

Vision of Pedagogy course students on the origin and evolution of the human species

Visão de alunos do curso de pedagogia sobre a origem e a evolução da espécie humana

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Abstract

Darwinian biological evolution and its teaching generate controversy in society. Therefore, understanding how pedagogues conceive this topic is important, as they are the first to introduce it to children. Human evolution has been proven by scientific evidence and the intelligent design hypothesis does not find academic support. The objective was to analyze how students of pedagogy perceive the human origin and the hypothesis of intelligent design. Participated in this study, pedagogy students of UNIFOR-MG. The questions of the BIOHEAD-CITIZEN questionnaire, A33: the improbability of the emergence of humanity; and B44: the role of intelligent design in the evolution of species were analyzed. Most students of the second period believe that human came by chance. In the 4th period, those who did not agree increased and in the 6th period the students mostly aligned with this view. Most of the students in the 2nd period showed that intelligent design was important in evolution, but in the 4th and 6th period this percentage decreased. It was found that in the course there was the consolidation of scientific knowledge, leading to the decline in acceptance of the intelligent design hypothesis, in a contradictory way did not measure tendency over chance in the origin of the human species.

Keywords: Human origin; Intelligent design; Evolution; Pedagogy.

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Resumo

A evolução gera controvérsias na sociedade e no seu ensino. Portanto, compreender como os pedagogos concebem esse tópico é importante, pois são os primeiros a apresentá-lo às crianças. A evolução humana foi provada por evidências científicas e a hipótese do design inteligente (sobrenatural) não encontra respaldo acadêmico. Objetivou-se analisar como os estudantes de pedagogia percebem a origem do homem e a hipótese do design inteligente. Participaram da pesquisa os alunos do 2º, 4º e 6º períodos de pedagogia do UNIFOR-MG. Foram analisadas as questões do questionário BIOHEAD-CITIZEN, A33: sobre a improbabilidade do surgimento da humanidade; e B44: sobre o papel do design inteligente na evolução das espécies. A maioria dos alunos do 2º período acredita que o homem surgiu ao acaso. No 4º período aumentaram aqueles que não concordavam e no 6º período os alunos majoritariamente se alinham com essa visão. A maioria dos alunos do 2º período revelaram dar importância ao design inteligente na evolução, entretanto no 4º e 6º período diminuiu essa porcentagem. Detectou-se que no curso houve a consolidação do conhecimento científico, levando ao declínio na aceitação da hipótese do design inteligente, de forma contraditória não se aferiu tendência sobre o acaso na origem da espécie humana.

Palavras-chave: *Origem humana; Design inteligente; Evolution; Pedagogy.*

Introduce

The theory of biological evolution is considered the unifying axis of Biology by many authors¹. Caldeira *et al*² agree with this view and add that evolution provides a basis for understanding current Biology and subsidizing concepts for various areas of study within Biology. These authors still point out that the construction of the concept of Darwinian evolution is currently complex because of the plurality of processes that need to be understood. That is why it is considered that the subject should be treated as soon as possible in Science classes, to create a foundation that allows the assimilation of Biology in the future.

The Theory of Evolution causes many discussions in the field of religion, because there are hypotheses which conflict with the changes brought by the theory between the students and researchers of the field. Many people still do not believe that all these organisms were created from a common ancestor and that chance would play a fundamental role in this evolutionary process. Over time, the relationship built between the Church and the Science has had several crises. It is possible to have a strong religious belief and accept that

the emergence of the human species took place through evolution³. It is not interesting to treat Evolution as only one more taught content. Evolution is fundamental to understand most of the concepts and theories of Biological Sciences⁴.

For creationists, the Universe, the Earth and all living beings were created by God, based on faith, where this creation was not by chance and that each culture has its version. In a general sense, it refers to the theory that God made the world by miraculous means, out of the blue. More specifically, in modern America, creationism is the theory that the Bible, particularly the early chapters of Genesis, is a literally true guide to the history of the universe and the history of life here on Earth, including us humans⁵.

