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# PERCEPTIONS OF FUTURE TEACHERS ABOUT SCIENTIFIC AND RESEARCH ACTIVITY

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**ABSTRACT**

This study identifies the perceptions of a sample of students who are trained as teachers in the basic education career and who have been trained in scientific and research activity. The design of the study is descriptive, in the sense that the perceptions are characterized as the result of the processes of enculturation, especially at the level of the educational system. These perceptions, or the mental image about the way university students think and act, are identified through a Likert scale, with a reliability of 0.816 (Cronbach's alpha). The present study was conducted using a questionnaire administered during the sixth cycle of Basic Education, parallels A, B, and C of the Faculty of Education Sciences at the State University of Bolívar, in the academic period 2024-2024. The findings from this deliberate sample demonstrate the predominance of a classical approach over scientific and research activity. This finding is consistent with results reported in related research and from other regions.

**Keywords:** Science, method, observation, objectivity, Ecuador.

## INTRODUCTION

The perceptions of scientific and research activity among students preparing to become future teachers in basic education were examined. This study is part of the field of formative research, which is fundamental in the preparation of professionals in education. This is particularly evident in the domain of quantitative research, where the objective is to cultivate investigative procedures that guarantee the caliber of the students' professional preparation. These procedures are designed to empower them to respond to the evolution and advancement of their scientific and pedagogical disciplines in the future.

It is evident, as demonstrated by numerous empirical observations, that it is imperative to mobilize conventional modes of thinking and operating when confronted with scientific and research findings in the domain of pedagogical sciences. This approach is instrumental in advancing to higher stages that are congruent with sophisticated epistemological reflections. Extant data appear to corroborate the prevalence of a classical conception of the nature of science and its methodology. Despite its advanced nature, the research was meticulously designed to ascertain the perceptions of students concerning the manner in which they conceptualize and engage in scientific and research activities of a formative nature.

According to Vásquez & Manassero (1999), Pecharromán & Pozo (2006), Scandroli & Eyler (2007), and Gürgil (2018), the comprehension of the essence of science among university students remains in its nascent stages. Despite the scientific education that students receive, these authors contend that their apprehension about the concepts of science and method, as well as the ontological and epistemic positions assumed on the subject, remain incomplete. This apprehension, at best, manifests inconsistencies and even contradictions.

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## CONTRADICTIONS OF A DIALECTICAL NATURE

The research process in the social and human sciences must take into account the inherent contradictions of a dialectical nature. These contradictions are an integral component of the research process itself. With respect to the dichotomy between objective and subjective, classical positivism posits that the implementation of the scientific method enables the acquisition of knowledge in its purest form. This conception, which emerged in the nineteenth century, posits that the relationship between the subject and the object of knowledge is characterized by independence. Nevertheless, Artemova (2024) posits that, from the vantage point of the theory of activity, this vision has precipitated a preponderantly technical approach in educational research facilitated by artificial intelligence. In this paradigm, the relationship between the subject, the object, the motivational, and the dialectical foundation of knowledge remains conspicuously absent.

Nevertheless, this approach to the act of knowing has been, and continues to be, the subject of scrutiny from alternative conceptions of science. It is not a matter of dispensing with or perceiving subjectivity as something that is harmful to the interests of an investigation. Conversely, the meaning and scope of objectivity must be resolved within the framework of the contradiction between the objective and the subjective, thereby bringing the former to the forefront. In this manner, the researcher must endeavor to maintain objectivity, without thereby denying their personal perspective. In this sense, recent studies on the teaching of the nature of science demonstrate that educational actors recognize that absolute objectivity is unattainable, since scientific knowledge is necessarily mediated by social, cultural, and personal factors. Consequently, the present study proposes a vision that is not merely opposed to objectivity but rather is constructed from a critical awareness of the subjectivity inherent in the research process. (Triantafillou et al., 2021)

Furthermore, in the relationship established by the subject who investigates with the object of knowledge, there is objectivity to the extent that theories, procedures, and tools of scientific research are needed. The reliability of methods in the face of the need to find new knowledge, without being an absolute guarantee, in addition to placing science in a prominent place compared to other types of knowledge, suggests objectivity (Gensollen & Jiménez, 2018).

