El cuento como estrategia didáctica para la enseñanza de las teorías de la evolución de Lamarck y Darwin-Wallace a nivel medio superior

The story as a teaching strategy for teaching evolution theories of Lamarck and Darwin-Wallace superior to average

María Lorena Yoloxochitl Karla Quintino Salazar
Universidad Pedagógica Nacional
quintino28@hotmail.com

Resumen

El objetivo de la presente investigación fue analizar el cuento como una estrategia didáctica en el proceso de enseñanza-aprendizaje para la comprensión de las teorías de la evolución de Lamarck y Darwin- Wallace. La naturaleza de la investigación fue del tipo cuantitativo. El tratamiento de resultados fue realizado mediante un Análisis de X^2 (*chi cuadrado*) en la frecuencia de las respuestas del pretest y del postest, en función de discriminar entre los grupos estudiados. Con base en la hipótesis alternativa se estableció que la narrativa como estrategia didáctica promueve el aprendizaje de las teorías de Lamarck y Darwin-Wallace.

Palabras clave: Cuento, estrategia de enseñanza, teorías de la evolución.

Abstract

The aim of this study was to analyze the story as a teaching strategy in the process of teaching and learning for understanding the evolution theories of Lamarck and Darwin-

Wallace. The nature of the research was quantitative. Treatment of results was performed by X2 analysis (chi square) in the frequency responses of the pretest and posttest, based on discriminating between groups. Based on the alternative hypothesis that the narrative was established as a teaching strategy promotes learning theories of Lamarck and Darwin-Wallace.

Key words: Story, teaching strategy, theories of evolution.

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Introduction

In the case of biology teaching a topic where there has been an increased interest in seeking conceptual change is the understanding of biological evolution through natural selection. This is due to two reasons, firstly the issue encompasses all of biology, and today is inconceivable to science is devoid of the idea of evolutionary change (Mayr, 1982); but also because the Darwinian explanation of evolution causes the student bring up own preconceptions, their cultural and motivated by their beliefs (religious occasions) heritage, but mostly contextual origin, where there is great overlap between the thought of students and pre-Darwinian scientific thinking. Therefore seems to require a historical approach to teaching (Ruiz, 1997).

The evolution and the Darwinian model of natural selection play a central role in biology, so students must acquire adequate training of these concepts, considering that underlie biological knowledge organized and given its unifying character should be a of the first to review concepts within programs, allowing them to understand the nature and process of science (Guillén, 1994).

One of the main reasons for this research, in part generated by observations in the teaching practice, it is difficult to teach the knowledge of the theories of evolution, part II Biology Program of the College of Sciences and Humanities, where it is limited to presenting the views of Lamarck and Darwin-Wallace, where it is observed that the students just memorize some "relevant" sentences of theories, taken from textbooks, not realizing that

these statements were developed within a context historical, with a wealth of positions, knowledge and data, not in isolation. The teaching of biology should be focused not only disciplinary knowledge to handle the student, it is necessary to provide elements that enable them to learn, build and manage knowledge, to understand the concepts and theories of the field, with order to be made aware about the social impact that the work of scientists has historically played (Duit, 2006).

This raises the interest of exploring the concepts that students have about these theories, and the story is proposed to evaluate if it helps getting the right learning these theories can explain the essential concepts underlying them.

Objectives and hypotheses

General Objective:

Prepare, present and evaluate the story as a strategy to promote learning of Lamarck and Darwin-Wallace, in teaching high school.

Specific objectives:

a) Evaluate previous ideas about the theories of Lamarck and Darwin-Wallace students and teachers of high school.

b) Compare the previous ideas of teachers teaching this subject and students in high school.

c) Assess acquired concepts postoperatively.

The central hypothesis of this study was to:

• The story promotes learning the subject of Lamarck and Darwin-Wallace. Theoretical Framework

Knowledge taught during education must be shown as the solutions achieved by men in the course of their confrontation with the practical and concrete problems of real life. Duit (2006) says that the teaching of science, including biology, is an interdisciplinary activity in which the powers are necessary providing other sciences, approaching it from different perspectives.

