International Journal of Eurasia Social Sciences
Vol: 10, Issue: 37, pp. (981-994).
Research Article

Received: 01.03.2019 Accepted: 13.09.2019

THE EFFECT OF ASTRONOMY ACTIVITIES REGARDING WALTON ARGUMENTATION ON PSEUDOSCIENCE BELIEFS OF SCIENCE TEACHER CANDIDATES[1]

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ABSTRACT

In this study, the effect of astronomy teaching carried out by argumentation applications formed according to Walton's argument-based dialogue structure on pseudoscience beliefs of science teacher candidates was analyzed. In the study, which was carried out with 54 science teacher candidates who were enrolled in the Department of Science Education at the Faculty of Education of Pamukkale University and enrolled in the astronomy course, a mixed method with qualitative and quantitative research methods was used. While 26 teacher candidates in the experimental group were given argumentation-based astronomy teaching, the control group with 28 students had a normal course of astronomy teaching. At the beginning and the end of the study, both groups were applied the Science, Pseudo-Science Separation scale, and at the end of the study, semi-structured interviews were conducted with six teacher candidates. The visual and written data obtained from the argumentation-based teaching practices were evaluated and interpreted together with other quantitative and qualitative data. According to the data obtained in relation to the quantitative dimension of the study, it was found that there was a positive development in the experimental and control groups in terms of pseudo-scientific beliefs, but the development of the teacher candidates in the experimental group was significantly higher than the control group. At the end of the research, the qualitative data obtained from the opinions of the prospective teachers who participated in the semi-structured interviews revealed that the participants in the experimental group were more successful in terms of science, pseudoscience distinction.

Keywords: Argumentation, walton dialog structure, astronomy, pseudoscience, science education.

[1] This study is supported by the BAP project of Pamukkale University coded as 2015EĞBE004

INTRODUCTION

The pseudoscience concept is often used in the negative context to mean "pseudo" or false science. Though the pseudoscience concept has been in use since the eighteenth century, Karl Popper was the thinker who brought it to the agenda of the contemporary philosophy of science. Popper (1962) defines the term pseudoscience as the doctrine and the strings, which claim to be scientific, in other words, claim to explain phenomena, and to be based on scientific methods or have the epistemic status of scientific truths, but which are closed to falsification and testing.

Pseudo-scientific claims are frequently brought to the agenda mostly by media and are followed with great interest by the majority of the society (Martin, 1994). Liu (2009) has found in his study that the rate of believing pseudo-scientific claims is quite high in many societies. This result demonstrates the difficulty of distinguishing between pseudo-science elements bearing scientific claims and scientific knowledge. As Tutar (2014) puts it in the preface to his book "Science and Pseudoscience", "the fictional language of pseudoscience is very easily imposed on those who do not understand its inner structure and the people who are educated at all levels are easily manipulated by these pseudo-approaches." One of the most important elements that distinguish pseudoscience from other superstitious and false beliefs is that it has a structure that does not contain the standards required by science despite the use of scientific arguments. To be able to distinguish between science and pseudoscience, to know the features of scientific knowledge, which is the product of scientific activities, is very important.

Considering the place of science in our lives, it has become inevitable for science education to gradually gain more importance. It has become one of the basic education subjects of all societies to be able to educate science literate individuals who can make rational decisions using science's ways of thinking (Duschl et al., 2007; Millar and Osborne, 1998).

One of the most prominent methods in the process of students' acquisition, structuring and development of mental activities is argumentation (Erduran, Ardaç & Güzel, 2006). Argumentation is based on students' expressing the reasons that support their opinions by making use of their preliminary knowledge and making efforts to justify these views. Other students who have opposing views also put forward their alternative ideas and doubts. Working as a scientist in this way, they establish justification and support to prove their claims. In this way, scientific knowledge is reconstructed (Siegel, 1995).