The subjective nature of research is a critical consideration in the research process. Pinto & Paula's (2018) assertion is evidently at odds with the tenets of experimental behaviorist theory, which fails to acknowledge the reciprocal influence between the subject and the object of study. Indeed, it proves challenging for researchers, particularly in the social and human sciences, to disengage from their interests, beliefs, and even questions of value.

With regard to the discrepancy between quantity and quality, the quality of an object, fact, or phenomenon is elucidated in terms of its attributes or properties that distinguish or characterize it. The quantitative aspect is manifested, for instance, in the magnitude or intensity with which an object of thematic attention is expressed.

Therefore, quantity and quality are not synonymous, but rather, they are distinct entities. It is evident that, from our perspective, these entities do not represent irreconcilable opposites. Conversely, they are regarded as "two sides of the same coin" (Cerda Gutiérrez, 2000).

However, research processes in the social and human sciences are complex, unique, subject to chance or uncertainty, and respond to questions of value. Indeed, as Martínez Miguelez (2006) emphasizes, the thematic focus on reality reveals its intricate nature. This is due to the inherent limitations of researchers in both the human and physical sciences. These limitations prevent them from comprehending the complete array of elements that constitute reality, as well as the comprehensive network of relationships or connections among these elements. This underscores the significance of diverse approaches and viewpoints, including those that diverge in methodological techniques.

While there may be research that is exclusively quantitative or qualitative in nature, this does not preclude the existence of research that incorporates both quantitative and qualitative methodologies. Beyond positions that defend the quantitative or the qualitative at all costs, the differences or similarities are marked by the level of interpretation and the methodology used.

In the context of scientific research, the empirical and the theoretical are a dialectical pair that requires the researcher to effectively resolve this contradiction. It is imperative to recognize that both of these elements are indispensable components of a holistic understanding of the subject. Furthermore, as Matos et al. (2007) have asserted, "The empirical always has a theoretical sense, while the theoretical contains the empirical in one way or another, although not as the ultimate criterion of truth."

SCIENTIFIC RESEARCH AND METHODS OF KNOWLEDGE

In the context of research development, the utilization of research methods is paramount. It is precisely these procedures and indications that allow the researcher to construct scientific knowledge. The application of these methods is contingent upon the diversity of tasks deemed necessary in a given research study.
It is important to note that there is no singular methodology for scientific research; rather, there exists a multitude of approaches. Furthermore, the selection of research methodologies is contingent upon the inherent characteristics of the research process, the researcher's cultural background, and their epistemological stance.
Consequently, the researcher's decision regarding the methods to be used, without taking into account these conditions, constitutes a significant contradiction. The aforementioned points also allude to the positions that boast of using a unique and infallible "objective" method.
Conversely, the scientific method can be regarded as an inherent characteristic of human cognition. This assertion underscores the notion that the cognitive processes of researchers do not adhere to a linear or mechanical framework, as postulated by positivism. Instead, they exhibit a dialectical nature, underscoring the dynamic and evolving nature of scientific inquiry.
The interpretative character of the natural process of knowing is added. From this perspective, meaning is derived from a dynamic that operates between the whole and its constituent parts, and vice versa, within a specific social and natural context. Consequently, the data obtained through research and the results of an experiment are not necessarily accurate.

