	2.80	1.037
Preparing the oral presentation	2.76	1.161
Analyse the results obtained	2.72	1.058
Formatting the bibliography	2.70	1.205
Formulate conclusions	2.69	1.112
Meeting delivery deadlines	2.50	1.223
Designing a comprehensive index	2.48	1.138
Using digital resources for oral presentation	2.33	1.088
Total scale	2.73	.676

Scale of transversal competences

According to the students' perception, the IT leads to a better development of both the set of transversal competences and specific research competences. In relation to the transversal competences, the sample surveyed showed moderate agreement in the perception of the transversal competences developed with the IT, with an average of 3.27 on the total scale. As shown in table 8, the students consider that the transversal competences that IT has contributed most to developing are self-learning, critical thinking and the ability to argue. On the other hand, they show greater disagreement in the development of creativity, leadership and decision-making.

In the light of these results, it can be seen that, according to the opinion of the students surveyed, the competences developed to a greater extent are associated more with cognitive aspects of learning and less with more personal qualities or aspects of personality. In this regard, the results of Cuétara et al. (2019) also show that the learning of students who carry out research projects is deficient in terms of the personality qualities required to carry out the research cycle.

Table 8

Items of the transversal competences scale that are perceived to be more developed with IT (ordered by score)

Item	Media	Standard deviation
Self-study	3.68	1.043
Critical thinking	3.53	1.041
Argumentation skills	3.41	1.044
Ethics	3.33	1.139
Initiative	3.31	1.043
Adaptation to new circumstances	3.30	1.081
Troubleshooting	3.25	1.065
Responsibility	3.18	1.156
Commitment to the tasks	3.18	1.144
Self-confidence	3.17	1.190
Decision-making	3.15	1.085
Leadership	3.13	1.099
Creativity	3.00	1.094
Total scale	3.27	.815

Scale of specific research competences

In relation to the specific research competences, the sample surveyed agrees that IT has contributed moderately to their development, with an average of 3.54 on the total scale. As shown in Table 9, the students consider that the specific research competences that IT has contributed most to developing are those related to the actions of the research process,

such as the search for information and reflection on the results. On the other hand, those they consider to have developed less are those relating to cognitive-linguistic aspects, such as written and oral communication, such as controlling emotions in oral presentations and writing scientific reports without spelling mistakes.

Other research has also been able to identify the competences that students acquire when carrying out research work. On the one hand, they learn to take field notes, interview, carry out observations inside and outside the school, write research reports and present them publicly (Domingo-Coscollola and Hernández, 2015). On the other hand, students can acquire research skills such as the ability to identify problems, make hypotheses and predictions, use recruitment procedures and draw conclusions (Cano, 2009). Finally, Menoyo (2020) considers that students develop specific research competences that enable them to formulate questions, set objectives and adopt a research methodology, among others. However, regardless of the degree of acquisition of these specific competences, the study by Ferrés et al. (2015) concludes that "the level of acquisition of the ability to understand the fundamental elements of research and the scientific method, and of competence in research, established by the curriculum, is insufficient" (p.33).

Table 9

Items on the scale of specific research competences perceived to be most developed with IT (ordered by score)

Item	Media	Standard deviation
Search for information from different sources	3.79	1.010
Use a formal linguistic register	3.69	1.014
Reflect on the results obtained	3.68	0.919
Writing coherent texts	3.63	0.995
Select valid information from the sources consulted	3.62	1.003
Search for rigorous and scientific information	3.60	1.045
Defend arguments orally	3.59	1.088
Using different digital platforms	3.58	1.062
Using office software	3.56	1.129
Presenting ideas orally	3.54	1.105
Designing information-gathering instruments	3.40	1.063
Writing scientific reports without mistakes	3.35	1.151
Controlling emotions in oral presentations	3.31	1.180
Formulating questions relevant to a scientific-professional field	3.26	1.023
Total scale	3.54	.755

Scale of attitudes towards research after doing IT

In general terms, the surveyed students show a high degree of agreement with regard to attitudes towards research after taking the IT, with an average of 3.60 on the total scale, being the scale with the highest score. As shown in Table 10, students show the highest level of agreement with the items indicating the social value of research, and the lowest level of agreement with the items relating to interest in the research profession. The research by Toma et al. (2019) using the TOSRA scale also showed lower scores on a similar dimension, enthusiasm for science.

