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Article

Exploring interest and familiarity in science skills across teacher training stages

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Abstract: Skills in scientific processes are part of scientific literacy and constitute a very important component of science teaching. However, there are few studies that determine how key factors in scientific literacy change throughout the educational process. This research examines how familiarity and interest in science processes evolve throughout the education of future teachers. The study involved 200 students from different educational stages: 41 students from secondary education; 67 students from high school; 69 students from bachelor's degree in education; and 23 students from the secondary education master's program from different educational centers in the Valencian community. Data collection instruments included a validated closed-question questionnaire, as well as a discussion group with a representative group of students aimed at better understanding the quantitative data, thus combining quantitative and qualitative methods of data analysis. Overall, it is observed that familiarity and interest in science processes improve throughout the educational stages. Based on these results, the need for a change in science education from an early age is suggested to improve students' understanding and contextualization of science in their daily lives.

Keywords: familiarity; interest; skills; science education

1. Introduction

The challenges of the 21st century are intricately linked with scientific education. Miklos [1] identifies natural phenomena, economic competitiveness, problems and solutions in science and technology, and training for new professional demands as key concerns that educational systems should address. That means advancement of scientific education must prioritize the cultivation of knowledge construction and the meticulous interpretation of information to foster individual comprehension. This progression, as delineated by Osborne [2], necessitates grounding in scientific practices, which, facilitated through science pedagogy, facilitate the development of models for articulating personal ideas.

Consequently, the provision of training that equips future citizens to navigate the scientific-technological and economic shifts defining the contemporary era is imperative. It is essential to prepare students via scientific education to optimize their potential. To achieve this, fostering a public science ethos is crucial in bridging the gap between science and society [3]. Conversely, concerning is the inadequate proficiency of young individuals in STEM disciplines [4], underscoring the multifaceted challenge of enhancing science education methodologies.

Familiarity and interest in scientific process skills

Scientific literacy encompasses an understanding of the various material, conceptual, or institutional tools involved in validating scientific theories. Additionally, it entails awareness of the social, economic, and ideological contexts underpinning technological advancement [5]. The pivotal role of science education in fostering scientific literacy underscores the imperative for schools to promote core scientific values. This nexus between literacy and science pedagogy has been consistently underscored in various educational reforms, emphasizing the significance of imparting scientific process skills [6–8].

Numerous studies [9,10] demonstrate enhanced academic performance in scientific disciplines when instructional methodologies prioritize these scientific process skills. Scholars like Bybee [11] delineate key scientific practices as: inquiring about natural phenomena, constructing scientific models, investigating, interpreting results, employing mathematical reasoning, developing explanations, substantiating arguments with evidence, and communicating findings. Previously, Padilla [12] categorized process skills into basic ones—such as observing, inferring, measuring, communicating, classifying, and predicting—and integrated ones, including controlling variables, operationally defining, formulating hypotheses, interpreting data, experimenting, and constructing models. Therefore, Maison and colleagues [13] underscore the critical need to adequately prepare teachers in scientific process skills. They advocate for teachers' familiarity and conceptual mastery to effectively impart these skills to their students.

Several studies have indicated that teachers exhibit a high level of familiarity with scientific process skills but display only moderate interest in them. Moreover, teachers tend to show greater interest in acquiring knowledge about integrated skills compared to basic process skills. However, they often possess limited conceptual understanding of scientific process skills [14,15], which can stem from deficiencies in scientific conceptual content knowledge or inadequate epistemological beliefs developed during their teacher training [15]. Despite these challenges, Porlán and colleagues [16] underscore that change in teachers' conceptions and practices is feasible, although challenging. Introducing the Technological Pedagogical Content Knowledge (TPACK) model in future teachers' classrooms is proposed as a means to enhance their Pedagogical Content Knowledge (PCK) and facilitate the learning of scientific process skills through the integration of pedagogical, content, and technological knowledge [17].