In the research, an improvement was aimed with an argumentation-based teaching method in the pseudo-scientific beliefs of prospective teachers about astronomy. Argumentation involves both a cognitive and a social process. In this process, teacher candidates were able to express their thoughts freely and to find new alternative ideas through a collaborative teaching approach by listening to and evaluating others' thoughts. According to Jimenez-Aleixandre (2008), it is necessary to establish dialogue environments in which collaborative learning can take place so that students can make their learning permanent by producing new ideas. In addition, as Whitehead (1989) puts it, it is possible to develop the dialectical logic through multiple dialogues, not only between the students but also with the teacher, and to consider the events and concepts discussed in a multidimensional manner.

An alternative model for the analysis of scientific debates, Walton's dialogue structure allows for more hypothetical reasoning within dialogues. According to Walton (1996), the imprecise nature of hypothetical reasoning provides us with some implications in dialogues. Hypothetical reasoning does not need to prove the accuracy conclusively or inductively. However, it must bear a reasonable weight. According to Walton (2001), even if the evidence put forward in a discussion with hypothetical reasoning is inadequate and not very convincing, it provides a possibility to go on with a temporary hypothesis on the road.

When the literature is examined, there is a limited number of argumentation studies in which the scienc and pseudoscience distinction is analyzed and where the Walton dialogue structure is applied. With the activities prepared according to the Walton dialogue structure, the pseudoscience elements involved in astronomy have been opened to discussion.

METHOD

The Research Model

In this study, nested mixed method design which is one of the mixed method designs is preferred based on combining and integrating qualitative and quantitative research and related data. The nested mixed methods design involves the use of data in either unified or sequential manner, but the main idea is that either quantitative or qualitative data is built into a wider pattern and that these data sources have a supporting role on all of the pattern (Creswell, 2014).

In the quantitative dimension of the research, the quasi-experimental method with pre-test and post-test control group was used to investigate the effect of argumentation-based astronomy teaching on pseudo-scientific beliefs of the participants. In the quasi-experimental design with pre-test, post-test control group, one of the selected groups is taken as an experimental group and one as the control group.

In the qualitative dimension of the study, it was studied with the document analysis method in the experimental group to examine the development of argumentation skills. In addition, at the end of the application process, semi-structured interviews were conducted with the participants selected from both the experimental and control groups in order to examine the changes in the participants' beliefs in the pseudoscience field. The quantitative and qualitative data related to these phenomena were collected and analyzed separately and then the results were integrated and interpreted.

Study Group

In the first week of the spring semester of 2015-2016 academic year, the researcher provided information about the planned study in two branches taking the astronomy course and decided to carry out the research by selecting branch A as the experimental group and B as the control group. The study group of this research consists of 54 science teacher candidates who are studying at the Science Education Department of Pamukkale University, Faculty of Education, Department of Mathematics and Science Education and enrolled in Astronomy course. 26 teacher candidates in branch A was selected as the experimental group whereas branch B with 28 teacher candidates was selected as the control group (Table 1). All of the teacher candidates in the experimental group participated in all applications of the research. The study which was carried out during the 2015-2016 spring term lasted for 14 weeks.

Data Collection Tools and Analysis of Data

The adaptation of the science, pseudo-science distinction scale developed by Oothoudt (2008) into Turkish was carried out by Çetinkaya et al. (2013). As a result of the explanatory and confirmatory factor analyzes of the scale, whose linguistic equivalence was provided, it was found that the scale consisting of 32 items was reduced to 23 items and it was determined that the items were collected in four sub-dimensions:

a. Pseudoscience
b. Scientific Method
c. Science, Pseudoscience Distinction
d. Pseudo-scientific beliefs

The activities to be used in the research were developed by the researcher. During the development of activities, widespread pseudo-scientific beliefs related to astronomy were researched, scenarios were created according to Walton Argumentation structure and finalized by using expert opinions. In addition, during and after each event, critical questions were added to increase the depth and quality of argumentation. Six activities were applied in this study. The names of these activities and their purposes in the distinction of science, pseudo-science are given in Table 1. The activities applied in the data collection process were recorded with camera.