RELATIONSHIP BETWEEN THE THEORETICAL AND THE METHODOLOGICAL

At the level of the methodological encompasses the conceptual frameworks, methodological approaches, and technical skills that the researcher employs in their analysis of a specific object or phenomenon. Please respond with a detailed explanation of the investigation process.
Nevertheless, it is important to note that the methodological approach is in no way divorced from the theoretical framework. The latter provides researchers with a framework for understanding the information to be collected and the relevant indicators that serve as a basis for the development of data collection instruments. With regard to the implications of the theory, Merton (as cited in Díaz Barriga, 2014) issues a warning regarding the potential consequences of the following: As stated on page 26, the elements "constitute the matrix from which the flow of hypotheses and the respective data collection are derived."
It is important to note that this is not a process that is resolved regardless of the object of investigation. In contrast to the approach employed in natural sciences, the methodological concerns inherent to social and human sciences cannot be addressed in a indiscriminate manner. Consequently, methodologies, techniques, and instruments must be adapted to align with the specific nature of the research endeavor, rather than the opposite.
The theoretical framework underpinning the study is evident in the interpretation of previously processed and analyzed data. According to the findings of the study, the researcher's cultural background and the research methodology employed play a pivotal role in this process. There is a substantial discrepancy between the theoretical framework that served as the initial point of departure and the theoretical framework that the researcher constructs. Therefore, acknowledging the significance of these theoretical and conceptual references in this process does not result in the multiplication of mere descriptions of reality, where beliefs, common sense, and public opinion are taken for granted (Buenfil, 2002).
It is imperative to acknowledge the pivotal role that researchers play in establishing the indispensable connection between theoretical and methodological frameworks. Martínez Migueléz (2006) underscores that researchers are not inherently possessed of the truth. Rather, they are individuals who engage in critical thinking and reflection on their research endeavors. They do not subscribe to a belief in "magic wands" and, despite placing trust in the efficacy of established methods, maintain an openness to alternative forms and possibilities in research and scientific work.
The primary objective of this research was to ascertain the perceptions that students training for a career in teaching hold regarding scientific and research activities.

## MATERIALS AND METHODS

The present study adopted a descriptive research approach. In this study, a 5-option Likert scale was employed to assess the perceptions of 80 students from the sixth cycles of the A, B, and C groups during the 2024–2024 academic period. This survey was conducted as part of the quantitative research component

of the Basic Education Career of the Faculty of Education Sciences at the State University of Bolívar. The objective was to ascertain the perceptions of scientific and research activity among the selected university students. A non-probabilistic sample was utilized due to the availability of the subjects who participated in this research (Sáez López, 2017).

To execute this survey, a questionnaire was administered that was adapted by Peme Aranega et al. (1997a and b, 1999) and who, in turn, adapted the ICDE (Inventory of Didactic and Epistemological Beliefs) to study explicit beliefs developed by Porlán (1994). Indeed, the instrument under consideration, in its most recent iteration of Scandroli and Eyler's (2007) model, comprised a total of 18 statements, which pertain to the subsequent dimensions: The following elements are to be considered:

- The scientific method
- The role of observation
- The theoretical framework
- Objectivity
- The idea of scientific progress
- Theories

The reliability of the instrument was calculated using the statistical software IBM SPSS Statistics version 25.0. The value obtained was 0.816 (Cronbach's alpha), which, according to Frias-Navarro & Pascual-Soler (2022), indicates excellent internal consistency.

The data obtained with this type of questionnaire were expressed in percentages and graphically by bars. In this instance, the results pertaining to the role of observation are presented.

## RESULTS AND DISCUSSION

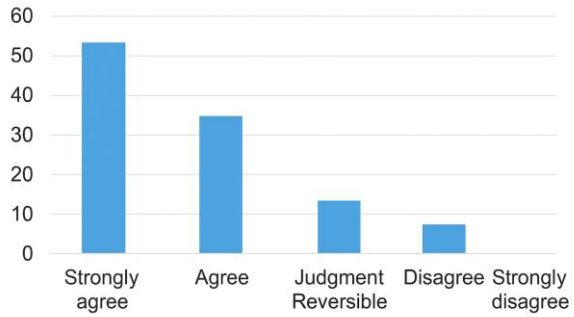


Fig. 1. The objective and systematic observation of reality allows us to discover what is happening in it.