Furthermore, it's important to acknowledge that these deficiencies may be exacerbated in certain groups due to the influence of social and emotional factors that shape STEM positioning [18], as well as the significant impact on students' self-efficacy perception in relation to their identity, leading to substantial gender biases in students' preferences [19]. As documented in scientific literature, these perceptions and attitudes towards STEM content are pivotal in predicting students' future engagement in science-related studies [20], underscoring the necessity for teacher training initiatives that address these realities [21].

There is limited research on the familiarity with and interest in the scientific process among students in compulsory education. Among the available studies, Solaz-

Portolés et al. [22] concluded that familiarity and interest levels are high and significantly improve by the end of secondary education. However, there is a dearth of research on familiarity and interest at the preschool or primary education levels, despite studies such as Aristizabal and Restrepo's [23] demonstration that preschoolers aged 5 have the ability to formulate inferences of varying complexity and typology. Historical references, such as Tonucci [24], also suggest that children construct explanatory theories of reality from a young age, akin to those utilized by scientists.

This situation underscores the imperative of instructing based on scientific process skills, highlighting the crucial need for future teachers to possess the capacity to fulfill this role effectively. The teacher's capability to deliver such instruction depends, in part, on their familiarity with and interest in scientific process skills. Conversely, the efficacy of this instruction on students is contingent upon their own familiarity with and interest in the scientific process. Thus, the factor of interest and familiarity emerges as pivotal in the scientific literacy processes for both students and teachers, thereby holding significance for teacher training. Despite the compelling evidence, specific quantitative studies evaluating familiarity and interest in science processes across various educational levels are lacking. Hence, to address this gap, we embarked on an initial exploratory study to assess the familiarity and interest demonstrated in these skills among secondary and baccalaureate students, teacher trainees, and students enrolled in a master of secondary education program. This study aims to address the gap in understanding how familiarity and interest in scientific process skills evolve across different educational levels. By examining these groups, the study intends to uncover patterns and correlations that can inform strategies for enhancing scientific literacy and effective science instruction. Ultimately, the goal is to identify ways to better prepare future teachers to cultivate a strong foundation in scientific process skills, thereby improving the overall quality of science education.

2. Methodology

2.1. Sample characteristics

The work sample comprises 200 students from diverse educational stages, distributed as follows: 23 students from the 3rd year of secondary education, 18 from the 4th year of secondary education, 67 1st-year post-secondary baccalaureate students (with 26 specializing in science and technology and 41 in humanities and social sciences), 69 students pursuing a teacher's degree (with 51 focusing on early childhood education and 18 on early childhood/primary education), and 23 students enrolled in the master of secondary education program, specializing in technology. Of the total student population, 30.5% identify as male, 66.5% as female, and 3% chose not to respond (see **Table 1**).

The secondary students' range in age from 13 to 15 years old, baccalaureate students (post-secondary) from 16 to 18 years old, students in the teacher's degree program from 19 to 36 years old, and master of secondary education students from 23 to 53 years old. All these students originate from environments proximate to the city of Valencia (Spain), sharing similar socio-cultural characteristics (see **Table 1**).

Table 1. Main characteristics of the study sample.

Stage educational		**No. students (total 200)**	**Sex (30.5% men, 66.5% women, 3% NAS/NC)**			**Age (years)**
			Man	**Women**	**NAS/NC**	
Secondary	3rd	23	7	13	3	13–15
	4th	18	3	15	-	
1st baccalaureate (post-secondary)	Science and technology	26	10	15	1	16–18
	Humanities and social sciences	41	18	23	-	
Degree (teacher training)	Childish	51	5	46	-	19–36
	Primary	18	3	14	1	
Secondary teacher master's degree technology		23	15	7	1	23–53

2.2. Quantitative analysis methodology

2.2.1. Data collection instruments

To address the objectives of our research within the positivist paradigm, we will employ a non-experimental design, defining the variables to be measured using two validated questionnaires administered electronically. These questionnaires will gauge the following variable:

- Dependent variable:

Familiarity and interest in the processes of science. The Spanish version of the questionnaire validated by Miles [14] will be utilized. This questionnaire solicits information regarding participants' familiarity with and interest in science process skills. Part A of the questionnaire comprises thirteen items, with the first six focusing on basic skills and the subsequent seven on integrated skills. In this section, participants are required to indicate whether each skill is "not familiar to me," "familiar to me, but I do not understand its meaning," or "familiar to me, and I understand its meaning." In Part B, participants are asked to select one of the following options for each of the thirteen skills from Part A: "I am not interested in learning about it," "I am interested in learning more about it," or "I am very interested in learning more about it."

