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Evaluation of Research Competencies in High School Students. Cross-Sectional Study

Ángel Wilkins Álvarez Vásquez[1], María Liliana Calderón Macías[2]*, Ana Joselyne Parrales Choez[3], Christel Gema Moreira Parrales[4]

Abstract

The educational trends of the twenty-first century demand high school students with research skills that allow them to develop critical thinking and problem solving. Objective: To evaluate the research competencies of high school students in an urban parish in Ecuador between July and August 2025. Method: cross-sectional study conducted in high school students, the sample was 216 students selected in a simple random way, the instrument used was adapted from the Research Competencies Evaluation Scale (EECI), descriptive statistics such as frequency, percentage, mean and standard deviation were analyzed. Results: The general meaning per item (each question) was 3.29 ± 0.98, that is, the research competencies in high school students who participated in this research is average. Students perceive themselves as having a low capacity (Mean 2.90 ± 0.95) in the competencies related to the structuring of the logical design of the research and the procedures of selection and analysis of data. Students consider that they have a high capacity in the competencies related to communication and use of ICTs (Mean 3.51 ± 0.99). Conclusions: These findings suggest the need to strengthen the pedagogical approach to research from an early age, incorporating active methodologies, teacher accompaniment and safe spaces for trial and error. In addition, it is critical that students understand methodological design not as a rigid formula, but as a flexible tool for answering relevant questions in their contexts.

Keywords: *Social skills; Research; Student; Methodology*

Introduction

Currently, the teaching of research skills in secondary education still represents a challenge for the education system (Villacres et al., 2025). In Ecuador, high school students – especially those interested in studying health – are expected to receive complementary training in experimental scientific areas that allow them to address natural phenomena through observation and experimentation (Competency Curricular Framework for Learning for the National Education System, 2023). Recognized as one of the competencies of the twenty-first century, research competence can help students navigate through the complexities of an ever-evolving world (Ciraso-Calí et al., 2022). A student with developed research skills has basic knowledge in methodology, information search, writing rules and the use of information and communication technologies (Castillo-Martínez & Ramírez-Montoya, 2021). In traditional educational practice, these competencies are expected to be developed at the level of higher or university education,

[1] School of Nursing. Universidad Estatal del Sur de Manabí. Jipijapa – Ecuador.
[2] School of Nursing. Universidad Estatal del Sur de Manabí. Jipijapa – Ecuador. maria.calderon@unesum.edu.ec
[3] School of Nursing. Universidad Estatal del Sur de Manabí. Jipijapa – Ecuador.
[4] School of Nursing. Universidad Estatal del Sur de Manabí. Jipijapa – Ecuador.

directing the student to solve real or potential problems or situations that affect their field of action (Bani et al., 2020). However, global trends in education require the teaching of research skills in secondary education and point to it as necessary to develop critical thinking and problem-solving (Lacson & Dejos Jr, 2022). On the other hand, most students conceive of research as a tedious, complex, and uninteresting process, especially when they are not used to research (Lacson & Dejos Jr, 2022), so the results of their first research experiences are often deficient and incomplete. Among the main causes of this problem is the lack of preparation and therefore little development of research skills (Villacres et al., 2025). In this sense, it is essential that teachers are aware that students cannot acquire these skills immediately, so it is recommended to evaluate these competencies beforehand (Marrs et al., 2022), in order to design effective educational strategies for their development.

In this context, within the framework of the project of linkage with society "Transversal competencies in high school students interested in studying health careers", the present research was developed that aimed to evaluate the research competencies in high school students of an urban parish of Jipijapa, province of Manabí.

Method

This is a cross-sectional study conducted among high school students in an urban parish in Ecuador between July and August 2025. The study used a sample of 216 students selected in a simple random manner from a total of 485 students. The sample was calculated under a 95% confidence index using the digital tool QuestionPro (QuiestionPro, 2022). The instrument used was adapted from the Research Competency Assessment Scale (EECI) developed and validated by Ortega & Jaik in 2010 with a reliability level of 0.98. The questionnaire is divided into two sections, competencies in research methodology and generic competencies (Ortega Rocha & Jaik Dipp, 2010). In addition, the participants were asked about sociodemographic variables. For the self-evaluation of the items, a Likert scale of 1 to 5 points was used, where 1 is not at all competent and 5 is very competent. For the analysis of the data, descriptive statistics such as frequency, percentage, mean and standard deviation were applied. Prior to the application of the questionnaire, the authorization of the parents or legal representatives of the students was requested because they are minors. It was necessary to sign informed consent and assent, which was explained in detail by the researchers and signed by the parents and students participating in the research. The ethical aspects of the study were reviewed and approved by the Directorate of Linkage with Society of the State University of the South of Manabí through Protocol/Project No. COD. 003-2025-D.V.UNESUM.