Semi-structured interviews were conducted with the participants who were chosen purposively among the teacher candidates in the study for the in-depth examination of the pseudo-scientific beliefs about astronomy and for the evaluation of the argumentation process. Interview questions were created by the researcher considering the sub-dimensions of Science, Pseudocience Distinction Scale applied at the beginning and end of the research. In the interviews, a total of nine questions were asked to participants, six for the pseudoscience distinction and three for the argumentation process. At the end of the interview, the video recordings were first examined in computer environment and then in written format.

Table 1. Activities and Activity Focal Points

Activity Number	Activity Name	Activity Focal Point
1	Can Astrology See the Truth?	Is astrology science? or pseudoscience?
2	Character Analysis with Horoscope	Is it scientific that horoscope, which is an astrological concept, determineds individual's character traits?
3	How Scientific Are The News We Read?	How do we distinguish whether the news and comments in the written and visual media are scientific?
4	Moon Travel	How true is the phenomenon of "Journey to the Moon is unrealistic" as a pseudo-scientific element?
5	UFO	What is the point of view regarding the phenomenon of "Extraterrestrial Life" and the news in the field?
6	Ancient Aliens	What are the approach to scientific and pseudo-scientific elements in a production which is referred as a documentary?

The responses of the participants to the scale in the quantitative dimension of the research were coded using SPSS 22.0 package program. In the research, descriptive analysis and content analysis were performed on the qualitative data obtained from semi-structured interviews with the participants selected from both groups and from the activities carried out with the teacher candidates in the experimental group. In addition, the arguments presented by the participants in each activity were examined one by one by the researcher and an expert as a result of the analysis of the video recordings performed during the argumentation activities. The arguments produced were categorized according to Walton argument schemes. As a result of the evaluation, the individual schemas produced by the participants are given as a percentage (%) and frequency values in tables.

FINDINGS (RESULTS)

Findings from Science, Pseudoscience Distinction Scale

The 23 items that make up the scale were scored in 5-point Likert-type between "Strongly Disagree" and "Strongly Agree". The items expressing the pseudo-scientific beliefs were evaluated with high scores whereas items expressing scientific beliefs were evaluated with low scores. Therefore, the high score obtained from this scale reveals that the participant's pseudo-scientific beliefs are strong (Table 2).

Table 2. Independent t-test Results of Science, Pseudoscience Distinction Scale Scores

Dimension	Test	Group	N	$\overline{X}$	S	sd	t	p
1st Sub-Dimension	Pre-Test	Experiment	26	24.65	4.01	52	1.48	.14
		Control	28	23.11	3.63			
	Final Testing	Experiment	26	14.65	2.60	52	4.71	.00
		Control	28	20.82	6.56			
2nd Sub-Dimension	Pre-Test	Experiment	26	20.42	4.32	52	.21	.83
		Control	28	20.21	2.61			
	Final Testing	Experiment	26	12.08	2.43	52	4.86	.00
		Control	28	16.46	3.95			
3rd Sub-Dimension	Pre-Test	Experiment	26	19. 65	3.44	52	.10	.91
		Control	28	19.57	2.04			
	Final Testing	Experiment	26	13.08	2.24	52	4.58	.00
		Control	28	16.21	2.74			
4th Sub-Dimension	Pre-Test	Experiment	26	7.4	1.36	52	5.53	.00
		Control	28	9.54	1.29			
	Final Testing	Experiment	26	5.15	1.56	52	8.15	.00
		Control	28	8.11	1.06			
General	Pre-Test	Experiment	26	7.27	6.90	52	.10	.92
		Control	28	72.43	4.62			
	Final Testing	Experiment	26	44,.6	4.539	52	7.861	.000
		Control	28	61.61	9.867			

When Table 2 is examined, it is seen that there is no statistically significant difference between the pre-test scores of the participants in the experimental and control groups in terms of science, pseudoscience distinction scale ($t_{General}$ (52) = 0.10; p>.05). When the scores of the sub-dimensions of the scale were analyzed, it was found that there was a statistically significant difference between the pre-test scores of the first, second and third sub-dimensions of the participants ($t_{1.Sub-Dimension}$(52) =1.485; $t_{2.Sub-Dimension}$(52) = 0.216; $t_{3.Sub-Dimension}$(52) = 4.862; p>.05). When the fourth sub-dimension is examined, it is seen that there is a significant difference between the pre-test scores of the participants and this difference is not in favor of the experimental group ($t_{4.Sub-Dimension}$(52) =5.531; p<.05). When the pre-test scores of the participants in the experimental and control groups are examined in general, the mean scores are close to each other (pre-test experimental = 72.27 and pre-test control = 72.43)