As illustrated in Figure 1, an overwhelming majority of respondents, specifically 86.25%, concur that the observation of reality is paramount for researchers seeking to comprehend its intricacies. This phenomenon is particularly pronounced when the assessment is objective and systematic. In this manner, and on the basis of data obtained through the impartial observation of reality, the researcher generates new knowledge (theories). However, attaining knowledge of the world or reality—in this case, educational—necessitates specialized knowledge, which is the product of research with a hint of scientific objectivity and, in no sense, based on experience or simple intuition (Alonso Rodríguez, 2021).

These results are consistent with those of a study by Domínguez (2012), who noted the presence of social stereotypes that stigmatize those who carry out scientific work in the responses of a directed sample of undergraduate students. Among these, the image of scientists as a serious person who acts coldly and is even dehumanized is particularly salient. This depiction is archetypal of those who are required to be objective and neutral.

It is evident that the perception of objective and neutral observation is indicative of an underlying traditional vision regarding science and its methods. In its classical iteration, positivism enables the acquisition of knowledge in its purest form through the application of the scientific method. From this standpoint, the genesis of research problems from subjective perspectives is strictly prohibited. This prohibition is further strengthened when such problems are driven by the researcher's intentions, motives, or practical interests. This conception, which emerged in the nineteenth century, posits that the relationship between the subject and the object of knowledge is characterized by independence. Nevertheless, this approach to knowledge, particularly in the context of social and human sciences, has been and continues to be subject to scrutiny from alternative conceptualizations. In the case of those surveyed whose perception is aligned by the neutrality of science and its methods, it should be noted that the dispensing of subjectivity as something

that is harmful to the interests of research is not a matter of concern. Conversely, the meaning and scope of objectivity must be resolved within the framework of the contradiction between the objective and the subjective, thereby bringing the former to the forefront. In this manner, the researcher must endeavor to maintain objectivity, though this does not imply the negation of subjectivity (Matos et al., 2007).

The subjective nature of research is a critical consideration in the research process. This phenomenon is particularly pronounced in the context of research, particularly in the social and human sciences. Researchers may find it challenging to disengage from their personal interests, beliefs, and questions of value as they conduct their work. However, this does not imply that the knowing subject is bound or gives free rein to his preferences or predilections. Conversely, in an effort to maintain objectivity and to consider the circumstances of his investigations, it is necessary to prioritize what is best, rather than allowing personal tastes or desires to influence the decision (Rescher, as cited in Alonso Rodríguez, 2021).

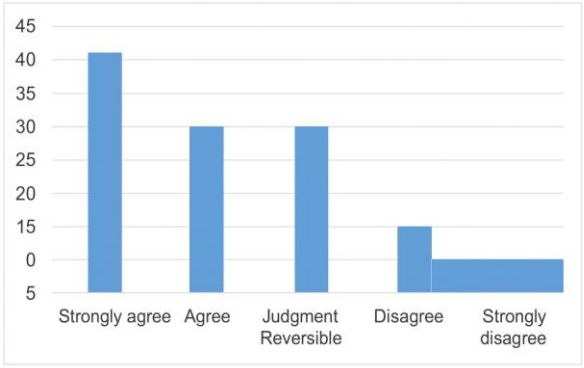


Fig. 2. The scientist's observation is "neutral", it is not contaminated by previous ideas.

As illustrated in Figure 2, a majority of respondents expressed support for the autonomy of the subject in relation to the object of study. However, 23.75% of students in the intentional sample are undecided strikers. However, given the systematic nature of the observation conducted by the researcher, it is challenging to proceed without the influence of preconceived notions. In the context of empirical research, the integration of multiple research methodologies is imperative. The decision to conduct an experiment, formulate a hypothesis, or develop a theory is of paramount importance. The findings of an experiment can serve to substantiate or refute the initial supposition. Moreover, the generation of novel scientific knowledge can catalyze additional empirical studies (Aróstegui, 1995).