The great changes that the world has suffered over the past two decades have led to the questioning of certain elements that have been present in the analysis of social and political phenomena. The problem of transformation of education in our country is mainly oriented methodological aspects. A relevant aspect, was to confront the rote learning, which was the norm, repetition of text or notes provided by the teacher derived from an authoritarian conception was fully questioned and reflection of academic work (Suarez and Lopez was promoted Guazo 1993).

Graduates professionals from various fields of science, generally have deficiencies in basic aspects of philosophical, methodological and epistemological bases related discipline; this lack affects not only the way teaches discipline, but how does their daily research work. Proper management of the epistemological foundations of biology and science in general, will affect students who are present a realistic view of the scientific endeavor. Encourage them to understand the temporality of scientific truth, its constant transformation, to avoid dogmatic schemes (López-Suárez and Guazo, 1993).

Constructivist teaching based on the ideas of Vygotsky and Piaget postulates that school science education starts with the construction itself that students make of reality, so that teachers know where from teaching, they should seek students to express their own ideas and can be applied in various situations; This would prevent, according to constructivism, the trend of science teachers try to impose truths (Sánchez, 2000).

It is therefore suggested that currently integrate scientific theories and the history of its development to science instruction at all educational levels more directly, including teacher training. It is important to start teaching science, and in particular the theory of evolution, noting that science seeks the systematic organization of knowledge about the world, is interested in formulas, general laws and theory that relate different phenomena and seeks to explain observable event. Can also be understood as the set of explanations have been given of natural phenomena and the methods used to arrive at such explanations. Scientific knowledge emerges by consensus among scientists, from prior knowledge and although not always agree on some issues not established, often coincide with already established knowledge (Sanchez, 2000).

According to Hernández (2006), we can say that science teaching is a complex problem, in which two trends:

a) The science presented as an accumulation of results but historical;

b) treated as something that can be grasped by the working examples set forth in scientific books, or what is more common, with examples from everyday life science.

Prior knowledge about the theory of evolution.

Evolutionary theory is the central paradigm of modern biology (Ruse, 1979). The importance of this theory in the conceptual development of biology has been enormous, and although it still has shortcomings, we can say, as T. Dobzhansky, "Nothing in biology makes sense to say, except through the prism of evolution ". Indeed, the understanding of life is directly linked to the evolutionary conception (Castro, 2008).

The possibility of misinterpretation of scientific hypotheses, or a bad use of them increases because of insufficient knowledge of the issues and confusion, more or less interested, the scientific issues to matters occurring arise ethical and social. To do nothing better than to provide students an education that allows them to integrate, from an evolutionary perspective of biological knowledge they acquired during their studies and at the time, they serve as a support for a deeper reflection on the character to be human and nature (Castro, 2008).

The theory of evolution is a unifying construct that allows to continue the past and present of biological history, but whose complexity presupposes that to understand the student possesses formal thinking in Piaget's sense. However, this subject should be taught by numerous examples and demonstrations, is really poorly explained in textbooks, and taught by teachers who are often unaware of the level of knowledge of their students (Sanchez, 2000).

It is a fact that biologists and educators in this field know to learn properly the process of evolution is crucial for students to understand and integrate the processes of life. In practice, however, is not the teaching of the subject is achieved by a number of reasons. These are attitude, environment and cognitive ability of the students; the complexity of the

theory itself and the difficulties teachers have to address it. But in general the different methodologies that have been proposed to ensure that the student takes ownership of evolutionary knowledge, no satisfactory results shed (Lawson and Worsnop, 1992).

Among the factors that influence how a person responds when faced with new data, are the characteristics of their prior knowledge; in the case of the theory of evolution, are involved original belief, religious occasions, which are very difficult to change (Chinn and Brewer, 1993). Furthermore, the new data to be acceptable, it requires demonstrations, experiments or experiences that refer to real world or are perceptually obvious, which is very complicated for the case of biological evolution. The difficulty in learning theory has determined that education, there is a concern to understand how students conceive the mechanisms of evolution, because their ideas differ from those supported by biologists, in principle it is considered that this is a confrontation between an abstract concept such as the theory of evolution and a difficult concept to perceive as variation versus concrete thinking of students (Sanchez, 2000).

