Journal of Research Administration
Society of Research Administrators International

STUDENTS' PERCEPTION OF THE METHODOLOGY IN THE TEACHING OF PHYSICS AT THE UNIVERSIDAD NACIONAL MAYOR DE SAN MARCOS

Fulgencio Villegas Silva
Faculty of Physical Sciences – UNMSM, Peru

Miguel A. Castillo Corzo*
Faculty of Physical Sciences – UNMSM, Peru

Marco A. Merma Jara
Faculty of Physical Sciences – UNMSM, Peru

***Corresponding Author: Miguel A. Castillo Corzo**
Faculty of Physical Sciences – UNMSM, Peru

ABSTRACT:
A research was carried out at the Faculty of Education and Electronic Engineering of the Universidad Nacional Mayor de San Marcos, with the purpose of analyzing the teaching methodology used by teachers in Physics subjects. To this end, a questionnaire was applied as a measurement instrument to a sample of students. The questionnaire covered various dimensions of the teaching methodology, such as the ease of understanding the material, the clarity of the explanations, the usefulness of the exercises and practices, and the didactics of the teacher. The collected data were processed using the statistical software SPSS (Statistical Package for Social Sciences) and the corresponding interpretations were made. The results of the study revealed the following: in terms of the ease of comprehension of the teaching material, the predominant qualifier was "low" with 44.4%, while both the qualifiers "medium" and "high" presented an equal percentage of 27.8%. In relation to the clarity of the teacher's explanations, the predominant qualifier was "low" with 43.5%, while 28.1% indicated a "high" qualifier. Regarding the usefulness of the exercises and practices, the predominant qualifier was "low" with 38.9%, while 27.8% indicated a "high" qualifier. Regarding the teacher's didactics, the most common qualifier was "medium" with 34.2%, while 32.4% indicated a "high" qualifier. Finally, concerning the main variable of the study, the methodology of teaching physics, the most predominant qualifier was "low" with 34.3%, while the qualifier "high" represented 32.4%.
Keywords: Physics teaching, teaching methodology, didactics

INTRODUCTION

Teaching physics presents a challenge for many college students, as it requires understanding complex concepts and solving exercises and problems. This difficulty is reflected in the low grades obtained and generates an atmosphere of disinterest in the subject. It is considered that the methodology used by teachers in the teaching of physics could be one of the main causes of this

problem. The lack of adequate preparation in didactics and the tendency to follow ineffective routines contribute to the lack of interest in physics.

Based on the above, the following questions are posed to address the problem:

What is the perception of the students regarding the methodology used by the teachers in the teaching of physics? Has the methodology used by the teachers been adequate for the teaching of physics? Has the teaching material been easy to understand for the students? Have the explanations provided by the teachers been clear and precise? Have the exercises and practices been useful for the comprehension of physical concepts? Has the application of didactics by the teachers facilitated the understanding of the physical concepts by the students?

These questions will allow us to analyze and evaluate the teaching methodology in the teaching of physics, with the aim of identifying possible improvements that promote greater interest and understanding on the part of students. The common goal in all countries is to improve science education and increase the number of people choosing careers in science. The teacher plays a fundamental role as the greatest influence in the learning process; therefore, it is crucial to focus on the preparation of science teachers. A critical aspect of this preparation is the methodology, which combines pedagogy and content. This is where science teachers begin to focus on acquiring knowledge, attitudes, and skills to teach meaningfully. (Kang, 2017)

The mere acquisition of knowledge in the traditional way in the field of physical sciences is insufficient to improve students' reasoning and skills. Appropriate approaches and methods need to be adopted for the teaching of physics so that learning can have a positive impact on students' cognitive changes. This has been demonstrated in research carried out in Croatia, which involved secondary and higher education students. In this study, three different learning designs were used: traditional methods of teaching, reading, presenting, and discussing modern physics topics, and experimentation and debate on classical physics topics. By implementing these methods, it was demonstrated that Piaget's theoretical aspects and Vygotsky's sociocultural theories can be combined to achieve meaningful and enriching results. (Marušić & Sliško, 2012)