Consequently, within the domain of scientific research, the empirical and the theoretical are a dialectical pair, necessitating that the researcher effectively resolve this contradiction. It is imperative to acknowledge that both of these elements are indispensable and should not be regarded as discrete entities. Furthermore, the empirical invariably possesses a theoretical dimension, while the theoretical incorporates the empirical to a certain extent, albeit not as the definitive criterion of truth (Matos et al., 2007).

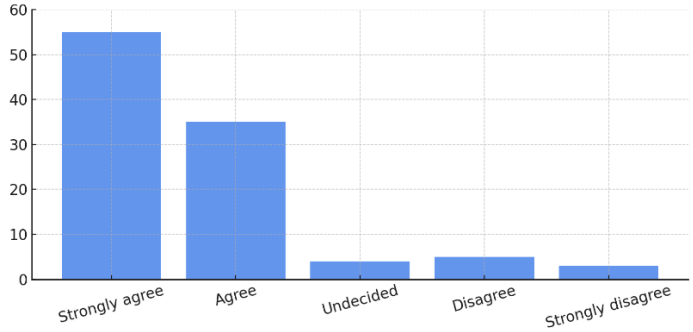


Fig. 3. In a scientific methodology, the same steps are always followed, which lead to from the impartial observation of the facts to the elaboration of theories.

As illustrated in Figure 3, 35% of respondents presume that research activity is comprised of adhering to the steps that are stipulated by the tenets of scientific methodology. Conversely, 53.75% of participants expressed support for this approach, attributing the efficacy of aseptic research methods in generating novel scientific knowledge to their inherent design. However, within this ostensibly evident truth, a form of empiricism devoid of sophistication can be discerned among proponents of a neutral stance in the realm of scientific inquiry and its methodological framework, as exemplified by the practice of scientific observation.

Therefore, according to these presuppositions, it is asserted that the observer must relinquish his preconceived notions and personal biases to unveil, through sensory perception, the underlying principles and governing laws that protect the integrity of natural or social reality. In contrast, Delval (as cited in Villarroel, 2004) asserts that "observing invariably entails adopting a particular perspective and formulating a hypothesis regarding the salient elements, thereby implicitly selecting and directing one's observation" (p. 45).

In this order, the advocacy of a positivist orientation within the domain of scientific research, particularly concerning observational methods, is regarded as a deviation that disregards the conceptual and methodological frameworks that underpin the research process. Theory plays an instrumental role in the research process by ensuring methodological rigor and providing a nuanced interpretation that transcends common sense, personal beliefs, and public opinion (Buenfil, 2002).

Conversely, the scientific method can be regarded as an inherent characteristic of human cognition. Consequently, the cognitive process of the researcher is not linear or mechanical, but rather exhibits a dialectical nature. The resolution of a scientific problem, and even more so in the social sciences, necessitates a flexible process, in no sense linear or mechanical, and a substantial amount of creative imagination and personal initiative. Therefore, in the course of conducting an investigation of this nature, it is imperative to acknowledge the challenges that extend beyond the confines of technical and operational intricacies.

## CONCLUSIONS

It is imperative that formative research in university classrooms take into account the ideas and perceptions that students bring with them as a result of the processes of acculturation that are generated in society and, in particular, by educational institutions. It is evident that the focus must be deliberately oriented towards the attainment of a pedagogical generalization that is deemed essential and cannot be reduced to the scope of inductive generalization by means of abstraction. Rather, it is through the implementation of analytical procedures and theoretical synthesis, as well as modeling and idealization, that the relationships of this nature can be accentuated, thereby unveiling a higher level of essentiality. Therefore, rather than emphasizing the formal correctness of students' modes of thinking and acting, it is necessary to emphasize the adoption of the social praxis of a scientific and investigative culture. This accumulated result, this constant creation, manifests as ideas and realizations of the subject from the perspective of the training process or teaching and learning in higher education.