There are several important problems in learning of evolutionary theory, the first difficulty comes from the presence in the students and sometimes teachers a preconception of Lamarckian evolutionary process (Bishop and Anderson, 1990; Jiménez-Aleixandre, 1992). Indeed, the idea that changes in organisms occur in response to environmental conditions and that these changes are heritable is deeply rooted and is not easy to get a conceptual shift positions Darwinists. The intuitive logic inherent in Lamarckian ideas and the fact that there is no real conflict between the two theories seem to be responsible for this difficulty to acquire a key concept in evolutionary theory. A second issue, are also major difficulties lies in the misidentification of the concept of natural selection with the idea of the struggle for existence and the triumph of the strongest pre-Darwinism developed by Herbert Spencer concepts. This approach has historically led to the misuse of Darwinian ideas such as those put forward by Marx (social Darwinism), which have served as a tool to justify the socioeconomic structure of human societies, eugenics and racism. Finally, there are difficulties that come from both the complexity of some theoretical concepts, such as the scientific debate that currently exists on certain aspects of the evolutionary process, which

hampers together a good understanding of evolutionary theory, by not and students, but the teachers themselves are not experts in this field (Castro, 2008).

When the various texts relating to the study of the theory of biological evolution are reviewed, highlights the coincidence regarding the way they should be taught this important issue to students. It begins with a historical overview of the development of human thought, catastrophism-fixity, concluding with non fijistas evolutionary ideas. During this tour, it is intended that students understand the importance of studying in this light biological processes as completely dynamic and constantly changing processes, although ideally evolutionary thinking is taught as a series of ideas that have changed time, starting with the thought of Lamarck, continuing the Darwin-Wallace, and concluding with the synthetic theory and contemporary Darwinists positions. The teacher usually chooses between two possible teaching strategies: a simple enumerative explanation of the classic examples of evolution, or try to bring the theory of evolution to the student, into something real and observable. Whereas this scheme is ideal, students are expected to acquire a number of appropriate knowledge about the theory of evolution, however, the understanding of the subject and his views on the evolution leads to seriously question the current teaching scheme (Gersenowies, 2010).

When opinions on the subject in social and academic environments are exchanged, it is not uncommon to find people with a college preparatory keep saying "Darwin said we descended Monkey", "The theory of evolution is Darwin", "The example of Darwin's giraffes "," the theory of evolution is that, just a theory ", and many other misconceptions that not only reflect a complete misunderstanding of the historical development of evolutionary ideas, but own the methodological principles of science and structure of a research program that has been very successful in the past 150 years, which is the study of biological evolution. This study is not subject to reliably demonstrate that the theories of Darwin or the synthetic theory are absolute, but on the contrary, are considered provisional and perfectible, there a number of facts to be explained in a logical structure (Gersenowies, 2010).

There are a number of errors with respect to some issues discussed within the teaching of evolution, which may constitute sources of confusion, which are mentioned only having to do with Lamarck and Darwin:

• It is considered that Darwin presented his theory in finished form, a fact that is false.

• The theory of biological evolution is presented as a completely finished and not as a research program developing explanation.

• Rarely mentioned are the facts that should explain the theory are explained and which ones are in dispute.

• Presented many myths surrounding the figure of Darwin and the contribution of researchers as were Wallace, Fisher, Mayr, Stebbins and others, made to detract Darwin's real contribution is reduced.

• One of the most frequent examples to explain the theory of evolution is the comparison between the Lamarckian and Darwinian evolution using extension neck giraffes, which often appears in textbooks. In the first half of the nineteenth century, Lamarck attributed the lengthening of the neck to the inheritance of body modifications caused by the habit of stretching his neck. Darwin attributed the lengthening of the neck to the constant selection of individuals and races who were born with longer necks.

• Another classic mistake is to say that Darwin used as an example of evolution finches, when only sporadically mentioned in his work (Gersenowies, 2010).

Background

Currently the teacher has many ways to present your class, using different materials and varied strategies, however there are few work done on the use of story as a teaching resource in the teaching of biology, especially at the secondary level superior, but there is a considerable number of works done on narrative and its educational function.