Alternative approaches to traditional teaching indicate that students should have more active participation from having experiences to solving problems; In other words, knowledge must be applied as an alternative to memorizing concepts. We believe that a good teacher must know, in addition to his or her discipline, an adequate methodology for teaching science, after a critical analysis, adapt what he or she finds valuable, correct what he or she finds deficient, and contribute new ideas and points of view in a process of continuous experimentation. (Campanario & Moya, 1999) The inquiry methodology is useful in science teaching, it seeks to encourage students to experiment, discover, and analyze results based on real problems; In this way, it seeks to generate skills in students. The development of this approach to teacher motivation and interest in bringing about a change in traditional science teaching. (Uzcátegui & Betancourt, 2013) As for the teaching of Physics, Chemistry, and Biology, there is a lot of research work to be done, especially in terms of the extension of teaching methods and how to contribute to the development of explanatory

skills of the teacher. The ability to adapt to student needs and offer and receive feedback is an important skill for physics and chemistry teachers. (Geelan, 2020) It is also important to note that the use of elaboration strategies in the learning of mathematics has allowed students to construct their learning, especially related to their context and being more meaningful to them. Students who use the traditional method do not perform academically in the same way as those who use appropriate strategies. (González, 2015)

The use of appropriate methodology and didactic resources plays an important role in students, allowing them to increase their knowledge and facilitate their learning. The implementation of didactic resources in the teaching of physics consists of using materials that allow them to relate to their environment and resemble their reality, in such a way that they can better interpret physical phenomena. (Cabrera, 2014) In the learning processes, the didactics that are going to be applied are important because they allow innovation in education, hence its research occupies a main place. A didactic innovation project is a strategic influence that allows planning to be achieved where the main role is occupied by teachers. (Barraza & Cárdenas, 2015) The frequent use of appropriate scientific methodologies and techniques has revolutionized several fields of science education and teaching. Teachers must learn details, skills, and methodologies based on inquiry in order to apply them in practice. (Davar, 2012)

When methodological references are included in a learning assessment system, they become an indispensable and appropriate tool to guide the educational task correctly and in a timely manner. (Lorenzana, 2012) Lecture is the oldest method of instruction and is still the most common form of instruction today. Studies determine that the traditional method of lecturing teaching is teacher-centered and students are only passive listeners, whereas, in modern teaching methods, students are involved in all activities, organized and supervised by the teacher.

The difference between an effective teacher and an ineffective teacher is the methods and materials they use to spark their student's interest in their subject. Research indicates that social constructivist theory, which involves individual and cognitive constructivism, is a highly effective teaching method from which all students can benefit as collaboration and social interaction are incorporated. (Hussain, Azeem, & Shakoor, 2011) Physics is the basis of all natural sciences; it gives us a clear picture of nature. Studying it requires an appropriate method that allows us to rediscover it for ourselves. The method consists in innovating the observation of past discoveries, that is, in making the experiments by ourselves, only remembering by heart some subjects. A study was conducted with children and college students, more than 70% prefer to study through experiments.(Garalova, 2019). For the solution of difficulties in the learning of Physics, based on the Historical-Cultural approach, the Theory of Activity and Theoretical Generalization, the research was developed through the structural-functional method for the organization of the content to be learned and the regularities of the study activity, considering the realization of actions as important as modeling, Experimentation and simulation in class for the solution of theoretical-practical problems. (Campelo, 2003)

On teaching methods at the postgraduate level, 220 undergraduate students of the University of Karachi were surveyed. Most students considered the reading method to be the most effective, as the teacher provided comprehensive knowledge, saved time, and allowed for notetaking. Group discussion was the second preferred method due to increased participation, effective learning, absence of memorization, and encouragement of creativity. These insights and qualifications offer insights to improve the teaching and learning process. (Sajjad, 2010)