Table 10

Items of the scale of attitudes towards research after completion of IT (ordered by score)

Item	Media	Standard deviation
Countries should invest more money in research	4.01	1.029
Research can help make the world a better place	3.88	1.085
I am curious about the world we live in.	3.87	1.060
All practitioners should know how to research	3.86	1.052
Research contributes to solving social problems	3.82	1.075
Persistence contributes to achieving objectives	3.82	1.029
I like to inform myself about current issues	3.79	1.041
Research contributes to improving the quality of life	3.70	1.144
I am interested in the research	3.47	1.163
I can think of ideas to solve problems	3.46	1.075
I would like to have a job where I can do research	3.21	1.226
I often consult scientific information	3.18	1.176
I would like to teach research	2.70	1.267
Total scale	3.60	.794

Contrasts between scales and contextual variables

As can be seen in Table 11, there are no statistically significant differences between the perceived difficulties and the variables studied, except for achievement. This means that the difficulties are common to all students, irrespective of gender, the type of baccalaureate or the type of school. On the other hand, there are differences according to the grade obtained in the IT, since students with lower grades perceive more difficulties than the rest.

On the other hand, Table 11 also shows an influence of the variables gender, type of school, type of baccalaureate and performance on perceptions of the development of competences, both specific research and transversal, and on attitudes towards research.

Gender is a variable that has been shown to be influential in several research studies. In our study, gender shows statistically significant differences on the scale of specific research skills and attitudes towards research after taking the IT. In both scales, students

who identify with the female gender have higher scores than the rest. Similarly, in other studies, female students tend to perform better and thus have a higher degree of competence development. For example, at baccalaureate level, a recent report (MEFP, 2021) reports a significantly higher graduation rate for female students (63%) than for male students (48%). However, with regard to attitudes towards research, our results differ from other studies, where male students tend to show a greater predisposition towards research, or where there are no gender differences (Babaoğlu and Arikan, 2017; Bueno and Pérez, 2014).

The ownership of the school shows significant differences in all the scales, except in the difficulties scale. In the rest of the scales, students belonging to public schools indicate perceptions with lower scores. The school and its characteristics (resources, educational project, etc.) is a variable that has shown an important influence in several studies (Díaz, 2015). In our case, it could be thought that IT is developed differently in both types of school, that it is assigned different importance or that different methodologies are used, which would in turn influence competence development and its perception.

The baccalaureate mode also shows differences in all scales, except in the difficulty scale. In the rest of the scales, the highest perceptions are found among students in the scientific-technological stream and the lowest among students in the artistic stream. In this sense, the fact that the modality with the highest perception in competences and attitudes towards research is the scientific-technological modality could imply that more inquiry-based methodologies are applied in this modality, or that this modality is more associated with research than the rest.

The IT performance variable shows differences in all scales. Those who obtain lower marks perceive greater difficulties in carrying out the IT, the perception of the development of competences (both transversal and research-specific) is higher in those who obtain better marks, and the improvement in attitudes towards research follows the same pattern. Thus, it seems logical to think that the perceived improvement in competences would be a real reflection of better grades.

Table 11

Contrasting scales with gender and contextual variables

Variable	Categories	Difficulties	Cross-cutting competences	Specific research competences	Attitude towards research
Gender	Female	X=2.74	X= 3.30	X= 3.62	X= 3.66
	Male	X=2.71	X= 3.28	X= 3.43	X= 3.52
	<i>p</i>	.276	.555	.000	.000
Ownership	Public	X=2.75	X=3.22	X=3.5	X=3.57
	Concerted-private	X=2.68	X=3.41	X=3.68	X=3.66
	<i>p</i>	.071	.000	.000	,034

Modality	Scientific and technological	X=2.71	X=3.31	X=3.60	X=3.72
	Social-humanistic	X=2.74	X=3.28	X=3.50	X=3.49
	Artistic	X=2.83	X=2.97	X=3.31	X=3.32
	<i>p</i>	.409	.000	.000	.000
Performance	Suspended	X= 3.16	X= 2.56	X= 2.86	X= 2.95
	Approved	X= 2.92	X= 2.91	X= 3.13	X= 3.27
	Notable	X= 2.76	X= 3.24	X= 3.46	X= 3.49
	Excellent	X= 2.61	X= 3.45	X= 3.76	X= 3.83
	<i>p</i>	.000	.000	.000	.000

Conclusions

Based on the results presented above, by way of a general conclusion, we consider that the students' perception of IT is positive in terms of the improvement of competences and attitudes towards research, a fact that may encourage the bodies responsible for educational policies to continue promoting this practice, as well as a more intensive use of research-based (or inquiry-based) teaching methodologies at the different educational stages. In this sense, we agree with authors such as Menoyo (2013, 2016) and Franco-Mariscal (2015) in considering that research skills should be acquired early on, developing research work with students that is agreed upon by the teachers at the different stages and from the different subjects.