The completed questionnaires will be scored as follows: in Part A, a value of 0 will be assigned for the option "not familiar to me," a value of 1 for "familiar to me, but I do not understand its meaning," and a value of 2 for "familiar to me, and I understand its meaning." In Part B, values of 0, 1, and 2 will be assigned for "I am not interested in learning about it," "I am interested in learning more about it," and "I am very interested in learning more about it," respectively.

The questionnaire is valid for the complete sample, as it has been used before with the same ages: for secondary students Ortega-Torres et al. [25] and university students Ramirez-Echeverry et al. [26].

- Independent variables:

Educational stage: This variable refers to the current level of education being pursued by the participants. Four groups will be established:

1) Secondary
2) Post-secondary degree
3) Degree (teachers in training)

4) Postgraduate (secondary master's degree)

Pre-degree studies: This variable categorizes participants based on their pre-degree educational background. Two groups will be established:

1) Basic training in science
2) Basic non-science training

Gender: This variable captures the gender identity of the participants. Three groups will be established:

1) Male
2) Female
3) Prefer not to answer

Additionally, other information collected in the questionnaires includes the study center, academic year, and age of the participants.

The data collection process was conducted during science classes with the presence of both the science teacher and the researcher. On average, part A of the questionnaire took 45 min to complete, while part B required 30 min for each group. The total data collection period was 6 months.

2.2.2. Statistical analysis

In all numerical results where a statistical analysis of the data is presented, significance testing was conducted using the following methods:

Kruskal-Wallis test: This non-parametric test was employed to determine if there are significant differences in the values of the independent variable (quantitative) among the groups defined by the dependent variables (categorical). The test is suitable for comparing three or more groups and is performed with a bilateral significance level.

Double-entry contingency table analysis: For categorical variables, a double-entry contingency table was constructed. Pearson's z and the chi-square test were utilized to compare proportions of independent data. These tests evaluate the association between two categorical variables.

A p-value less than or equal to 0.05 was considered significant, corresponding to a 95% confidence interval.

All statistical analyses were conducted using the statistical package for the social sciences (SPSS), version 24.

2.3. Qualitative methodology

Discussion group

The discussion group, as a technique rooted in the critical paradigm, serves as a means to explore social reality through qualitative methodology, emphasizing debate or discussion within small groups [27]. Drawing from the results gleaned from the questionnaires, a discussion script was formulated to engage students enrolled in the master of secondary education program (S1(Appendix)). This decision was based on the premise that this cohort possessed the greatest capacity for reflection on the topic due to their age, maturity, prior training, and dedicated classroom time focused on the subject matter central to the research at hand.

Subsequently, a comprehensive analysis of the transcription was undertaken to attain a holistic understanding of its content, as advocated by Friberg and Öhlen [28].

This involved fragmenting the data into minimal units of meaning, facilitating a deeper exploration of the insights gleaned from the discussion.

The discussion focus group comprised five students, consisting of two girls and three boys. Among them, two students were not employed, while the remaining three were balancing work commitments alongside their studies in the master's program.

3. Results

3.1. Results quantitative

The Kruskal-Wallis test indicates significant differences (p-value < 0.000) among the various educational stages concerning familiarity and interest in both basic and integrated skills of the scientific process (see **Table 2**).

Table 2. Statistics of the Kruskal-Wallis test that relates familiarity and interest in the skills of the scientific process in the different educational stages (secondary, baccalaureate, master in training and master of secondary education).

	Familiarity		**Interest**	
	Basic skills	**Integrated skills**	**Basic skills**	**Integrated skills**
Chi squared	29.198	32.508	36.996	22.773
gl	3	3	3	3
Asymptotic sig.	0.000	0.000	0.000	0.000

The significance level is 0.05.