An innovative method for teaching physics in high school is presented, which is based on the use of scientific models and the active participation of students. This approach, which involves modeling cycles, has been shown to be more effective in students' process of understanding compared to other methods such as "cooperative inquiry" and "learning cycle." The importance of the teacher's pedagogical experience is highlighted and it is suggested to promote the development of pedagogical knowledge and skills in secondary school teachers. In addition, specific recommendations are offered to encourage these practices within the physics education community. (Wells et al, 1995) In this research, an analysis of the teaching methodology used in the teaching of physics is carried out, from the perspective of the students, in order to identify both the strengths and weaknesses present in this approach. To achieve this goal, a questionnaire is used that encompasses four key dimensions of the teacher's methodology. These include questions about the improvement of the methodology of teaching physics, the provision of clear and comprehensible materials, the delivery of precise explanations, the design of relevant exercises and practices, as well as the application of effective didactics that promote the satisfactory understanding of physical concepts by students, as well as encouraging their motivation and participation in the subject.

METHODOLOGY

The research focuses on the student population of the Universidad Nacional Mayor de San Marcos, specifically in the Faculties of Electronic and Electrical Engineering, as well as in the Faculty of Education in the specialty of Mathematics and Physics. A questionnaire was used as a measurement instrument to collect information on four dimensions (D1, D2, D3, D4) related to teaching methodology in the teaching of Physics (V), during the 2023-1 academic year, which was carried out from March to July 2023.
Table 1 shows the descriptions of the identifications of each of the dimensions considered.

Table 1. Identification of the variable and its four dimensions of the teaching methodology

Id.	Description
V	Methodology of Teaching Physics
D1	Ease of comprehension of teaching material
D2	Clarity of the teacher's explanations

D3 Usefulness of Exercises and Practices

D4 Teacher's Didactics

Population: Students of the Universidad Nacional Mayor de San Marcos, the Faculties of Electronic and Electrical Engineering, Faculty of Education in the specialty of Mathematics and Physics.

Sample: A sample of 108 students in total was considered, enrolled in the subjects of Electricity and Magnetism of the Faculty of Electronics and Electrics (66), students Physics II (20) and Physics IV (22), of the Faculty of Education.

Instrument: Questionnaire with 28 questions, considering the variable Methodology of Teaching Physics (V) and four dimensions (D1, D2, D3, D4) on the methodology of teaching in Physics. Table 2 shows the distribution of the number of questions for each dimension and their weight as a percentage.

Table 2. Weights of the dimensions in the questionnaire

id. Dimension	D1	D2	D3	D4	Total
Number of Questions	6	6	6	10	28
Weight	21.43%	21.43%	21.43%	35.71%	100.00%

From the number of questions and the number of dimensions, it is understood that we want to know more about the teacher's didactics, second, the usefulness of the exercises and practices, and finally with equal weight the clarity of the teacher's explanations and the ease of understanding the teaching material.

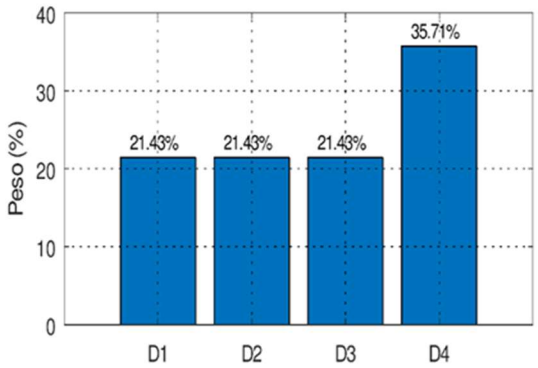

Figure 1. Weight in percentage of each of the dimensions (D1, D2, D3, D4) of the teaching methodology. Powered by GNU Octave (Eaton et al, 2020)

Measuring Instrument Reliability Statistics

The items corresponding to the questionnaire have been subjected to the Cronbach alpha reliability test, Table 3 shows the results obtained through the SPSS software (IBM Corp, 2017)

Table 3. Reliability statistics of the items of the measuring instrument of dimensions D1, D2, D3, D4

Cronbach's Alpha	Number of Items
0,983	28

RESULTS AND DISCUSSION

The results obtained after having processed the data obtained for the study variable, as well as for each of the dimensions. Table 4 shows the results obtained using the SPSS statistical software.

