Fd-Rie
Formación docente
revista iberoamericana de educación

Article

Didactic proposal for the teaching of classical mechanics through microhistories.

Propuesta didáctica para la enseñanza de la mecánica clásica a través de microhistorias

Proposta didáctica para o ensino da mecânica clássica através de micro-histórias

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Received May, 2021 - Approved July 2022
Revista Iberoamericana de la Educación
Vol - 6 No. 4, October - December 2022
e-ISSN: 2737-632x
Pgs 66-77

Abstract: Physics learning can be performed in many ways. The objective of this research is to determine the influence of the use of microhistories in the teaching of Classical Mechanics in the first and second year students of the General Unified High School of the FEBE Educational Institution. The research is of an exploratory-descriptive level through a documentary and field research, for the collection of information an instrument was elaborated composed of four activities that are governed to the ERCA learning cycle. At the end of the research it was concluded that micro-stories do contribute to

improve learning, establishing that with their use the student generates significant learning.

Key words: Microhistory, Pre-instructional strategy, Post-instructional strategy, Erca, Classical Mechanics.

Resumen: El aprendizaje de la Física puede ser ejecutado de muchas maneras. La investigación tiene como objetivo determinar la influencia del uso de las microhistorias en la enseñanza de la Mecánica Clásica en los estudiantes de primero y segundo año de Bachillerato General Unificado de la Institución Educativa FEBE. La investigación es de nivel exploratorio-descriptivo a través de una investigación documental y de campo, para la recolección de la información se elaboró un instrumento compuesto por cuatro actividades que se rigen al ciclo de aprendizaje ERCA. Al finalizar la investigación se concluyó que las microhistorias sí contribuyen a mejorar el aprendizaje, estableciéndose que con su utilización el estudiante genera un aprendizaje significativo.

Palabras clave: Microhistoria, Estrategia pre instruccionales, Estrategia post instruccionales, Erca, Mecánica Clásica.

Resumo: A aprendizagem da física pode ser implementada de muitas maneiras. A investigação visa determinar a influência do uso de microestórias no ensino da Mecânica Clássica nos alunos do primeiro e segundo anos do Bacharelato Geral Unificado da Instituição de Ensino FEBE. A investigação

é a nível exploratório-descritivo através de um documentário e pesquisa de campo, para a recolha de informação foi desenvolvido um instrumento que consiste em quatro actividades que são regidas pelo ciclo de aprendizagem ERCA. No final da investigação concluiu-se que as micro-histórias contribuem para melhorar a aprendizagem, estabelecendo que com a sua utilização o estudante gera uma aprendizagem significativa.

Palavras-chave: Micro-história, Estratégia pré-instrucional, Estratégia pós-instrucional, Erca, Mecânica Clássica.

INTRODUCTION

The obstacles in the teaching-learning process of Physics have been solved according to the technological progress, since the educational processes have been improving according to the management of new information and communication technologies, thus: "Internet has radically changed the way people learn. On the one hand, the availability of information sources, on the other hand, the way in which we exchange data of all kinds." (Corporación Colombia Digital, 2012, p. 11), the sources of information that we have today are innumerable and every day more and more appear, these have revolutionized the way of teaching and learning Physics.

The theoretical and practical domain goes hand in hand and therefore it is necessary to know the why of things, in this case the why of the appearance of the laws of Classical Mechanics, this is a topic that currently few or none of the high school students know, and it is of utmost importance to find the way in which teachers can provide this part of science, which is unknown to new generations of students. From the use of microhistories of how the

theories that govern Physics arose, the student will find it easier to be immersed in this beautiful field of study called Classical Mechanics in Physics.

Consequently, the problem statement is given to the need to investigate: How to use microhistories in the teaching of Classical Mechanics aimed at students of first and second year of General Unified Baccalaureate?

The objectives guiding the research are to analyze the use of micro-stories in the teaching of Classical Mechanics to first and second year students of the Unified General High School, to determine the characteristics that micro-stories should have for the teaching of Classical Mechanics, to establish the relevant aspects in chronological form of the historical process of the advancement of Classical Mechanics and to present a methodological proposal for the teaching of Classical Mechanics in Physics through the use of micro-stories.

The neglect that teachers have, by not relating the historical events that led to the appearance of Classical Mechanics, establishes the need to create a methodological proposal that allows the historical aspect of Physics to be united through the creation of a mini-collection of stories with animation that can be used by teachers as an introduction to the topics of study.