Based on the analysis of the results among peers (**Table 3**), several observations can be made regarding the familiarity and interest in science processes across different educational stages:

Table 3. Statistics of the Kruskal-Wallis test comparing pairwise familiarity and interest of the different educational stages asymptotic significances are shown.

	Familiarity		**Interest**	
	Basic skills	**Abilities integrated**	**Basic skills**	**Abilities integrated**
Sample 1—Sample 2	p-value	p-value	p-value	p-value
Secondary—Post secondary	0.452	0.072	0.600	0.849
Secondary—Degree (teacher training)	**0.001**	0.054	**0.000**	**0.007**
Secondary—Secondary teacher master's degree	**0.000**	**0.000**	**0.000**	**0.001**
Post-secondary—-Degree (teacher training)	0.099	0.896	**0.000**	0.051
Post-Secondary—Secondary teacher master's degree	**0.001**	**0.000**	**0.000**	**0.003**
Degree (Teacher training)—Secondary teacher master's degree	0.270	**0.000**	0.308	0.681

The significance level is 0.05; values less than 0.05 are indicated in bold.

There are no significant differences between the educational stages of secondary and post-secondary in terms of familiarity and interest in science processes (**Table 3**, row 1).

Significant differences were observed between secondary and teacher training degrees in terms of familiarity with basic and integrated skills, as well as interest in integrated skills (**Table 3**, row 2). Familiarity tends to increase at the degree stage, along with interest (mean scores can be seen in **Table 4**). Significant differences are observed in familiarity and interest, both in basic and integrated skills, when comparing master of secondary education (postgraduate) with secondary (**Table 3**, row 3) or with post-secondary (**Table 3**, row 5), with higher scores among postgraduate students (**Table 4**).

Table 4. Mean score of the variables familiarity and interest in the basic and integrated skills of the scientific process.

		Familiarity		**Interest**	
		Basic skills	**Abilities integrated**	**Basic skills**	**Abilities integrated**
Educational stage	*N*	**Average (∂)**	**Average (∂)**	**Average (∂)**	**Average (∂)**
Secondary	41	1.31 (±0.37)	1.24 (±0.39)	1.03 (±0.49)	1.08 (±0.56)
Post-secondary	67	1.47 (±0.29)	1.46 (±0.38)	1.05 (±0.43)	1.06 (±0.50)
Degree (teacher training)	69	1.57 (±0.37)	1.44 (±0.44)	1.42 (±0.42)	1.36 (±0.50)
Secondary teacher master's degree	23	1.74 (±0.19)	1.83 (±0.25)	1.52 (±0.34)	1.56 (±0.35)

∂ = Standard deviation.

Between the educational stages of post-secondary and degree (**Table 3**, row 4), differences are only observed in the level of interest in basic skills, which tends to be higher among degree students (**Table 4**). Differences are observed in familiarity with integrated skills between the degree and postgraduate educational stages (**Table 3**, row 6), with higher scores among postgraduate students (**Table 4**).

Based on the overall analysis, it can be concluded that the level of familiarity and interest in science processes tends to increase as individuals progress through educational stages (**Figure 1**).

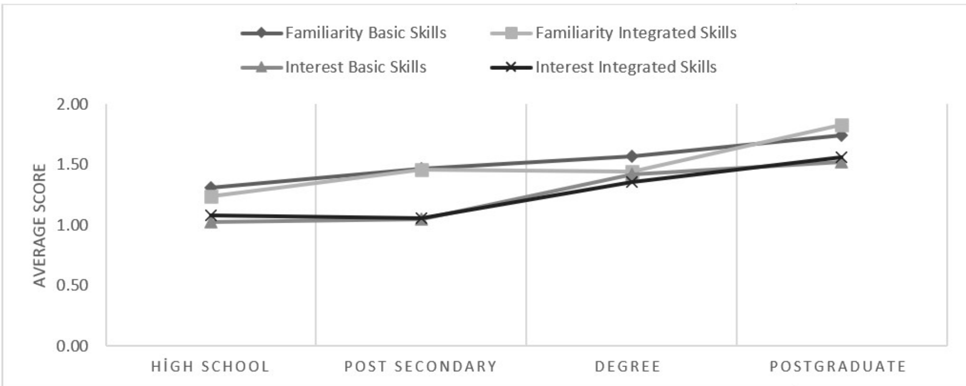

Figure 1. Graphic representation of the average score of the familiarity and interest variables for the set of basic skills and integrated skills.