For example, one can mention: Solbes and Traver (2001), who focused on critical analysis of the situation in the usual teaching, regarding the lack of adequate historical perspective that highlights the poor image of the nature and evolution of science students and their

influence is transmitted in the same disinterest towards learning physics and chemistry. The authors developed teaching materials to teach physics and chemistry with a historical approach, based primarily on reading texts, contextualized biographies. Once the materials developed by the authors, used the results obtained by the experimental groups and control groups were compared, finding that students who have followed a historical treatment, showing an image of science more contextualized and close to reality, and most significant perceived decline in scientific discovery activity decreases as the cumulative view of science, improving the knowledge of scientists and their work and want to know the process of creation science it is found. In the experimental groups a better understanding of issues related to the contextualization of scientific knowledge is detected, also increase students generators known problems of various scientific papers. Finally, the authors conclude that the lack of student interest and attitude characterized by little appreciation towards the study of science was motivated in part by the ahistorical view of the education usually showing a biased picture of the nature of science and evolution. They found that you can increase the interest in the study of physics and chemistry, using a minimally stopped treating some historical aspects, introduced in the process of acquiring the different concepts and theories, since you can display an image of the more accurate and closer to the reality of the work of scientists and the context in which it develops and has evolved throughout history science.

Singer (2006) investigated the effect of the story as a teaching strategy on student learning performance of high school students in Venezuela, to the address corresponding to the properties of the inorganic chemicals topic. The design corresponds to field research, since the data are collected in the reality of learning environments. The hypothesis is that the strategy of teaching and learning using the dramatized story should encourage increased student performance using the illustrated story and, in turn, the story not shown should correspond to lower average test scores on student achievement the contents studied. The treatment of the results was performed by analysis of variance of mean scores and then the Tukey test was applied, based on discriminating between groups. The hypothesis of increased student achievement as a result of the administration of the dramatized story is corroborated by corresponding statistical tests; however, the story dominated not shown on

illustrated tale, which is explained by the freedom of imagination and motivation in the absence of illustrations.

Kalkanis and colleagues (2010) conducted their research in order to analyze the influence of the stories in the process of teaching and learning for understanding and application of the periodic table, in the subject of chemistry ninth grade of basic education in Venezuela , which is equivalent to the third year of secondary school in Mexico. Its aim was to update and include other educational resources in the teaching of chemistry; specifically in the teaching of the periodic table, through the use of story as simple teaching resource; claim that listening to or reading a story has many benefits such as: developing listening skills and interaction, encourage reading, increase vocabulary and comprehension. They wonder How you can influence the story as a teaching resource in the teaching-learning process for understanding and application of the periodic table? To answer the authors determined the level of students' knowledge on this subject before applying the story as a teaching resource. The stories that were used are the authors own production. The design was a pretest-posttest control group and to study the effect of the application of methodological strategies for meaningful learning. The results were analyzed using the test "t" Students of average grades pre-test and post-test, based on discriminating between groups. From the results obtained in this investigation, it was concluded that the story is effective as a teaching resource for the understanding and application of the periodic table.

Method

In order to develop the objectives, the following method was used:

a) Groups and their criteria of choice: The working groups. were selected according to the arrangement of the College of Sciences and Humanities, Atzcapotzalco campus, the 2009-2 cycle, afternoon shift; one of the main features is that they were studying Biology II, according to the school's program, two control groups and two experimental groups with randomly selected.

b) Design of questionnaire: 20 multiple-choice items were developed to explain the concepts on the theories of Lamarck and Darwin-Wallace, each question was assigned four possible short answers, where only one is correct. These questions are divided into two

equal difficulty questionnaires and balanced content, this in order to avoid long-term memory. For structuring questions, the key concepts of the theories of Lamarck, as the inheritance of acquired characteristics and natural acotaron scale. The key to the Darwin-Wallace theory concepts were common origin and natural selection.

c) Together, for all groups, the questionnaire used by Sánchez (2000) was applied for the previous ideas on the subject of evolution, all four groups and to compare with our results.

d) Design cuento.- To prepare the narrative elements suggested by Zavala (1994) will be followed.

e) Data analysis: The following tests were applied

He developed frequency tables and Darwinian lamarkianas responses between the results of students' preconceptions and the preconceptions both groups of both groups and teachers.