Table 4. Frequency and percentage for teaching methodology (V) and their respective dimensions D1, D2, D3, D4

	V		D1		D2		D3		D4	
	Freq.	%	Freq.	%.	Freq.	%	Freq.	%	Freq.	%
Low	37	34,3	48	44,4	47	43,5	42	38,9	36	33,3
Middle	36	33,3	30	27,8	30	27,8	36	33,3	37	34,3
Alto	35	32,4	30	27,8	31	28,7	30	27,8	35	32,4
Total	108	100,0	108	100,0	108	100,0	108	100,0	108	100,0

Regarding the ease of comprehension of the teaching material (D1) in Table 4, it is observed that the qualification of low is predominant with 44.4% (48), while the qualification of medium and high are equal with 27.8% (30), this means that teachers prepare the teaching material with very specialized terms according to the subject and that students are faced with new terms. new notations, making it difficult for most students to easily understand. Regarding the clarity of the teacher's explanations (D2) in Table 4, it can be observed that the low qualifier predominates with 43.5% (47), while 28.1% (31) indicate the high qualifier. This implies the difficulty to understand the concepts of physics for the first time, the teacher uses the approach to calculus that usually involves equations and differential and integral calculus, leaving in less intensity the conceptual explanations regarding the subject treated.

Regarding the usefulness of the exercises and practices (D3) in Table 4, it is observed that the low qualifier predominates with 38.9% (42), while 27.8% (30) indicate the high qualifier. This is due to the fact that the exercises developed in class are at first impression, complicated to solve or require greater mathematical tools to develop them. About the teacher's didactics (D4) in Table 4, it can be observed that the average grade predominates with 34.2% (35), while 32.4% (35) indicates the high grade. This implies that the teacher's experience is manifested by complementing it with additional instruments. The data collected in Table 4 reveal important aspects about the main variable of study, the Methodology of Teaching Physics (V). It should be noted that the predominant qualifier is 'low', representing 34.3% (37) of the responses, while the qualifier 'high' covers 32.4% (35) of the student opinions.

These results have a strong implication in the perception of the students in several dimensions evaluated, such as the ease of understanding the teaching material, the clarity of the teacher's explanations, the usefulness of the exercises and practices, and the didactic quality of the teacher.

By virtue of these findings, it is evident that students face challenges when assimilating the concepts and exercises of the subject, which directly influences the complexity of physics subjects. It is necessary to pay special attention to improving the teaching methodology, in order to provide a more conducive environment for learning and understanding these fundamental contents with more dynamic and strategic pedagogical approaches, which can contribute to overcoming the difficulties identified and achieving greater success in the educational process of physics.

CONCLUSIONS

Based on the students' perceptions, the crucial relationship between the teaching methodology used and the level of understanding of physical concepts is highlighted. To optimize this process, it is recommended to have more interaction and motivation in the classes, making use of examples from everyday life and virtual laboratories that simplify the topics. Terminology should be accessible, avoiding introducing a new language, and the importance of balanced teaching between the conceptual and the mathematical is underlined. Exercises should be gradual in difficulty and application focused. In this sense, the methodology should encourage self-directed learning and employ various tools, including simulators and digital resources, rather than relying exclusively on the whiteboard as a teaching resource. These findings highlight the need to approach teaching in a dynamic and active way for a better understanding and assimilation of physics concepts.