When the final test scores obtained from the scale are examined, it is seen that there is a statistically significant difference between the scores of the participants in the experimental and control groups both from the overall scale and from the sub-dimensions ($t_{1.Sub-Dimension}$(52) = 4.471; $t_{2.Sub-Dimension}$(52) = 4.862; $t_{3.Sub-Dimension}$(52) =4.583; $t_{4.Sub-Dimension}$(52) =8,150;$t_{General}$ (52) =7.861; p<.05).

The overall mean scores of the participants in both the experimental and control groups for post-test were lower than those of the pre-test overall mean scores (post-test experimental=44.96 and post-test control = 61.61). However, it was seen that the decrease in the pre-test scores of the participants in the experimental group was more than the decrease in the scores of the participants in the control group. Similarly, in the scores obtained from the fourth sub-dimension, the decrease in the experimental group was more than the decrease in the control group.

As shown not only in the first three sub-dimensions, where there is no significant difference between the pre-test results, and also in the fourth sub-dimension, where there is a difference against the experimental group according to the pre-test results, the decline in the pseudo-science beliefs of the participants in the experimental group was significantly higher than the participants in the control group as a result of the applications. It is seen that the activities carried out in the research contributed positively in favor of scientific beliefs in science, pseudoscience distinction in all dimensions of the scale.

Findings from Argumentation Applications

Six activities were conducted in the research process. In the activities carried out in the form of group discussion, each participant was allowed to express their thoughts freely. All of the activities were recorded with camera. Each participant was given a code name and these code names were used in the report. In addition, after the activities, each participant was asked to fill out the argumentation activity form. The arguments put forward by the participants in the activities were categorized according to the Walton Argument Chart. These findings were supported and interpreted by the findings obtained from the analysis of the argumentation activity forms.

When the charts related with all activities are generally evaluated, it is seen that some argument charts are used frequently and some charts are used rarely. It was found that four argument charts were never used by the participants (Table 3).

Table 3. Argument Charts Used in All Activities and Usage Frequencies

No	Argument Chart	Frequency (f)	Ratio to all charts (%)
1	Argument from sign	53	20.54
2	Argument from the sample	40	15.50
6	The argument created by using the known	32	12.40
3	Argument from verbal classification	19	7.36
7	Argument from expert opinion	15	5.81
8	Argument from evidence-based hypotheses	15	5.81
9	Argument from causal relationship	12	4.65
18	Argument from a sample situation	11	4.26
10	Argument from the cause-effect relationship	9	3.49
22	Unreliable argument from the case	8	3.10
16	Argument from prejudice	7	2.71
13	Insignificant argument	6	2.32

14	Argument from the popular	6	2.32
17	Argument from a specific rule	6	2.32
12	Argument from simulation	5	1.94
20	Uncertain argument from a cause	4	1.55
21	Argument from a verbal classification uncertainty	3	1.16
23	Argument from the arbitrariness of verbal classification	3	1.16
4	Sided (dependent) argument	2	0.77
15	Argument from moral criteria	1	0.39
24	Verbally unreliable argument	1	0.39
5	Counter argument	0	0
11	Argument from results	0	0
19	Argument through slow realization of change	0	0
25	Completely unreliable argument	0	0
Total		258	100

Evaluation meetings after the activities are one of the most important factors in the emergence of a very different number of chart types throughout the activities. In these meetings where the nature of the charts created by the participants in the previous activity were questioned, the ways to create a more convincing argument were discussed and thus preparing for the next activity. Providing participants with the necessary information about the Walton Argument Charts before the application allowed participants to produce arguments in different charts.