Results

Characterization of the participants

The average age of the participants was 17 years. 95.8% of students have internet service at home, which mostly comes from an antenna or cable connection (92.1%). 69.4% of students have a computer at home (Table 1).

Table 2. Characterization of the participants

		n (%)
Average age	17 years	
Have internet at home	Yes	207 (95,8)
	No	9 (4,2)
Internet source	By cable or satellite antenna	199 (92,1)
	Mobile data	16 (7,4)
	Not applicable	1 (0,5)
Have a computer at home	Yes	150 (69,4)
	No	66 (30,6)

Authors, 2025.

Evaluation of research competencies

The general meaning per item (each question) was 3.29 ± 0.98, that is, the research competencies of high school students who participated in this research are average (Table 2). Students perceive themselves as having a low capacity (Mean 2.90 ± 0.95) in the competencies related to the structuring of the logical design of the research and the procedures of selection and analysis of data. Students consider that they have a high capacity in the competencies related to communication and use of ICTs (Mean 3.51 ± 0.99). Cronbach's alpha of the applied instrument yielded a value of 0.93, thus expressing the reliability of the answers obtained (data) and validating the diagnosis.

Table 2. Results of the evaluation of research competencies

Scale Items	Media	Standard deviation
Identify situations and/or problems in their environment (school or community) that need to be investigated	3.25	1.03
Identify the elements of the research problem	3.18	0.97
Define specific objectives based on the general objective	3.21	0.88
Explain why the topic of study is being developed	3.47	0.95
Explain who benefits from the research	3.48	1.01
Identify research limitations	3.25	0.93
Relate the background to the research work being conducted	3.25	0.93
Define concepts related to research variables	3.26	0.88
Specify the theoretical model under which the research will be developed	3.01	0.93
Specify the dimensions or subcategories to be used in the research	2.96	0.93
Operationalize research variables	3.04	0.93
Characterize the types of research (exploratory, descriptive, correlational, or explanatory)	3.20	1.00
Differentiating between experimental and non-experimental research	3.17	1.04
Use probability sampling	2.77	1.01
Use non-probability sampling	2.74	0.96
Choosing the research method	3.36	1.02
Choosing the research technique	3.39	1.03

Design and implement a questionnaire	**3.53**	**0.95**
Conduct an-interview	3.41	1.01
Build Shapes and Tables	3.20	1.00
Manage measures of central tendency (mean, media and mode)	3.27	1.00
Interpret statistical data	3.26	0.97
Communicate orally	**3.83**	**0.91**
Communicating in writing	**3.70**	**1.01**
Operating the Computer	**3.70**	**1.04**
Conduct bibliographic searches of the scientific literature	3.37	1.03
Prepare a bibliography reference or citation	3.26	1.09
Translate texts from English to Spanish	3.42	1.14
Produce written texts (essays, bibliographic consultations)	**3.53**	**1.05**
Total	**3.29**	**0.99**

Authors, 2025.

Discussion

Research competence

The findings of this research reveal that high school students perceive themselves as having a medium level of research competence. This perception is consistent with recent studies that highlight the influence of emotional, pedagogical and contextual factors in the construction of research competencies during adolescence. Satisfaction of competence in the classroom is closely linked to teaching practices that promote autonomy, emotional support, and clear structure (Reymond et al., 2022). In their qualitative study with high school students, they identified that the climate of perceived error, the quality of teaching, and peer support are determinants for students to feel competent (Reymond et al., 2022). The medium to low perception of research competence in this study could reflect an absence of these conditions, especially in rural contexts or with structural limitations. In addition, literature has underlined the role of self-efficacy beliefs in academic performance. Students with low self-efficacy tend to avoid challenging tasks such as research, which perpetuates a negative perception of their own abilities (Pajares & Schunk, 2001). This cycle can be compounded by educational practices that prioritize memorization over critical thinking and inquiry. The relationship between self-esteem and social skills has also been explored in Latin American contexts. A previous study revealed that higher self-esteem is associated with better social skills, which could facilitate participation in collaborative research processes (Cuastumal & Guadalupe, 2023). In this sense, strengthening self-esteem and the sense of belonging in the classroom could be a key strategy to improve the perception of research competence.