In terms of familiarity, two main groups can be defined based on average scores:

The first group consists of the educational stages secondary, post-secondary degree, and degree, characterized by a medium level of familiarity.

The second group comprises the postgraduate educational stage, which exhibits a high level of familiarity (**Figure 1**).

Regarding interest, two distinct groups emerge:

The first group includes the educational stages secondary and post-secondary degrees, characterized by a low level of interest.

The second group consists of the degree (teacher training) and master of secondary education stages, which demonstrate a medium to high level of interest (**Figure 1**).

It is important to note that these groupings may vary depending on each specific skill, as demonstrated in Appendix (**Figures A1** and **A2**).

3.2. Focus group results

A discussion focus group to delve deeper into the topic of familiarity and interest in science processes, particularly with a group of students from the secondary master's degree program. This group was selected due to their demonstrated interest, familiarity, motivation, and learning strategies in science, despite potential time constraints.

The development of a discussion script (S1 (Appendix)) facilitated the structured exploration of relevant themes during the discussion. Following the discussion, transcription, and analysis, an emerging map was generated to categorize the identified themes, subcategories, and codes derived from the units of meaning identified in the transcription analysis (**Figure 2**). The codes were defined as a simplification of the name of the subcategory encountered during the focus group.

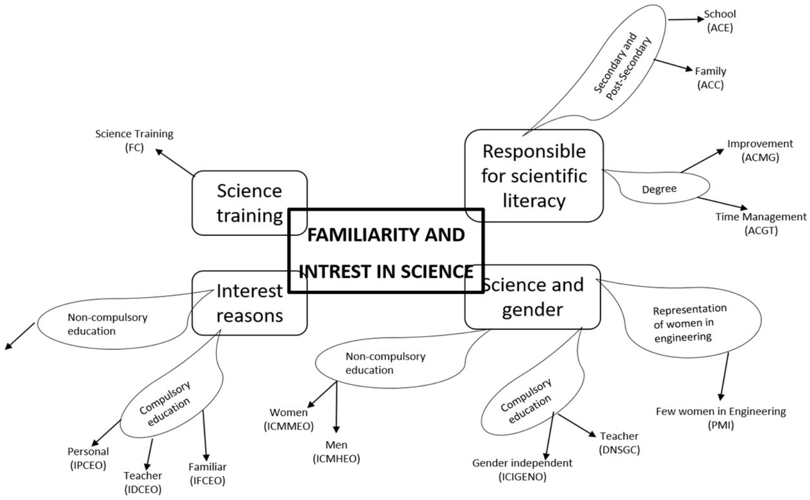

Figure 2. Category system, subcategories and codes associated with interest and familiarity with science in students of the master of secondary education.

Legend: Personal interest sciences compulsory education (IPCEO); interest in the compulsory education sciences teacher (IDCEO); family interest sciences compulsory education (IFCEO); personal interest sciences non-compulsory education (IPCENO); science training (FC); scientific literacy in school (ACE); scientific literacy at home (ACC); equal science interest for gender in non-compulsory education (ICIGENO); higher male science interest in compulsory education (ICMHEO); minor science interest women in compulsory education (ICMMEO); teacher non-gender separation of sciences (DNFSGC); few women in engineering (PMI); scientific literacy improvement in grade (ACMG); scientific literacy and time management (ACGT).

This approach offers valuable insights into the contextual factors influencing students' perceptions and experiences related to science processes, thereby enriching our understanding of the subject and potentially informing educational practices.

We can show some quotes from the focus group in **Figure 2** as an example of the connections found (P# is the participant description):

P2: "During compulsory education, my interest in science was greatly influenced by both my family and my teachers. My parents always encouraged my curiosity, and my science teacher's enthusiasm made the subject fascinating and engaging."