The introduction to a new subject of study has always been a conflict when not having the right way to embark on the subject, especially in Physics where it is required to be very assertive when giving a clear and precise introduction. (Martínez, P 2007) About the introductory activities he argues that:

These are activities that are preferably carried out at the beginning of a class or a new learning phase and whose purpose is to motivate students and provide them with a first contact with the topic to be developed during the

session. These activities involve the active participation of the students; for this reason their degree of difficulty is not usually very high, always being at a level appropriate to the knowledge (and even preferences) of the students. One of their main characteristics is that they almost have a playful or fun component with the aim of increasing student motivation, relaxing the classroom atmosphere and presenting new elements in an attractive and accessible way (p.26).

In view of the above, it is considered necessary to propose a didactic guide that allows to generate a significant learning of Classical Mechanics through micro-stories adapted to the technological resources currently available, such as "Video Scribe" that allows to draw stories or sequenced images by means of a virtual digitizer and blackboard.

From the point of view of (Mora & Reyes, 1987) Classical Mechanics "is the science that, based on Newton's laws, studies the motion of bodies and the causes that produce it, when the speeds are small compared to that of light" (p. 3).

According to (Morales, 2017) the microhistory "approaches readers by using a simple and motivating narrative, close to literature and away from the cold and formality-laden intellectuality that closes in on itself" (p.38), it is a didactic technique friendly to students, since it handles a simple language that facilitates the understanding of the events recounted, in addition to telling specific facts of the story.

According to (Martinez S, 2017) Video Scribe is a program to create presentations of the topic you want, its central element is that it allows you to make videos with animations that look like a whiteboard or colored board, in

it you add drawings, texts and you can add images from the folder, you can use resources with a marker, which presents the topic with creativity (p.4).

MATERIALS AND METHODS

The research is based on a qualitative and quantitative approach, since we want to make an assessment of the incidence of the application of microhistories in the teaching of Classical Mechanics, in addition, after the collection of the information, a statistical analysis of the results obtained is carried out to determine conclusions from them.

In addition to being a documentary and field research, the modality of the proposal is that of a feasible project.

According to (Hernández et al., 2014) the population is "the set of all cases that agree with certain specifications" (p.174), according to this definition we can establish that in the present research we work with a population of 35 students between 15 and 17 years of age, from the Educational Institution "FEBE", located in the center of the city of Quito, of which 19 students correspond to first of General Unified Baccalaureate and 16 students correspond to second of General Unified Baccalaureate.

The techniques and instruments that have been used in the two phases that allow the execution of the research, constitute the documentary analysis and scientific reading; while a questionnaire based on the accounts of the microhistories of Classical Mechanics in Physics in each activity has been used as an instrument of data collection.

As pointed out by (Arias, 2006) the questionnaire "is the survey modality that is carried out in written form by means of an instrument or paper format containing a series of questions, it is called a self-administered questionnaire

because it must be filled out by the respondent, without the intervention of the pollster" (p.74), so for this research a questionnaire with multiple choice answers has been used, which have been developed and applied online using the Quizizz and Kahoot applications, so that respondents (1st and 2nd BGU students) can answer them from anywhere and at any time.

The applied instrument has been divided into four activities, each activity has been developed during a class period, having a total of four classes.

The four proposed activities have the same objective, which is to determine how the didactic resource called micro-stories contributes to the teaching-learning process of the subtopics of Classical Mechanics in Physics, which are taught in the first and second year of the General Unified Baccalaureate.

The instrument has been designed under the ERCA learning cycle, based on which the tasks to be performed in each activity have been strategically placed in order to collect the necessary information at the end of each activity. In order to determine the usefulness of the micro-story presented, the questionnaire is applied at the beginning and at the end of each activity, with the purpose of carrying out a comparative analysis between the answers obtained in the pre-instructional questionnaire and in the post-instructional one, considering that the students already have a pre-established idea of the issues raised.

In addition, it should be taken into account that the instrument has been used at different moments of the class, applying the pre-instructional didactic strategies, of which the micro-stories are part; the co-instructional strategies, which are used for the development of conceptualization, in which simulators of physical phenomena are used, related to the topics addressed by the micro-stories, with the purpose of helping the student to understand the physical

phenomenon; finally, use is made of the post-instructional strategies that are used to evaluate the knowledge acquired by the students, in this case the pre-instructional questionnaire has been used, which consists of the same questions of the questionnaire applied in the experience phase, adding a question related to the usefulness of the micro-stories.