Religion can directly influence the teaching of Science, because when academic training has no effect on a student linked to a religious dogma, this can cause conflicts in the learning of Science and Biology. For teaching a theory that is apparently against the principles of creation that until now were viewed as truth by the

subject. It cannot be denied that both Science and Religion bring knowledge of the world to living beings, but it is worth emphasizing that both have their own truths⁶.

From the advance of the Sciences from the eighteenth century, and the development of several studies in the field of Biology as: Paleontology, Anatomy, Embryology, etc. biological evolution begins to be deciphered, not without resistance from society, especially from the religious sectors. Although a series of studies have been developed that have deepened and confirmed the discoveries in this field since the days of Darwin, the resistance continues. Carneiro and Rosa⁷ argue that the mechanistic nature of evolutionary processes is difficult to understand, especially for those who see purpose in everything, some interpret biological evolution as simply progressing from lower forms of life toward forms of life.

The subject of biological evolution teaching has grown as a research phenomenon in Brazil in recent years, which does not reduce the need to research it from different angles, given its value for teaching Biology and for Science. However, few studies focus on the teaching of this subject in elementary school, and it is important to emphasize that in this period children will probably have contact with scientific theories, so if they are presented in an erroneous way it may reverberate in future stages of education⁸.

In the literature there are distinct classifications between Science and Religion as described by Ian G. Barbour. For Barbour stand out four main categories: conflict, independence, dialogue and integration. However, it is important to point out that there are other ways of analyzing the relationship between Science and Religion, but for this study we limit ourselves to analyze relations based on the categories elaborated by Barbour⁹. Barbour's texts are widely used worldwide for the analysis of the relationship between science and religion, being very useful for works that investigate controversial topics between the two fields.

The so-called category of conflict proposed by Barbour points out that there are compelling clashes

between Science and Religious belief. For Colonetti and Sanches¹⁰ that, although having a reduced number of followers of this category, they have a lot of visibility, defending the absolute truth of their vision of the world and the misunderstanding of the other. For religious of this category only sacred writings can give answers, and for scientists, only the scientific method through logic and rationality could give explanations for the inquiries concerning our existence. According to Mahner and Bunge¹¹, Science and Religion have incompatible approaches, with very different methodological, epistemological and attitudinal perceptions. Thus, in the analysis of these authors, the need to move away from the religious field in order to assimilate scientific knowledge.

Barbour's category of independence considers that each of the two visions, religious and scientific, has its value, which are different analyzes, with different methods where on the one hand one believes in creation and the other on evolution, but one has little to contribute with each other, are distinct and each with its value in society. Coutinho¹² states that the questions of Science are about natural phenomena, while those of religion are about meanings and purposes, about our origin and destiny. Woolnough¹³ argues that Science and Religion are based on distinct pillars, therefore, they have marked differences, for that reason they should not be unique but different.

The category of dialogue, proposed by Barbour⁹, seeks some interaction between Science and Religion, with a border less rigid than the independence one. Although it did not need Religion, Science could benefit from beliefs to fill its gaps in the search for answers to its doubts, so it could be a dialogue, making Science richer. Coutinho and Silva¹⁴ realize that this category could be exemplified by explaining the beginning of the universe as the work of a Creator. Several religious seek dialogue as a way of pacifying their world view with evolutionary theory¹⁵.

Barbour⁹ elaborated the category of integration between Science and Religion as the most profound way of bringing the two fields together. In this

type of vision, natural theology is included, arguing that the existence of God is based entirely on human reason, and not on historical revelation or religious experience¹⁴. Those who boast about the Intelligent Design hypothesis can be considered inside this category, in their attempt, although forced, to merge scientific and religious knowledge³.

The objective of this research was to analyze how Pedagogy students perceive the human origin and the participation of an intelligent designer in the evolutionary process. We also sought to detect a possible change in conception on these themes during Pedagogy university course. The authors of this work respect the individual religiosity, but it is important to reinforce the value of Science, Darwinian theory of evolution and the secularism of the school. Thus, it is intended that the future teacher of Science of children respects the religion of the students, but that it preserves scientific teaching in a secular way, without the insertion of religious issues and pseudoscience, as the hypothesis of intelligent design.