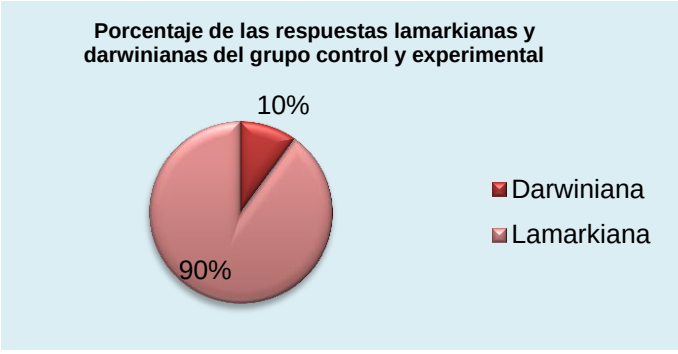
He developed frequency tables correct-incorrect answer the pretest of the control and experimental groups teachers.

He developed frequency tables correct-incorrect answer the pretest and posttest in the control and experimental group.

X2 Analysis of frequency tables, for which the program Statistica version 7 was used.

Analysis of results

Preconceptions in the control and experimental groups.

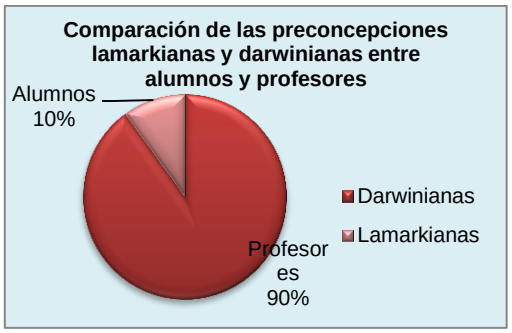


The results show that 90% of the responses share lamarkianas preconceptions for both groups. Students have the idea that organisms change to adapt to the need for these changes

occur in organisms in response to environmental conditions and that these changes are heritable. This idea is deeply rooted and is not easy to get a conceptual shift towards Darwinian positions. Sánchez (2000), Bishop and Anderson (1990) and Jiménez-Aleixandre (1992) state that there are several problems when learning of evolutionary theory, among them are the attitude and cognitive ability of the student, the complexity of the theory itself and the difficulties teachers have to address it. Another possible explanation of why most of the students retain lamarkistas ideas is mentioned Chinn and Brewer (1993), on how the new data and the characteristics of the prior knowledge possessed by learners as well as resistance to conceptual change are presented

Sánchez (2000) mentions that the new data are acceptable, is required demonstrations and hands-on experiences for the case of evolutionary theory is very complicated, so it is considered as an important factor in explaining these results, the role that teachers have in the teaching of evolutionary theory and the problems of science education are a hindrance to learning not only for students but also for teachers (Bell, 1998).

Comparison of preconceptions among students and teachers.

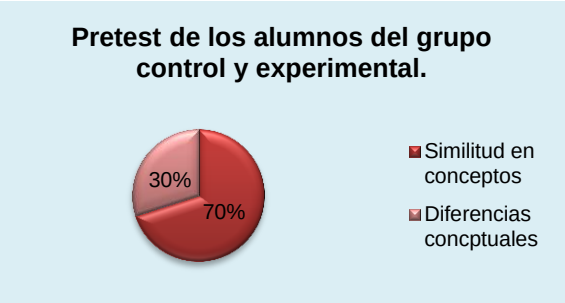


It was observed that 90% of respondents from the comparison between the preconceptions of teachers regarding the student, regardless of the intervention meets expectations, since it is based on the premise that the teacher is the expert in evolutionary theories.

However it is observed that incorrect responses of teachers 50% of teachers share lamarkianas ideas with students in the sense that organisms change by necessity to adapt to the environment, these changes in organisms occur in response to environmental conditions and that these changes are gradual and inheritable, which explains the result in students and

corroborates explained by Bell (1999), who mentioned that teachers are still teaching models for transmission so the student know what the teacher teaches.

Pretest of students in the control and experimental group.



At this point it was observed that 70% of students in the two groups are the same concepts. However it is observed that 30% of respondents in the experimental group showed a better grasp of the concepts of gradual change, natural scale and the inheritance of acquired characters, concepts of the theory of Lamarck, which is consistent with the preconceptions observed where you predominas the lamarkianas.