When the arguments produced during all activities are examined in general, it is observed that the quality of the arguments put forward by the participants during the activities increased gradually. The ratios of "insignificant, from prejudice, uncertain from a cause, from a verbal classification uncertainty, unreliable from the case, from the arbitrariness of verbal classification and verbally unreliable" arguments among the argument charts to the other argument charts are given in Table 4 for each activity.

Table 4. The Ratio of Uncertain, Unreliable and Prejudice Based Argument Argument Chart Numbers to General Argument Chart Numbers

Activity Number	Number of all arguments (n)	Number of Uncertain, Unreliable and Prejudice Based Arguments (n)	Ratio (%)
1	35	13	37.14
2	48	9	18.75
3	56	5	8.92
4	43	2	4.65
5	32	1	3.12
6	44	1	2.27
Total	258	31	12.01

As it can be seen from Table 4, in the initial activities, while uncertain, unreliable and prejudice-based argument rates were high, this rate decreased in the progressive activities and decreased to the lowest level in the last activity. This result shows that the participants' skills of creating arguments and the quality of their arguments increased in each activity. At the end of each activity, the group evaluations and the feedback from the argumentation activity forms were shared with the group, which was effective in increasing the argument creation skills of participants.

Findings from semi-structured interviews

The qualitative aspect of the research is to examine in depth the effect of argumentation-based astronomy teaching on the pseudo-scientific beliefs of science teacher candidates. Therefore, the results of the Science, Pseudo-Science Distinction Scale, which was performed before and after the application, were taken into consideration in the selection of semi-structured interview participants selected from both groups.

One of the interview questions asked to the participants was:

"Let's say you have an important exam today and you have read the following about your sign in the morning:

"Today will be a pretty unlucky day for you due to the compelling appearance of Venus-Neptune. Try not to make important decisions because the probability of making decisions is very low. Be very careful with your health. Stay away from the chance games. Never even leave home if possible!"

Would there be any change in your daily life after reading this interpretation? (For example, what would you pay attention to?) The answers of the participants selected from the experimental and control groups were analyzed and given in Table 5.

When the data in Table 5 were examined, only 2.43% of the participants in the experimental group were concerned about fear, restlessness and panic, and this rate was 8.57% for the participants in the control group. Similarly, the ratio of participants who stated that they can take some precautions in their daily life taking into account the pre-vision mentioned in the question is seen to be quite high in the control group compared to the experimental group.

Table 5. Analyses for the First Interview Question

Themes	Experimental Group		Control group	
	Frequency (f)	Percentage (%)	Frequency (f)	Percentage (%)
Anxiety/Fear/Restlessness/Panic	1	2.43	3	8.57
Taking into consideration with faith/Taking measures/Being Careful	3	7.31	5	14.28
Taking into consideration without faith	7	17.07	12	34.28
Completely disregard/disbelieve	25	60.97	13	37.14
Making fun/Purposely acting on the contrary	5	12.19	2	5.71
Total	41	100	35	100

While the majority of the participants in the experimental group (60.97%) stated that they would continue their lives without considering such a vision, this ratio was only 37.14% in the participants in the control group.

Some noteworthy participant opinions regarding this question are discussed below:

"*I would really be alarmed to read such an interpretation about my sign. Okay, I can't arrange everything accordingly, but I would be careful while crossing a street (laughs)..." (K-4)*

> *"If I read such an interpretation in the morning paper, I would be a little depressed, but I wouldn't mind at all. And I would forget it during the day. I'm not going to plan my life based on it anyway..." (D-2)*
>
> *"I care about such things. I wouldn't even leave home if I didn't have an exam. And I would be depressed during the exam, and it would probably go bad. I would say I wish I wasn't studying..." (K-1)*

Another interview question asked to the participants is as follows:

“Let us assume that you are working as a science teacher. Some of your students come to you and say that yesterday evening in a television program, some experts stated "aliens come to visit our world from time to time, even abduct some people and animals to study them". What would be your answer to the students who were curious about your views? (Can you explain by giving an example?)

This question is aimed to analyze the approach of science teacher candidates by learning from their response to a possible event in the future. The answers to the question are given in Table 6.