P5: "I've realized that my responsibility for scientific literacy extends beyond just attending classes; effective time management is crucial. Balancing coursework with self-study allows me to delve deeper into scientific topics and stay informed about advancements in the field".

P1: "As a woman studying a degree in science, I've noticed the stark underrepresentation of women in engineering fields. This disparity often stems from early educational experiences where girls may not be encouraged or inspired to pursue science with the same vigor as boys"

4. Discussion

The findings from our quantitative study align with those reported by Solaz-Portolés et al. [22], indicating that the degree of familiarity with science process skills increases as academic level progresses. Furthermore, there is a notable association between the level of familiarity and interest with the educational stage, evident across both basic and integrated skills. Similarly, we also observe an increase in the degree of interest as academic level advances. It is worth noting that, like Solaz-Portolés et al. [22], we did not observe a significant increase when comparing the secondary and post-secondary educational levels. Additionally, our results indicate that levels of familiarity tend to be higher than levels of interest at all educational stages, a trend consistent with the findings of the cited study for the secondary and post-secondary educational levels.

Overall, these findings suggest that the teaching of scientific processes becomes more enriched as students' progress through their educational journey. However, there is a notable deficiency in the knowledge of making predictions (a basic skill) across all educational levels, highlighting an area for improvement in the teaching-learning process.

When we discuss the qualitative results from the focus group data, the findings reveal that all participating students in the secondary master's degree program have a background in science dating back to high school, which is expected given their enrolment in the technology specialty of the master's program. Moreover, the analysis suggests that interest in science during compulsory education stages is influenced by personal and familial factors, including having relatives working in science-related fields and the teaching methods employed by teachers. In contrast, the pursuit of science training during non-compulsory educational stages is primarily driven by personal motivations.

These observations diverge from broader studies conducted on the Spanish population, which suggest that the most significant influencer in the choice of a science major is typically the science teacher, while familiar influence is relatively low [29]. It's important to acknowledge that this discrepancy may arise from the fact that our study sample consists of only five individuals from the same specialty, thus limiting its representativeness to the broader Spanish student population. However, it remains a representative sample for our study's specific context and objectives.

The findings of this study underscore the multifaceted influences shaping scientific literacy among students at various educational stages. During first education stages, such as secondary and post-secondary, participants attribute their scientific literacy to both familial support and the education provided within the formal educational system. This level of literacy is deemed sufficient for engaging in discussions and forming opinions on scientific and technological issues during these stages. These observations align with Torres's [30] assertion that extracurricular factors are as influential as school-related factors in shaping daily life experiences.

However, as students' progress to higher academic levels, such as during specialization in their degree studies, they perceive an improvement in their scientific literacy, particularly within their chosen field or career. Nevertheless, there appears to be a narrower focus on scientific literacy related to their specific field of study, with less emphasis on broader scientific issues outside their area of expertise. This narrowing of focus is attributed to time constraints arising from work commitments or simultaneous enrollment in multiple master's degree programs or courses aimed at enhancing their professional advancement.

The study's findings also corroborate previous research indicating a positive association between academic level and familiarity and interest in science processes. Similar to the findings of Solaz-Portolés et al. [22], it is observed that familiarity and interest in science increase as students' progress through higher academic levels, although this increase is not significant when comparing the Secondary and Baccalaureate educational stages.

This study highlights the complex interplay of factors influencing scientific literacy among students, underscoring the need for comprehensive teacher training programs and ongoing professional development initiatives to foster a robust community of practice aimed at enhancing science education.

The existing research on public perceptions of science suggests that younger adults and individuals with higher levels of education tend to exhibit greater familiarity and closeness with science [31]. However, there remains a dearth of studies focusing specifically on familiarity and interest in science among student samples.

These results emphasize the importance of teacher training, as teachers' beliefs in their teaching efficacy strongly predict students' self-efficacy, motivation, and academic performance. Through professional development, teachers can enhance their content knowledge, pedagogical approaches, and instructional skills, thus fostering a community of practice conducive to improved science education [32,33].