Materials and methods

This work was developed at the University Center of Formiga, Formiga, Minas Gerais, Brazil, with the purpose of analyzing the conceptions of 64 students of the Pedagogy course in three different periods (2nd, 4th and 6th) on how the species originated and the degree of importance given to the intelligent design hypothesis. All students from each period who were in class on the day that the questionnaire was applied were willing to answer it. These students are from the Midwest region of Minas Gerais, mainly from the city of Formiga and neighboring municipalities, a region with a Catholic tradition, but with a growing influence of evangelical denominations, with students within this religious spectrum. The majority are composed by workers, in the most diverse areas of service provision, in commerce and as secretaries, for example, who have difficulties in paying for the private university education course.

Two questions were used for the investigation in the BIOHEAD-CITIZEN questionnaire, which seeks to study

relevant and controversial topics, including Evolution and the Origin of Humanity. The BIOHEAD-CITIZEN research project seeks to explore multiculturalism related to important and controversial issues, among them Evolution (especially the issue of the human origin), Sexual Education, Health Education, Environmental Education, associated with behavior and the teaching of human genetics¹⁵.

The questions used had responses on the Likert scale, which avoid the traditional "yes" or "no", allowing the respondent a wider range of options for their analysis. According to Caldeira *et al*², this scale allows the respondent to present his degree of agreement or disagreement.

The selected questions for the study were:

a) A.33 The emergence of the human species (Homo sapiens) was just as improbable as the emergence of any other species.

“I totally agree”,

“I agree more than disagree”;

“I disagree more than agree” and

“I do not agree”.

b) B.44. "The importance of an intrinsic program to the organism (intelligent design) for the evolution of species"

“Great importance”

“Some importance”

“Little importance” and

“No importance at all”.

Statistical test X^2 (chi-square) was used for data analysis. The students' view on the human origin and the hypothesis of intelligent design of the evolution of the species were analyzed statistically, according to his previous knowledge. The sample was the students of the Pedagogy course. The chi-square test was performed for comparative analysis of data. The analysis was done manually and later the Excel program for the presentation of the results.

Results

Aiming to analyze the data of all the respondents of the Pedagogy course, on the questions A33 and B44, the following results were obtained:

TABLE 1 shows on Biohead-Citizen question A33, the calculated χ^2 was less than the tabulated χ^2 ; most of the students surveyed consider that the human species was as unlikely as the appearance of other species.

TABLE 1: Question A.33 - The emergence of the human species (*Homo sapiens*) was just as improbable as the emergence of any other species.

Sample	I totally agree	I agree more than disagree	I disagree more than agree	I do not agree	Total
2th Period	8	1	4	4	17
Expected	5.312	2.656	4.515	4.515	
Partial	1.361	1.032	0.058	0.058	
4th Period	7	6	11	8	32
Expected	10	5	8.5	8.5	
Partial	0.9	0.2	0.735	0.029	
6th Period	5	3	2	5	15
Expected	4.687	2.343	3.984	3.984	
Partial	0.021	0.184	0.988	0.259	
Total	20	10	17	17	64

χ^2 calculated: 5.826 - G.L: 6 - χ^2 table: 12.592

Also, in **TABLE 2**, of BIOHEAD – Citizen question B44, the calculated χ^2 was smaller than the

tabulated χ^2 , accepting the hypothesis of the importance of an intrinsic program to the evolution of the species.