Table 6. Analyses for the Sixth Interview Question

Themes	Experimental Group		Control Group	
	Frequency (f)	Percentage (%)	Frequency (f)	Percentage (%)
I would close the subject by saying Ridiculous news/Impossible/Lies...	3	11.54	5	20.83
I would say Ridiculous news/Impossible/Lies... but research the subject.	4	15.38	6	25.00
I would investigate the issue without commenting on the news.	18	69.23	7	29.16
I would close the subject by saying the news might be true.	0	0	2	8.33
I would investigate the subject by saying that the news might be true.	1	3.85	4	16.66
Total	26	100	24	100

When the answers related to this question are examined, the response of the participants in the experimental group is predominantly "I would investigate the issue without commenting on the news" with 69.23%. It is seen that the participants who gave this answer acted in an objective manner in any situation encountered and did not make a decision without investigating the given situation. Although 29.16% of the participants in the control group thought this way, the percentage of those who stated that they would give a positive or negative answer about the subject and then make research or close the subject was 70,82%. This result suggests that the information and practices related to the nature and epistemological structure of science contribute positively to the participants in the experimental group.

In addition, it was stated that only 3.85% of the participants' statements in the experimental group were correct while this rate was approximately 16.66% for the participants in the control group. It is thought that the activities implemented in the scope of the application are effective in developing a scientific approach to the news and information in question.

Based on the statements of the participants, this situation can be exemplified as follows:

> “*I would say to a student coming to me with such a question that something like that is impossible and then go research the subject. I also come across such news very often and they are mostly made up."* (D-6)
>
> "*This kind of news is always the work of people who are trying to attract the attention of people with the ambition of making money. They push the ignorant people into panic and fear in the society. I would tell my students not to believe in such news, and would relieve them."* (K-3)
>
> "*It would be wrong to say something without knowing the news. I would find, read or watch the news from the Internet. I take notes of things that are reasonable or not and let my students know about the results."* (D-1)

The other questions posed to the participants are as follows:

• Assume you read comments about your astrological sign and then had a very unlucky day. Moreover, you failed the exam you took. After all these, would you consider taking advices given by an astrologer about your sign (Why?).

• On TV or Internet, assume you watched news about UFOs (unidentified flying objects) being seen anywhere in the World. What would you feel about that? Why? (Fear, excitation, panic, happiness, hope,…)

• On TV a self-proclaimed astrological expert states that astrology is a science and he/she gives the following statements regarding that.

Sumerians who had installed an observatory on Harran plains tried to understand the effects of sky events. Chinese astrology studied philosohy, calender, cosmos and rhythm of natüre to predict the future events and to define the character of a human. Places like South America, which is far off geologically from Asia and Middle East, the same thought pattern was in existence: to predict the future. Observing, experimenting and statistical techniques had been used extensively. Therefore these show that astrology can be regarded as a branch of science.

What do you think of these? (Can you explain with your reasons?)

• As a scientist what would you do to test the following hypothesis: “People who are in the same astrological sign have similar traits”. Can you explain? Can you predict the outcomes of such a study? Why do you think such a way?

• Would you like to share the hardest and the most enjoyable stages during argumentation applications which have been performed in this research?

• How would these outcomes gained from the applications in the research affect your future life? (Can you please give an example?)

• What could be done to improve the applications and activities during research process? (Can you please give an example?)

CONCLUSION and DISCUSSION

As stated in the quantitative findings of the study, and as with many examples in the qualitative findings, the viewpoints of the participants in the experimental group were significantly improved by the argumentation practices. This development is clearly understood from the statements of the participants in semi-structured interviews. It is possible to understand that the science teacher candidates in the experimental group are trying to think as scientists during the advancing activities, both from the arguments produced and from the consensus formed as a result of the discussion. At the first activities, while the dominant view about the pseudo-science belief was "everyone believes what they want to", in the last activities and responses given by the teacher candidates who participated in the experimental group, the dominant view was that "if we are going to be a science teacher we should know what is scientific and what is not, we should illuminate our environment". This approach is also an important gain in terms of teachers' place in society. The fact that teachers' understanding and beliefs affect classroom practices are expressed in various studies (Cronin-Jones, 1991; Yerrick et al., 1997).