5. Conclusions

Concluding our exploratory study on familiarity and interest in science skills across various educational levels, we observe a consistent trend of increasing familiarity and interest as students' progress through their academic journey. Specifically, secondary and post-secondary educational levels, along with degree (teacher training) programs, exhibit a moderate level of familiarity, whereas the postgraduate stage demonstrates a high level.

Conversely, secondary and post-secondary stages show a lower level of interest compared to degree (teacher training) and postgraduate levels, which present a medium-low level of interest. Additionally, it is notable that familiarity consistently surpasses interest at all educational stages.

Moreover, our analysis highlights a notable gap in the understanding of prediction-making skills (basic skills) across all educational levels. This gap signifies an area for improvement in science education curriculum and instructional practices.

Moving forward, a more detailed examination of the differences between various skills, both basic and integrated, can provide valuable insights for designing targeted interventions and enhancements in the scientific training of future teachers. By addressing specific areas of need identified in this study, educational stakeholders can better tailor their efforts to foster greater familiarity, interest, and proficiency in science skills among students at all educational stages.

It is important to note that the diversity of the sample presents a limitation for this study. To gain deeper insights into the specific characteristics within different contexts, it would be necessary to expand the sample size for each subgroup. Additionally, given that the objective was to observe the progression of the relationship between the variables, it would be beneficial to continue collecting data from the same age groups over multiple years. Overall, these findings underscore the importance of considering educational stage in understanding familiarity and interest in science processes among students. They also highlight the need for further research to explore these dynamics in greater depth, particularly focusing on student populations.

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Appendix

S1. Discussion group

"Thank you for participating today in this discussion group associated with the research project on "familiarity and interest in the processes of science." My name is Esther Gamero Sandemetrio and I will participate with you in today's conversation. Before we begin, there are a few procedural issues that need to be addressed:

1) Your participation is voluntary and you can choose to withdraw at any time. Please feel free to leave at any time if you decide you need to.
2) Will the focus group last approximately 20 min?
3) Your willingness to participate and answer questions and get involved in the discussion is the key to today's group discussion and your active presence here is greatly appreciated.
4) Today's conversation will be recorded and transcribed later for analysis. All identifying names will be changed to protect the anonymity of your responses. Please read the consent form and take a moment to sign it. When everyone is ready, I will introduce the topic and we can begin.

In the discussion group there are no right or wrong answers, but rather different points of view. Please share your point of view even if it differs from what others have said. Don't be afraid to openly express your opinion. I encourage you to talk about your experiences with others instead of just me. We are interested in a conversation about this topic rather than personal interviews.

Today's topic is about how your interest and knowledge about the processes of science have changed throughout your professional training and what do you think are the reasons why these changes have occurred. I'd like to start by sharing an example of what we're interested in seeing here and let the conversation flow from there.

Throughout our research, and corroborating other works, we have observed that, although as children we think that science is important, the interest in it, the knowledge about it decreases in secondary and baccalaureate, on the other hand, said situation changes during our professional training (degree and master's degree). Therefore, my main interest lies in knowing the reasons why this interest has changed: changes in the way teachers teach-learn science, changes in the motivation to learn science, the need to have knowledge about science. for professional life or for everyday life... So, let's start exploring the term "Interest". Has your interest in science changed from secondary to now? who would like to start?

1) And has your knowledge about science changed?
2) And what are these changes due to?
3) To a particular teacher? (Note: according to answer, relate it to motivation and learning strategies)
4) Has your motivation for science changed? (Note: depending on the answer, ask about: the value of the task, self-efficacy, anxiety and control belief)
5) Have your learning strategies changed? (Annotation: depending on the answer, ask about: elaboration, organization, use of time and perseverance, self-regulation and help)