With regard to the first objective, we can conclude that the difficulties perceived by high school students in carrying out their research work are similar to those of any researcher. In this sense, Tamayo (2005) states that there are no differences in terms of research difficulties between a child, an adult or a trained researcher; the difference between them lies in the levels of systematisation of the processes that are developed.

Regarding the second objective, students perceive a moderate development of competences with the completion of IT. In order to foster research competence, students must acquire and develop skills linked to scientific methodology or scientific literacy, as well as more transversal aspects, which coincides with Menoyo's (2020) statement that students must acquire the necessary tools to be observant, curious, with a critical spirit, who know how to work collaboratively, who seek ways to find answers to their questions and who construct meaningful knowledge. This idea is aligned with the competences approach of the current Spanish education law (LOMLOE, 2020) and with the European Social Council Recommendation (2018) on key competences for lifelong learning, where transversal competences and research skills are increasingly necessary for professionals to respond to the challenges of current and future society.

Likewise, in relation to the third objective, the findings also show that the IT seems to influence an improvement in the perception of research as something that can help to improve society. However, students show a low interest in the research profession, even though they have taken the IT, probably due to the lack of an educational culture that promotes research, the search for knowledge and enquiry methodologies (Rojas et al., 2012). IT alone would not be enough to foster a favourable attitude towards research in all

its dimensions. In fact, there are important conditioning factors that predispose to unfavourable attitudes, such as the low relevance of research for the future professional and everyday life of students (Papanastasiou, 2005).

With regard to the fourth and last objective, the results obtained show interesting differences by type and type of baccalaureate which will have to be explored in depth in future research.

Finally, although this work is a precursor in this area within our context, it has limitations such as the type of sampling, which was carried out accidentally and not proportionally according to the population per territory, or the measurement of perceptions and not of real research competences. On the other hand, there is the difficulty of contrasting some of the results obtained with other studies, given the scarcity of research focused exclusively on IT. However, on the whole, the study is highly relevant in emphasising a topic of empirical interest that has not been sufficiently explored. In future research, following the line of the present study, it would be interesting to find out from a more qualitative approach, what meanings students attribute to the development of competences and attitudes towards research after the completion of IT. Likewise, a pre-post design could help to better determine the influence of IT on competence development and attitudes towards research.

References

- Aldana, G. M., Babativa, D. A., Caraballo, G. J. and Rey, C. A. (2020). Attitudes towards research scale (EACIN): evaluation of its psychometric properties in a Colombian sample. *Revista CES Psico*, 13(1), 89-103. <https://doi.org/10.21615/cesp.13.1.6>
- Alturo, N. (2021). *Investigar al batxillerat. La tutorització de treballs de recerca de llengua i literatura catalanes*. Universitat de Barcelona. <http://www.edicions.ub.edu/ficha.aspx?cod=12686>
- Babaođlan, B. and Arıkan, T. (2017). Sixth grade students' attitude toward science course. *Turkish Journal of Education*, 6(2), 68-78. <https://doi.org/10.19128/turje.294844>
- Bueno, A. and Pérez, A. (2014). Attitudes of primary and secondary school students to the dichotomous view of science. *Enseñanza de las Ciencias*, 32(3), 111-132. <https://doi.org/10.5565/rev/ensciencias.1015>
- Cano, M. I. (2019). School research: an issue of teaching and learning in Secondary Education. *Investigación en la Escuela*, 67, 63-79. <https://doi.org/10.12795/IE.2009.i67.05>
- Cañal, P. (2012). How to assess scientific competence? *Investigación en la Escuela*, 78, 5-17. <http://hdl.handle.net/11441/59927>
- Castillo, M. A., Samaniego-Gaxiola, J., Madinaveitia, Y. C., Mascorro, A. G., Díaz, D. A. R. and Avalos, H. (2018). Performance of generic competencies from research projects in students of agricultural and livestock technological baccalaureate in Coahuila. *Revista Mexicana De Investigación Educativa*, 23(79), 1217-1234.
- Cuéstara, Y., Hernández, M. and Álvarez, M. (2019). Research projects in the baccalaureate: an alternative for the teaching-learning process of statistics. In J. M. Contreras, M. M. Gea, M. M. López-Martín and E. Molina-Portillo (Eds.), *Actas del Tercer Congreso Internacional Virtual de Educación estadística*.