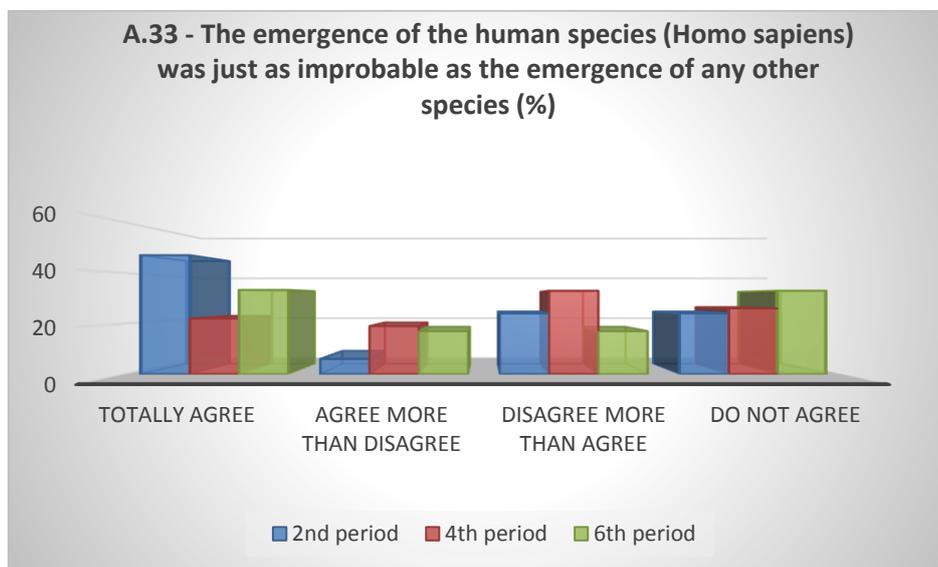
TABLE 2: Question B44 (BOHEAD-Citizen - "The Importance of an Intrinsic Program for the Evolution of Species")

Sample	Great Importance	Some Importance	Little Importance	No importance	Total
2nd Period	7	4	4	2	17
Expected	3.718	4.781	5.843	2.656	
Partial	2.897	0.127	0.581	0.162	
4th Period	5	10	12	5	32
Expected	7	9	11	5	
Partial	0.571	0.111	0.091	0	
6th Period	2	4	6	3	15
Expected	3.281	4.218	5.156	2.343	
Partial	0.501	0.011	0.138	0.184	
Total	14	18	22	10	64

χ^2 calculated: 5.373 – G.L: 6 – χ^2 table: 12.592

It can be seen on **FIGURE 1** referring to question A33 that there were no significant changes in the average acceptance of the premise "*The emergence of the human species (Homo sapiens) was just as improbable as the emergence of any other species*" between the periods of the Pedagogy course. An emerging data refers to the

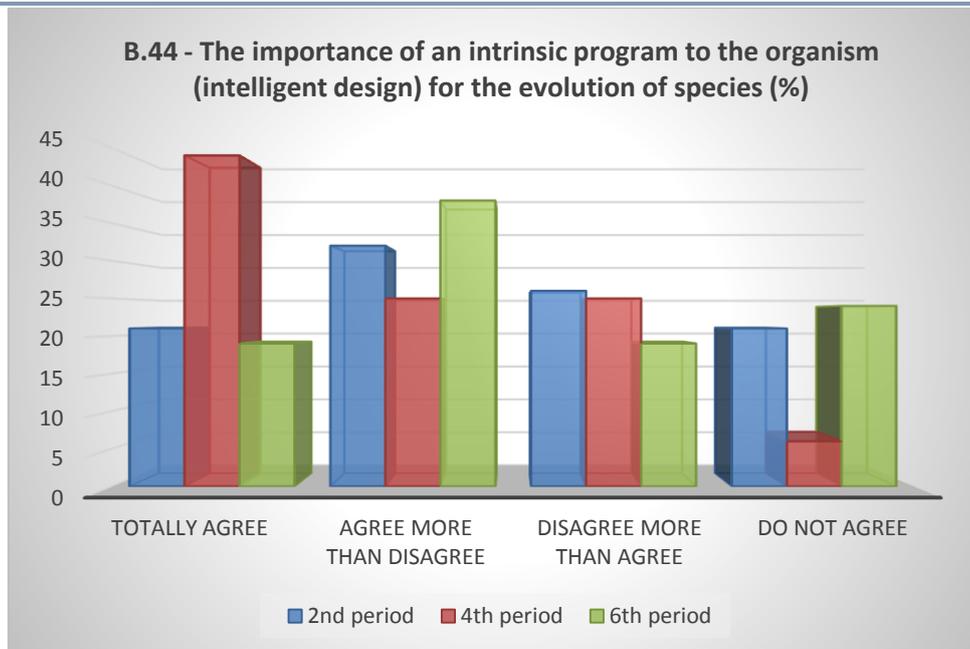
decline in the acceptance rate of the scientific view that the emergence of man is a natural phenomenon like any other species, in the graphic. Thus, it is confirmed what the statistical analysis of the chi-square demonstrated, that there is a significant variation of the opinions of the students between the periods.