## REFERENCES

1. Alonso Rodríguez, A. M. (2021). Objectivity and truth in the Science of Education as a Science of Design. Sophia, Philosophy of Education Collection, 31, 113-135. https://doi.org/10.17163/soph.n31.2021.04
2. Aróstegui, J. (1995). Historical Research. http://archive.org/details/arostegui-julio.-la-investigacion-historica-ocr-1995
3. Artemova, I. (2024). Bridging Motivation and AI in Education: An Activity Theory Perspective. Digital Education Review, 45, Article 45. https://doi.org/10.1344/der.2024.45.59-67
4. Buenfil, R. (2002). The uses of theory in educational research. Education and Science, 6(26), Article 26. https://revistaeducacionyciencia.uady.mx/educacionyciencia/article/view/188
5. Cerda Gutiérrez, H. (2000). The Elements of Research: How to Recognize, Design, and Build Them (3rd ed). The Owl.
6. Díaz Barriga, A. (with Miranda, L.). (2014). Methodology of Educational Research. Ediciones Diaz de Santos S.A.
7. Domínguez, S. (2012). Science and scientists through the eyes of young university students. Version. Communication and Political Studies, 19, Article 19.

8. Frias-Navarro, D., & Pascual-Soler, M. (2022). Notes for estimating the reliability of internal consistency of the items of a measurement instrument. https://doi.org/10.17605/OSF.IO/KNGTP
9. Gensollen, M., & Jiménez, M. (2018). Science as a point of view: Some challenges to scientific objectivity. Daimon International Journal of Philosophy, 75, Article 75. https://doi.org/10.6018/daimon/336151
10. Gürgil, F. (2018). A Study on Social Studies Teacher Candidates' Perception of Science, Scientific Research and Scientists. International Journal of Progressive Education, 14(3), 141-160. https://doi.org/10.29329/ijpe.2018.146.10
11. Martínez Migueléz, M. (2006). The Emerging Paradigm Towards a New Theory of Scientific Rationality (2 ed.). Editorial Trillas.
12. Matos, E., Montoya, J., & Fuentes, H. (2007). The process of scientific research oriented to research in social sciences.
13. Pecharromán, I., & Pozo, J. I. (2006). How Do I Know It's True?: Students' Intuitive Epistemologies of Scientific Knowledge. Research in Science Education, 11(2), Article 2.
14. Pinto, J. de F., & Paula, A. P. P. de. (2018). Contributions of Gonzáles Rey's qualitative epistemology to transdisciplinary studies. Psicologia & Sociedade, 30, e166100. https://doi.org/10.1590/1807-0310/2018v30166100
15. Porlán, R. (1994). The epistemological conceptions of teachers: The case of teacher training students. Research at School, 22, Article 22. https://doi.org/10.12795/IE.1994.i22.06
16. Sáez López, J. M. (2017). Educational research: Theoretical foundations, processes and practical elements: practical approach with examples, essential for TFG, TFM and thesis. UNED - National University of Distance Education. https://elibro.net/es/lc/bibliotecaueb/titulos/48890
17. Scandroli, N., & Eyler, N. (2007). Image of science in university level students: Dimension "Scientific method". Ibero-American Journal of Education, 44(3), Article 3. https://doi.org/10.35362/rie4432245
18. Triantafillou, C., Psycharis, G., Potari, D., Bakogianni, D., & Spiliotopoulou, V. (2021). Teacher Educators' Activity Aiming to Support Inquiry Through Mathematics and Science Teacher Collaboration. International Journal of Science and Mathematics Education, 19(1), 21-37. https://doi.org/10.1007/s10763-021-10153-6
19. Vásquez, Á., & Manassero, M. A. (1999). Characteristics of scientific knowledge: Students' beliefs. Science Education. Journal of Research and Didactic Experiences, 17(3), Article 3. https://doi.org/10.5565/rev/ensciencias.4068