- Curran, F. C. and Kitchin, J. (2019). Early Elementary Science Instruction: Does More Time on Science or Science Topics/Skills Predict Science Achievement in the Early Grades? *AERA Open*, 5(3). <https://doi.org/10.1177/2332858419861081>
- De la Cruz, C. (2013). Attitudes towards scientific research in university students: Analysis in two national universities in Lima. *Psiquemag*, 2(1), 1-16. <https://revistas.ucv.edu.pe/index.php/psiquemag/article/view/99>
- Decree 171/2022, of 20 September, on the organisation of baccalaureate education. *Diari Oficial de la Generalitat de Catalunya*, 8758, 22 September 2022. <https://portaljuridic.gencat.cat/eli/es-ct/d/2022/09/20/171>
- Díaz, T. (2015). The integral development of the student: some family and context variables. *Revista Ibero-americana de Educação*, 68(1), 125-140.
- Domingo-Coscollola, M. and Hernández-Hernández, F. (2015). Young people doing research in secondary education: alternatives for learning. *Profesorado. Revista de curriculum y formación del profesorado*, 19(2), 133-146.
- Estrada, O. (2014). Theoretical systematization of research competence. *Revista Electrónica Educare*, 18(2), 177-194. <http://dx.doi.org/10.15359/ree.18-2.9>
- Ferrés, C., Marbà, A. and Sanmartí, N. (2015). Students' enquiry work: Assessment tools and identification of difficulties. *Revista Eureka sobre Enseñanza y Divulgación de las Ciencias*, 12(1), 22-37. <https://revistas.uca.es/index.php/eureka/article/view/2900>
- Franco-Mariscal, A. J. (2015). Scientific competences in teaching and learning by research. A case study on metal corrosion in secondary school. *Science Education*, 33(2), 231-252. <https://raco.cat/index.php/Ensenanza/article/view/293274>
- Organic Law 3/2020, of 29 December, which amends Organic Law 2/2006, of 3 May, on Education. *Boletín Oficial del Estado*, 340, of 30 December 2020. <https://goo.su/kTqEXK>
- Lloret-Segura, S., Ferreres-Traver, A., Hernández-Baeza, A. and Tomás-Marco, I. (2014). The exploratory factor analysis of items: a practical, revised and updated guide. *Annals of Psychology*, 30(3), 1151-1169.
- Mamani, D. (2011). Attitude towards research and its importance in the choice of thesis modality for professional degree. *Revista Científica de Ciencias de la Salud*, 4(4), 22 - 27. <https://doi.org/10.17162/rccs.v4i1.82>
- María, I., Meneses, J. A. and Diez, M. (2017). The science education of students of the degree in Primary Education. *Electronic Journal of Science Education*, 16(2), 231-256.
- Menoyo, M. (2013). *Anàlisi del procés de realització i tutorització dels treballs de recerca a secundària*. Doctoral thesis, Universitat Autònoma de Barcelona.
- Menoyo, M. (2016). *La realización de trabajos de investigación Un reto para el alumnado y el profesorado de Secundaria*. Octaedro.
- Menoyo, M. (2017). Doing science to communicate science from 1st ESO: Learning to think, read, do, speak and write science. *Modelling in Science Education and Learning*, 10(1), 149-170. <https://doi.org/10.4995/msel.2017.6556>
- Menoyo, M. (2020). Educating the scientific outlook of secondary school students in the framework of the Sustainable Development Goals, educating for global citizenship at a time of educational change. *Modelling in Science Education and Learning*, 13(2), 21-42.
- Menoyo, M. (2021, July). *The assessment of competences in baccalaureate research work* [Invited paper]. II Congreso virtual Iberoamericano de Docentes. Teachers facing the pandemic. España.