RESULTS

Once the data collection instrument has been applied to the 1st and 2nd year BGU students of the "FEBE" Educational Institution, we proceed to the analysis and interpretation of the results, for which a comparison is made between the results obtained in the pre-instructional questionnaires and the post-instructional questionnaires to determine whether the objective of determining the usefulness of the micro-stories in the teaching process of Classical Mechanics in Physics is met.

When analyzing and interpreting the results of activity No. 1, by comparing the answers obtained in the same questions, applied at different times of the class (beginning and end), it is determined that students who select the correct answers increase from 42% to 84%, after presenting the micro-story prepared for teaching Newton's First Law.

As can be seen in Figure 1, the students consider that observing the microhistory allowed them to improve their understanding of Newton's First Law. In the analysis and interpretation of results of activity No. 2, it is determined that students answer correctly to the question posed in an increase from 44% to 81%. In the application of the post-instructional questionnaire, 87% of the students consider that the micro-story presented at the beginning

of the class has been useful to better understand Newton's second law, while 13% indicate that the application of the micro-story has not been useful.

When analyzing and interpreting the results of activity No. 3, the results show that students who answer the questions correctly increase considerably from 13% to 93% after the application of the micro-story prepared for the topic of Newton's Third Law.

It is evident that the microhistory presented at the beginning of the class has helped them to better understand Newton's Third Law.

Finally, when analyzing and interpreting the results of activity No. 4, it is evident that the students who answer correctly to the questions posed increase from 56% to 81%, after the application of the micro-story prepared for the topic to be treated, in addition to establishing that 100% of the students consider that the micro-story presented at the beginning of the class has been useful to better understand the Uniform Circular Motion.

It is necessary to continue using microhistories to verify their usefulness in the learning of Physics. Solbes, J & Través, M (1996) in their research determined that historical aspects are absent in most texts and when they appear they are treated superficially without attributing an important role to them.

It is necessary to raise the following question: Can studying the historical approach to physics help teachers and students to improve their scientific knowledge? In addition, it is necessary to determine the validity of past theories and knowledge in reference to the new knowledge that has been developed up to the present date. It is important to establish how the mental and conceptual schemes of students have been modified in the course of time and how it influences the understanding of the historical aspects of Physics.

CONCLUSIONS

The development of the project helped to establish a new teaching methodology based on the narration of micro-stories of Classical Mechanics in Physics, which allowed linking the historical part of science with the didactic strategies that have been appearing with the technological development, with the purpose of improving the teaching-learning process. Thus, the use of the program to illustrate stories called Video Scribe has been of great importance to give an interesting and attractive approach to the stories narrated in class with the purpose of improving the students' learning.

The narrated micro-story must have certain characteristics that move it away from the traditional narration, so it must have a friendly language and according to the educational level, with a variable tone of voice not uniform, it must also be narrated visually with expressive images, such as cartoons, and funny gif's that captivate the student's attention, also the background music should not be invasive, as it should facilitate the hearing of the narration and finally it must have a maximum duration of five minutes, if the narration is not too long, and funny gif's that captivate the student's attention, also the background music should not be invasive, as it should facilitate the hearing of the narration and finally it should have a maximum duration of five minutes, if the story is too long, it can be narrated in parts as a series.

Based on the results obtained with the data collection instrument, it is conclusive the remarkable usefulness of the application of micro-stories in the teaching process of Classical Mechanics in Physics, it is evident that students observe the information presented in the micro-story and relate it to the topic, In such a way that with its presentation the student affirms or changes his empirical conception about physical phenomena, in addition, the

student learns about the deductions, ideas and analysis made by scientists to establish different principles and physical laws that govern nature and how they are related to situations of everyday life, allowing the generation of a real meaningful learning.

The methodological proposal for the teaching of Classical Mechanics in Physics has a cooperative structure that includes the use of different didactic strategies within the class. Thus, the main axis is the microhistory of the subject to be treated, which can be reinforced with different didactic resources such as: physical or virtual presentations, simulators, experiments, among others, but with the characteristic that they must be directly related to the historical background narrated in the microhistories.

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