According to the students' perception, there is a high relationship between the methodology used by the teacher and the level of understanding of physical concepts. Teachers should develop their classes by interacting with students, motivating them, encouraging them, using cases and examples from everyday life that facilitate the understanding of physical concepts. On the other hand, laboratories or simulations must be used to provide all the knowledge in a didactic, real and simple way. Regarding the ease of comprehension of the teaching material, students find it difficult to

understand and comprehend the topics developed, this is due to the use of a new terminology in the development of the topics, thus resulting in a new language for the students. The terminology and language used by the teacher must be basic and simple, so that students understand what the teacher explains and do not get lost during the development of the class or the explanation of the topics developed. Likewise, the support materials that are given to students should be practical and simple so that all students can understand. In relation to the clarity of the teacher's explanations, it can be observed, from the results obtained, that students face difficulties in understanding certain concepts. This is due to the fact that not enough emphasis has been given to the conceptual development of the topics and the mathematical part has been given too much priority. On the other hand, regarding the usefulness of the exercises and practices, it can be deduced from this research work that it is important to consider the development of the exercises gradually in terms of their difficulty. Generally, the difficulty arises in the formulation and mathematical development of the exercise. According to the results obtained, the teacher's didactics is a very important and significant parameter in the learning and understanding of physical concepts.

The methodology used by the teachers aims to promote that students have the ability to acquire their own learning using previous cognitive knowledge. They must be trained for theoretical, practical and experimental teaching, using digital tools and practical simulators in virtual laboratories. The results of our research indicate that physics classes should be more active, more dynamic teaching strategies and methodologies should be used, and the use of the blackboard should not be considered as the only teaching tool.

REFERENCES

1. Barraza, A., & Cárdenas, T. (2015). Didactic innovation projects for the improvement of teaching practice. Mexico: Instituto Universitario Anglo Español. Mexico: Instituto Universitario Anglo Español.
2. Cabrera, F. (2014). Evaluation of the use of didactic resources applied to the teaching of kinematics. Quetzaltenango, Guatemala: Universidad Rafeal Landivar.
3. Campanario, J., & Moya, A. (1999). How to teach science? Main trends and proposals. Science Education, 179-192.
4. Campelo, J. R. (2003). A didactic model for teaching and learning Physics. Revista Brasileira de Ensino de Física, 86-104.
5. Davar, M. (2012). Teaching of Science. PHI Learning Pvt. Ltd.
6. Eaton et al. (2020). GNU Octave version 6.1.0 manual: a high-level interactive language for numerical computations, https://www.gnu.org/software/octave/doc/v6.3.0/.
7. Garalova, M. (2019). AIP Conference Proceedings [Author(s) 10th Jubilee International Conference of the Balkan Physical Union - Sofia, Bulgaria (26–30 August 2018)]. The new method of teaching physics. Sofía.
8. Geelan, D. (2020). Physical Science Teacher Skills in a Conceptual Explanation. Education Sciences.

9. Gonzalez, I. E. (2015). Learning development strategies to increase students' academic performance in mathematics. Guatemala: Universidad Rafael Landívar.
10. Hussain, A., Azeem, M., & Shakoor, A. (2011). Physics Teaching Methods: Scientific Inquiry Vs Traditional Lecture. International Journal of Humanities and Social Science.
11. IBM Corp. (2017). IBM SPSS Statistics para Windows, versión 25.0. Nueva York City, Nueva York.
12. Kang, N. (2017). Designing and Teaching the Secondary Science. Sense Publishers, 189-206.
13. Lorenzana, R. I. (2012). Competency-based assessment of learning in university education.Flensburg : Flensburg, University.
14. Marušić, M., & Sliško, J. (2012). Influence of Three Different Methods of Teaching Physics on the Gain in Students' Development of Reasoning. International Journal of Science Education. doi:10.1080/09500693.2011.582522
15. Sajjad, S. (2010). Effective teaching methods at higher education level. Pakistan journal of special education, 29-43.
16. Uzcátegui, Y., & Betancourt, C. (2013). The Inquiry Methodology in Science Education: A Review of Its Growing Implementation at the Elementary and Secondary Education Level. Journal of Research.
17. Wells et al. (1995). A modeling method for high school physics instruction. A. Phys., 606-619.