- Ministry of Education and Vocational Training (2021). *Classrooms for equality*. Ministry of Education and Vocational Training.
- Mohd, S. and Mohamad, N. (2010). Developing research skills at secondary school. *Procedia Social and Behavioral Sciences*, 9, 512-516. <https://doi.org/10.1016/j.sbspro.2010.12.189>
- Muñoz, J. M., Hernández, M. J. and Serratte, J. (2019). The interest in scientific knowledge of secondary school students in Spain. *Educação & Sociedade*, 40. <https://doi.org/10.1590/ES0101-73302019187204>
- Navarro, M., Förster, C., González, C. and González-Pose, P. (2016). Attitudes toward science: measurement and psychometric properties of the Test of Science-Related Attitudes for its use in Spanish-speaking classrooms. *International Journal of Science Education*, 38(9), 1459-1482. <https://doi.org/10.1080/09500693.2016.1195521>
- Nunnally, J. C. and Bernstein, I. H. (1994). *Psychometric theory*. McGraw Hill.
- OECD (2002). *Definition and Selection of Competences (DeSeCo): theoretical and conceptual foundations*. OECD.
- Olivera, E. (2020). Attitudes towards research of undergraduates in Management and Psychology at a Peruvian university. *Revista de Ciencias Sociales y Humanidades Chakiñan*, 11, 70 - 81. <https://goo.su/vMKn4>
- Palacios, L. (2021). A systematic review: Attitude towards research in Latin American universities. *Journal of Communication Research and Development*, 12(3), 195 - 205. <https://doi.org/10.33595/2226-1478.12.3.533>
- Papanastasiou, E. C. (2005). Factor structure of the "Attitudes Toward Research" Scale. *Statistics Education Research Journal*, 4(1), 16-26. <https://doi.org/10.1037/t64085-000>
- Payá, M., Ayuste, A., Cano, A. B., Gros, G., Escofet, A. and Piqué, B. (2018). *Guide for training in research competence*. Universitat de Barcelona.
- Queiruga-Dios, M. A., López-Iñesta, E., Diez-Ojeda, M., Sáiz-Manzanarez, M. C. and Vázquez, J. B. (2020). Citizen Science for Scientific Literacy and the Attainment of Sustainable Development Goals in Formal Education. *Sustainability*, 12, 4283. <https://doi.org/10.3390/su12104283>
- Royal Decree 243/2022, of 5 April, establishing the organisation and minimum teaching of the Baccalaureate. *Boletín Oficial del Estado*, 82, 6 April 2022. <https://goo.su/Ki0Z1z>
- Council Recommendation of 22 May 2018 on promoting common values, inclusive education and the European dimension in education. Official Journal of the European Union, 195/L 140, 7 July 2018. <https://goo.su/Qo1u90J>
- Rojas, H. M., Méndez, R. and Rodríguez, A. (2012). Attitude index towards research in undergraduate students. *Entramado*, 8(2), 216-229.
- Roso, M. (2010). Research in Secondary Education: the "young researchers". *Tejuelo*, 9, 100-120. <https://tejuelo.unex.es/article/view/2454>
- Rubio, M. J., Torrado, M., Quirós, C., and Valls, R. (2018). Self-perception of research competences in final year students of Pedagogy at the University of Barcelona to develop their Final Degree Project. *Revista Complutense de Educación*, 29(2), 335-354. <https://doi.org/10.5209/RCED.52443>
- Sánchez, C. and Viejo, J.L. (2012). Researching before university: research at pre-university educational levels. *Encuentros Multidisciplinares*, 42, 1-10. <http://hdl.handle.net/10486/678992>

- Tamayo, M. (2005). *El proceso de la investigación científica*. Noriega.
- Toma, R. B., Ortiz-Revilla, J. and Greca, I. M. (2019). What attitudes towards science do Primary School students who participate in extracurricular science activities have? *Apex. Revista de Educación Científica*, 3(1), 55-69. <https://doi.org/10.17979/arec.2019.3.1.4599>
- Valdés, A., Estévez, E. and Vera, J. A. (2013). Development of scientific competences in graduate students from the teacher's perspective. *Educere*, 17(56), 129-138. <https://goo.su/v3PkfiR>

Traducido con  DeepL

Date of receipt: 15 November 2022.

Review date: 14 December 2022.

Date of acceptance: 5 September 2023.