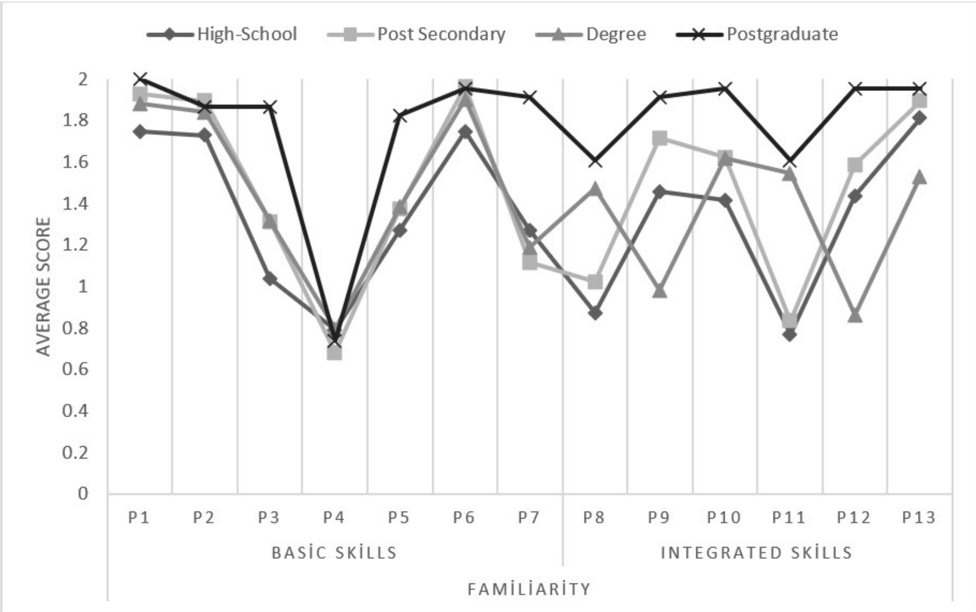

Figure A1. Graphic representation of the average score of the familiarity variable in each skill (observe P1, classify P2, make measurements P3, make deductions P4, make predictions P5, communicate results P6, formulate hypotheses P7, perform experiments P8, identify variable P9, formulate models P10, interpret data P11, control variables P12 and construct and interpret graphs P13) for each educational stage.

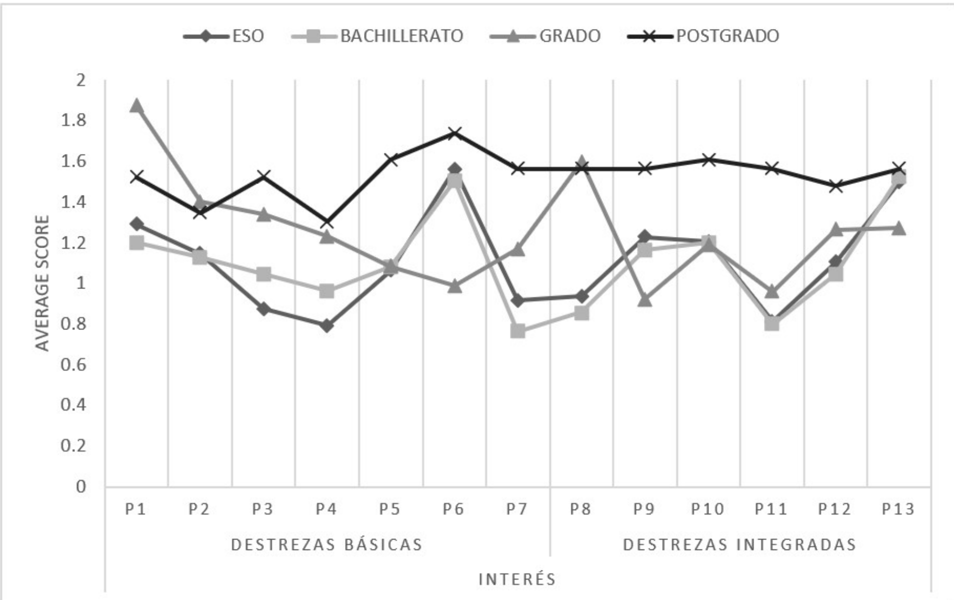

Figure A2. Graphic representation of the average score of the variable Interest in each skill (observe P1, classify P2, make measurements P3, make deductions P4, make predictions P5, communicate results P6, formulate hypotheses P7, perform experiments P8, identify variable P9, formulate models P10, interpret data P11, control variables P12 and construct and interpret graphs P13) for each educational stage.