As the argumentation producing skills improves science teacher candidates are expected to increase their knowledge about a specific field and the nature of science. This is due to the fact that they begin using knowledge coming from real scientific processes and solid rock scientific concepts instead of pseudo scientific concepts and hypes. According to Kaya and KILIÇ (2008), there is a relationship between the depth and quality of the argument and the gains students have in their science courses.

In the study by McNeill and Pimentel (2010), it has been seen that the learning process would be much easier when students are asked open ended questions, when students are encouraged to interact, when students are asked to find evidence for their assertions and when students are asked to form an ideal discussion environment.

During the argumentation activities discussed in the experimental group, it was observed that the participants' critical thinking skills increased. It can be said that the ability to question the topics discussed during the activities from different perspectives and to use scientific methods more effectively increased. The participants, who gradually developed the structure of their own arguments, have managed more rationally to handle the counter-arguments that are the product of different ideas.

Moreover, the research done by Öztürk (2013) shows that socio-scientific concepts in particular improves the students’ argumentation skills and the quality of arguments.

As a result, in this study, it is seen that the argumentation-based astronomy teaching decreases the pseudo-scientific beliefs of science teacher candidates. It is hoped that the results of this study will guide similar studies by contributing to the teacher training program.

WALTON ARGÜMANTASYON KURAMINA YÖNELİK ASTRONOMİ ETKİNLİKLERİNİN FEN BİLGİSİ ÖĞRETMEN ADAYLARININ SÖZDE-BİLİM İNANIŞLARINA ETKİSİ

ÖZ

Bu araştırmada, Walton'ın diyaloga dayalı argüman yapısı esas alınarak oluşturulan argümantasyon uygulamaları ile gerçekleştirilen astronomi öğretiminin fen bilgisi öğretmen adaylarının sözde-bilim inanışlarına etkisi incelenmiştir. Pamukkale Üniversitesi, Eğitim Fakültesi, Fen Bilgisi Eğitimi Anabilim Dalı'nda öğrenim görmekte olan ve astronomi dersine kayıtlı üç ve dördüncü sınıfta bulunan 54 fen bilgisi öğretmen adayı ile gerçekleştirilen araştırmada nitel ve nicel araştırma yöntemlerinin birlikte kullanıldığı karma metot kullanılmıştır. Deney grubunda bulunan 26 öğretmen adayı ile argümantasyon odaklı astronomi öğretimi gerçekleştirilirken, 28 öğretmen adayının bulunduğu kontrol grubunda astronomi dersi normal seyrinde işlenmiştir. Araştırmanın başında ve sonunda her iki gruba Bilim, Sözde-Bilim Ayrımı ölçeği uygulanmış, ayrıca çalışmanın sonunda her iki gruptan amaçlı olarak seçilen altışar öğretmen adayıyla yarı yapılandırılmış görüşmeler yapılmıştır. Argümantasyon odaklı öğretim uygulamalarından elde edilen görsel ve yazılı veriler diğer nicel ve nitel verilerle birlikte değerlendirilmiş ve yorumlanmıştır. Araştırmanın nicel boyutu ile ilgili olarak elde edilen verilere göre, deney ve kontrol gruplarında sözde-bilimsel inanışlar açısından olumlu yönde bir gelişim olduğu fakat deney grubundaki öğretmen adaylarındaki gelişimin anlamlı bir düzeyde kontrol grubundan fazla olduğu ortaya çıkmıştır. Araştırma sonunda gerçekleştirilen yarı yapılandırılmış görüşmelere katılan öğretmen adaylarının görüşlerinden elde edilen nitel veriler de aynı şekilde deney grubundaki katılımcıların bilim, sözde-bilim ayrımı konusunda daha başarılı oldukları sonucunu ortaya koymaktadır.

Anahtar Kelimeler: Argümantasyon, Walton Diyalog Yapısı, Astronomi, Sözde-Bilim, Fen Eğitimi.

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