Pretest between the control groups, experimental and teachers

Conceptos	**Alumnos % de respuestas correctas**	**Profesores % de respuestas correctas**
Cambio gradual	23%	75%
Polémica sobre la descendencia atribuida a Darwin	0%	25%
Autor del libro "El origen de las especies"	72%	100%

Selección natural	44%	100%

The comparison of the results at this point confirms the trend domain Lamarck's theory in the study population. However, draws attention to the concept of gradual change that belongs to the theory of Lamarck 77% of students answered incorrectly, but the teachers did 100%. Similarly for the historical fact of the controversy of the offspring of the monkey, erroneously attributed to Darwin, only 25% of teachers responded correctly, a common mistake mentioned by Gersenowies (2010).

These results can be explained as mentioned by Suarez and Lopez-Guazo (1993); the professionals from various fields of science generally have deficiencies in basic aspects of philosophical, methodological and epistemological discipline related to their bases. Diaz-Barriga and Hernandez (2006) states that a teacher should keep in mind when planning strategies, among other aspects the domain of scientific knowledge in general and in particular the curriculum content of the discipline they are teaching. It should be clarified that the teachers interviewed are biologists by profession but most do not have a teacher training that allows the design of teaching strategies.

Comparison between the pretest and posttest in the control group.

Conceptos	**Pretest % de respuestas correctas**	**Postest % de respuestas correctas**
Herencia de los caracteres adquiridos	80%	100%
Polémica sobre la descendencia atribuida a Darwin	5%	36%

Autor del libro "El origen de las especies"	50%	100%
Selección natural	0%	88%

The following table shows that there is an increase in the correct answers in the control group, where the most significant finding is the percentage for the concept of natural selection with a 88% increase after the educational intervention.

Comparison of pretest and posttest in the experimental group.

In the experimental group students showed an increase in their percentages of correct answers for the concept of gradual change was a 24-61%, for the concept of acquired characters was a 16-61%. As for the misconception that Darwin was mentioned monkey offspring step 0-17% for the data of the author of "The Origin of Species" step 72-100%. For the concept of natural selection the group showed an increase of 8% to 74% correct. With regard to the contribution of Wallace answered correctly 74% compared with 16% down. However, in question 9, where they are asked about the scheme that follows the theory of Lamarck, confused between incremental change and inheritance capabilities.

As you can see there was an increased percentage of correct responses after use of narrative, coinciding with investigations Solbes and Traver (2001) and Kalkanis and colleagues (2010), who claim that it is possible to introduce aspects of history in materials training developed for teaching, for a better understanding of issues related to the contextualization of scientific knowledge is detected.

Conceptos	**Pretest % de respuestas correctas**	**Postest % de respuestas correctas**
Cambio	24%	61%

gradual		
Herencia de los caracteres adquiridos	16%	61%
Polémica sobre la descendencia atribuida a Darwin	0%	17%
Autor del libro "El origen de las especies"	72%	100%
Selección natural	8%	74%

Conclusion

It can be concluded that:

• Students in upper secondary education have a preconception of Lamarckian evolutionary process, where ideas that agencies need to change by adapting to the environment and that these changes are heritable prevail.

• Despite the criticisms which can be attached to the use of questionnaires to assess not only declarative content and processes, the results of this research with the objective of finding causal schemes and principles on previous students' ideas are added to teachers provide important information when scheduling strategies of teaching and learning.

• The narrative has efficacy as a teaching strategy for teaching science content.

• The concepts where improvement was observed in the students were:

~ Gradual Change

~ Inheritance of acquired characters

~ Natural Selection

• For historical data

~ Darwin Myth and Monkey Race.

~ Author of "The Origin of Species"

Finally this work came from the interest of improving the teaching of evolutionary theory in high school, because as we saw students still maintain a Lamarckian interpretation and ignore historical aspects of the scientific process.

Provide evidence for teachers that need updating on the topics to teach, because in this research some of them still share the same ideas as their students, with the aim of developing methodologies that meet the needs of their educational context as intervention teacher is essential in the teaching-learning process and that this pedagogical mediation can be supported on a series of teaching materials, developed by the same or choose the right on meticulous planning.

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