Graph 1: Pedagogy students' answers on question A33

In **CHART 2**, in the question B.44 "The importance of an intrinsic program to the organism (intelligent design) for the evolution of species", a pattern of diminished alignment with this assertion is observed. It is important to note the high decrease in the recognition of the importance of the intelligent design hypothesis of the second period for the fourth period, in the graphic. Here

again it was confirmed that there is a significant variation in the opinions of students between periods, something already detected through the chi-square test.



Graph 2: Pedagogy students' answers on question B44

Discussion

From the data presented in **FIGURE 1**, it is possible to analyze that the students of the 2nd period of Pedagogy, for the most part, agree that the emergence of the human species was as unlikely as the appearance of other species. In the 4th period, with the passing of the course, there was an increase in the number of respondents who disagree more than agree or disagree with the assertive. Finally, in the 6th period there was the same percentage of students agree and disagree that the emergence of the human species (*Homo sapiens*) was as unlikely as the appearance of other species.

The statistical test showed that there is a significant variation in the responses between the periods, the disagreement with the proposition was more statistically important in the fourth period. However, in general, the chi-square test did not reveal a clear tendency to agree or disagree with the human species origin in a natural way.

This tendency reveals that there is an increasing difficulty in accepting the idea that the human species emerged like any other in the evolutionary process during the course of Pedagogy. It is possible to infer that

there are deficiencies in the scientific formation regarding the knowledge about origin and evolution of the human species.

Then, it becomes evident that there is a difficulty in accommodating scientific and religious issues, as these students perceive man as outside evolutionary processes, as something linked to a divine question. An attempt is being made to integrate science and religion, but to the detriment of the scientific field, a loss not remedied by the disciplines of the pedagogy course.

Pereira, Bizzo and Marco⁴ observed misunderstandings in the learning process of evolution due to the religious beliefs of teachers and students during the construction of knowledge / teaching, showing a strong influence of religious beliefs on the behaviors adopted by teachers in the classroom. The authors' perception reinforces what was found in this research about the learning gap in this subject so fundamental to the sciences and especially to Biology.

Souza and Dorville¹⁶ have developed a study of how Protestant teachers teach evolution in their classes, how their religious conceptions influence their views on theories of evolution. They also noted that teachers'

religious beliefs exert a great influence on what is taught to students, which raises fears about the data found on human origin in this study compared to students of pedagogy near the end of the course. It may be asked why it is important that this topic is important for early-school teachers, but the Science classes of this period are that present children with the basis of major scientific theories, so it is critical that they be conducted with academic rigor.

Such rigor is possible even in groups of students and religious teachers. Bizzo, Gouw and Mota¹⁷, through their research with young students throughout Brazil, point out that young people seem to understand that religion does not prevent the ability to observe, interpret and understand the world in a concrete and scientific way, understanding biological evolution as a fact, compatible with their religious faith.

According to Barbour's categories⁹, future teachers' conceptions about the origin of man are divided between two trends. Those (almost 50% of respondents) who perceive the origin of man as a natural evolutionary process, as occurs with other animals, seem to fit into the category of independence, because despite defining themselves as religious, they manage to separate the two fields and embrace the scientific view of the topic.