Methodological design

In this study, high school students perceive themselves as having a low level in terms of the methodological design of research. This perception is consistent with recent studies that point to structural weaknesses in research training from secondary education. The most effective strategies for developing research competencies in secondary school students include project-based learning (PBL), problem-based learning (PBL), the use of educational technologies, and

the explicit integration of research into the curriculum (Palacios et al., 2023). However, in many contexts, these strategies are not implemented systematically, limiting the development of skills such as question formulation, method selection, and data analysis. Other researchers highlight that, even at university levels, students perceive deficiencies in key competencies such as reviewing the state of the art, mastery of scientific content, and communication skills to structure coherent methodological designs (Ciraso-Calí et al., 2022). This gap originates in previous stages of the educational system, where research is usually approached superficially or as a complementary activity. Along the same lines, it is noted that research competence self-assessment instruments have proven to be valid and reliable for diagnosing these perceptions (Palacios et al., 2023). The low self-evaluation in the methodological design could reflect not only a lack of technical knowledge, but also insecurity, scarce formative feedback and a school culture that does not promote inquiry as a reflective process.

Sampling

The results of this research reveal that high school students perceive themselves as having a low level of research competence to develop sampling or sample selection in research. This perception is consistent with recent studies that show weaknesses in the understanding and application of fundamental methodological concepts among secondary school students. A previous study revealed that high school students have persistent difficulties in scientific skills such as hypothesis formulation, experimental design, and selection of appropriate samples (Fernández et al., 2022). This study also observed that even at the end of secondary education, many students fail to understand the purpose or the criteria of representativeness that support the sampling. Similar results found that students exhibit a moderate level of competence in research methods and data analysis, but a low understanding in technical aspects such as sampling design (Hornoz & Fegarido, 2025). This suggests that although students may recognize research problems, they lack the necessary tools to structure a rigorous methodological process. Other authors highlight that the development of research competencies in secondary school requires active strategies such as project- and problem-based learning, as well as an explicit integration of research into the curriculum (Palacios et al., 2023). However, sampling is usually approached superficially, as an isolated technical step, without linking it to the research purpose or the sociocultural context of the study.

Use of ICTs

Baccalaureate students perceive themselves as having an elevated level of competence in the use of information and communication technologies (ICT). This finding is consistent with recent studies that show a growing familiarity and confidence of young people in the digital environment, especially when it comes to academic tasks that involve searching for information, organizing data, and presenting results. Similar studies found that high school students perceive digital tools as facilitators of autonomy and competence, allowing them to learn at their own pace, explore personal interests, and structure their research processes more efficiently (Stalmach et al., 2025). This positive perception is linked to the daily use of technologies in school and extracurricular contexts, which reinforces digital self-efficacy. Other authors have shown that there is a significant association between student autonomy, attitudes toward problem-solving, and digital competence (Blanc et al., 2025). In their study, students who participated in STEM activities using open digital tools reported improvements in their ability to address research challenges, including planning, analyzing, and communicating results (Blanc et al., 2025). These

findings suggest that the use of ICT not only enhances technical skills, but also strengthens key cognitive and emotional dimensions for research, such as motivation, curiosity and perseverance. The high self-perception of competence in ICT could be acting as a transversal facilitator that compensates for other methodological weaknesses, such as sample design or hypothesis formulation.

CONCLUSIONS

The purpose of this study was to evaluate research competencies in high school students. It is concluded that, in general, students perceive themselves as having a medium level of research competence, with a low level of competencies related to methodological design and sample selection, and with an elevated level in the use of information and communication technologies. These findings suggest the need to strengthen the pedagogical approach to research from an early age, incorporating active methodologies, teacher accompaniment and safe spaces for trial and error. In addition, it is critical that students understand methodological design not as a rigid formula, but as a flexible tool for answering relevant questions in their contexts. Finally, it is important to consider that the self-assessment of research competencies not only reflects technical skills, but also emotional and motivational dimensions. The low perception reported by students could indicate an urgent need to redesign pedagogical strategies, incorporating approaches that promote autonomy, critical reflection and emotional accompaniment.

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