The other half of the pedagogy students seem to have a conception of conflict⁹ in relation to science, because probably based on their religious beliefs, they deny what science has already proven, that and human origin occurred like that of other species, creating a situation of difficulty of compatibility between the two fields. In **GRAPH 2**, referring to question B44, most students in the 2nd period answered "a lot of importance" to an intrinsic program (intelligent design), and a small percentage of the students in the 6th period answered "a lot of importance" to the intrinsic program to the body (intelligent design). It is observed that the students at the beginning of the course gave more importance to the assertive and during the sequency of the course this percentage decreased. It was possible to verify by the answers to question B44 that the majority of the students of the second period give much importance or some

importance in the hypothesis of the intelligent design; in the 4th and 6th period there was a considerable drop in this percentage among students who accept this hypothesis. This must be seen with something very positive, since this hypothesis and the movement that supports it represent a risk to scientific education, insofar as it denies the assumptions proven by evolutionary theory¹⁸.

The chi-square test demonstrated that there was a significant deviation to the expected frequency for the agreement answer with the statement of the question about intelligent design. Throughout the periods, a trend was not confirmed through the statistical test.

Oliveira, Bizzo and Pellegrini¹⁹ carried out a study with the objective of presenting Brazilian and Italian youngsters' relations on the theory of biological evolution, through the characterization of similarities and divergences in students' responses. The young Italians showed greater clarity in the understanding of the evolutionary theorists than Brazilians. However, both Brazilians and Italians realize that there are changes in species, recorded through fossils. But the young Brazilians were confused by the statements that dealt with the common ancestry and the history of man on earth. This allows the diffusion of hypotheses contrary to the foundations of Darwinian theory in Brazil, such as creationism and intelligent design²⁰.

This question of having a program intrinsic to evolution be a direction, a sense, a teleological perception of evolution. Perhaps these future educators perceive intelligent design to harmonize common sense, including in relation to the origin and evolution of the human species, that evolution follows a predetermined direction. This type of approach was perceived as being quite frequent even among Biology teachers, so this type of perception is widespread even among professionals who have access to the most consecrated concepts of Science in relation to evolution²¹. This teleological perception of evolution was detected among high school students in Brazil²², so it is important that pedagogues abandon this type of conception so that they do not present this type of

evolution presentation to Science students in the initial grades.

A difference found in the presentation of the evolutionist theory between Brazil and Italy¹⁹ illustrates the importance of the data found in this research. The Italian curricula present the theme of evolution, including the human one, in a clear line, from the Elementary School, unlike Brazil, that does not define this subject so clearly in the initial grades. Therefore, this shortage could be met by the future teachers of Pedagogy if these subjects were judged as important and treated in an attractive and academic way for children. It would also create a barrier to visions of religious commitment in the school and the valuation of scientific methodology for the construction of a theory.

The results presented in this study contrast with those obtained in the study by Silva *et al*²⁰, in which there was a considerable proportion of individuals (66%) who supported the theory of intelligent design and who also indicated an acceptance of the hypothesis at all levels of schooling. Teixeira⁸, in his research, interviewed teachers of Christian faith, observed the acceptance of biological evolution by teachers and the recognition of the importance of Biology, but believe that God conducts this process, showing that, as in the data found in this research, there is a great attraction that the hypothesis of intelligent design offers to religious, even if lacking in scientific credibility.

Souza and Dorville¹⁶ further argue that although US institutions have attempted to attribute to Creationism a status of Science through Intelligent Design, as it cannot be confirmed through scientific methodology. Ayala²³ demonstrates how flawed the argument of intelligent design is, since the evolution of living beings did not demand a designer, that all natural processes can reveal how living beings, including man, have come down to the present day.

It is important to emphasize that the partial rejection of the intelligent design hypothesis follows an international tendency, since in the United States, a nation that can be considered as the seat of this religious vision,

the insertion of this theme in education was summarily rejected, strong appeal by the community and institutes with religious commitment²⁴. Ayala²³ states that Darwinism brought a gift to the religious field, because a response to the existence of evil, suffering in nature, was found with the action of natural selection. This same author demonstrates in Silva²⁰ that it is a mistake to believe in intelligent design and even a blasphemy to believe in the Christian God, because organisms are so full of defects and failures, that this design would be anything but intelligent.

One more time, the responses were divided almost equally in relation to the acceptance of the participation of an intelligent designer in the evolution of species. A little more than 50% of pedagogy students, except for the fourth period that had a higher percentage of alignment with this form of pseudoscience, can be framed in what Barbour called the category of integration⁹ between science and religion. Students reveal that they are trying to incorporate their faith in scientific knowledge, unfortunately this type of integration ends up renouncing the basic assumptions of evolutionary theory and generating a mixture of low scientific quality.

Just under half of future basic education teachers revealed a position Barbour called independence⁹ from the intelligent design hypothesis. These students, even religious, can position themselves in favor of the scientific view in relation to the evolution of species, as they are thus aligned with the scientific conception proven by a series of evidences.

It is important to discuss that, although the hypothesis of intelligent design seems to be an accommodation, an integration between science and religion, and therefore its assimilation and maintenance during the course of Pedagogy would not be harmful to scientific knowledge, it would even be beneficial, this argument it is flawed in its origin. This movement denies all the basic pillars of the Darwinian theory of evolution, all of which have already been proven by much evidence, so it must be considered as a pseudoscience. If pedagogy students continue to believe in the fallacy of this hypothesis and, perhaps, take

this speech to the children's classroom in science classes, they will do scientific literacy a disservice and these children will be denied one of the bases of knowledge, of methodology science and biology of the modern world.

The personal positions of the issues addressed are in resonance with what could be expected from the high level of religiousness of the students, the belief that the human being has a special origin and that somehow a supernatural designer participates in the evolutionary process. Although it is not desirable to deny religious themes, it is important that students in a pedagogy course are introduced to scientific facts, supported by their established theories, and then can accommodate their beliefs, without assimilating forms of pseudoscience. In this work, it is believed that it is perfectly possible to be religious and understand that evolution occurred, assimilating its assumptions and being able to present it to its future infant students.

One aspect that needs to be considered in the analysis of this large number of pedagogy students aligned with views contrary to science, such as those that deny the natural origin of the human species and that consider the participation of the intelligent designer in evolution, is the change of the recent religious spectrum in Brazil²⁵. There is a rapid growth in the number of evangelicals, with all their different denominations, some more radical in religious dogmatism; on the other hand, there is a decline in the number of Catholics, less refractory to scientific questions. It is possible that this new religious panorama has an impact on these students' conceptions.

Conclusion

It was detected through this study that during the sequence of the course there was a consolidation of scientific knowledge, leading to a decline in the acceptance of the intelligent design hypothesis, that, on the other hand, can't be measured a tendency in the perception about chance in the origin of the human species. With this, it becomes necessary to increase the knowledge of Pedagogy students about human evolution

to increase the teaching of the topic so important to Science in the initial grades.

In general, it is suggested from the results found that there is an increase in the theme of biological evolution in Pedagogy courses, especially in the disciplines related to the teaching of Science, as it will be up to these professionals to consolidate basic knowledge about the subject, the students of the scientific method, and refuting intricacies related to the religious field that disturb academic knowledge. It would be interesting to increase how this scientific knowledge is constructed, subsidizing these future pedagogues for the questioning and investigation of controversial themes and, thus, to instigate the questioning and problematization of academic knowledge to their future students in the initial grades¹.

From the results of this work, it is suggested that further investigations be made to capture and discuss how the Pedagogy student takes his personal conceptions to the children's science classes that he will teach in the future. After all, this professional is essential for scientific literacy and if he does not incorporate academic knowledge and takes the wrong information to classes, the harmful effects for children will be lasting, if not permanent.

Conflict of interest declaration

The authors declare that have no conflict of interest that might constitute an embarrassment to the publication of this article.

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