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THE EFFECT OF DIFFERENT COOPERATIVE LEARNING METHODS ON PRE-SERVICE SCIENCE TEACHERS' ACADEMIC ACHIEVEMENTS AND EPISTEMOLOGICAL BELIEFS

(Research article)

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Abstract

The purpose of this study is to find out the effect of teaching "Human Nervous and Endocrine System" subject through the ask together learn together and reading-writing-application methods on third class pre-service science teachers' academic achievements and epistemological beliefs. Pretest-posttest comparison group quasi-experimental design, which is an experimental research model, was used. The sample of this study consists of 84 pre-service science teachers from two different groups at in the Science Education Department of Faculty of Education in a state university in the 2017-2018 academic year fall term in Türkiye. One of these groups was set as the Experimental Group-1 in which ask together learn together method would be carried out (n=39) while the other group was set as the Experimental Group-2 in which reading-writing-application method would be conducted (n=45). The data were collected via Academic Achievement Test and Epistemological Beliefs Survey. Independent groups t-test were used in analyzes since the data were suitable to perform parametric tests. It was determined that reading-writing-application method is more effective than ask together learn together method in terms academic achievement of pre-service science teachers used in teaching of "Human Nervous and Endocrine System". In addition, it was suggested that ask together learn together method is more effective than reading-writing-application method in terms of epistemological beliefs of pre-service science teachers. The results have revealed that reading-writing-application method is more effective in terms of increasing academic achievement of pre-service science teachers and ask together learn together method is more effective in terms of developing epistemological beliefs of pre-service science teachers.

Keywords: Cooperative learning, ask together learn together, reading-writing-application, epistemological belief, human nervous and endocrine system

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1. Introduction

To adapt to our contemporary world and keep up with the changes and developments worldwide, it is a must to prioritize science and technology. Comprehending these developments and changes requires creating a contemporary model of an individual. The model for our era should be individuals who are inquisitive, questioning, critical, open to collaboration, able to communicate, capable of generating solutions to everyday problems, and approach problems like a scientist by effectively using the steps of problem-solving. In today's world, there is a need to cultivate individuals with knowledge and skills who not only possess information but also use it, research, create, collaborate, and are open to communication and change. Therefore, it is essential to organize educational programs. The responsibility falls on practitioners, mainly teachers and researchers, to elevate learning to higher levels (Şimşek 2007).

In today's educational landscape, there are learner-centered approaches, methods, and techniques that are currently in use and subject to intensive research. These approaches, methods, and techniques reject the assumption that knowledge and skills can be directly transferred to students by teachers. On the contrary, it is argued that knowledge and skills can only be acquired through the learner's own activities (Doymuş, Karaçöp, Şimşek; 2010). In this context, active learning is a process that enables individuals to control themselves and make effective decisions in the learning process (Açıkgöz, 2003; Prince, 2004; Tlusty, 1993). Within the scope of active learning methods, there are various learning strategies such as problem-based learning, multiple intelligence model, project-based learning, and collaborative learning. Collaborative learning models are highly suitable for the learning of science education topics, considering their alignment with the learning processes and active learning experiences of students in the field of science (Çepni and Çil, 2009; Knackendoffell, 2005; Nammouz, 2005; Topsakal, 2006).

Collaborative learning, one of the active learning strategies, is a model that has significantly captured the attention of teachers and researchers. It is one of the existing models that is frequently studies and applied in educational practices (Graham, 2005; Johnson and Johnson, 1999; Maloof and White, 2005; Şimsek, 2007). Accordingly, there is a significant increase in the current use of the collaborative learning model, which is considered more effective and efficient compared to other learning models (Doymus, Karacop, and Simsek, 2010; Siegel, 2005; Webb, Sydney, and Farivor, 2002).

In the context of preparing individuals for the demands of the contemporary era, science education plays a crucial role. Science education encompasses an educational process based on the foundations of physics, chemistry, and biology. Therefore, it is essential to establish a strong foundation in the fields of physics, chemistry, and biology for effective

science education. Among these courses, the content and instruction of biology hold a particular significance. A considerable number of studies conducted on biology education aims to identify the difficulties that students experience while learning biology topics, their levels of understanding, or conceptual misconceptions (Clark and Mathis, 2000). Addressing the problems identified in the teaching and learning process through these research studies has become crucial for educators and education researchers. This necessity requires implementing new methods, techniques, and activities in biology education. The outcomes of these applications are supposed to be shared with all educators, emphasizing the importance of exchanging experiences and best practices in biology education.

One of the objectives of biology education is to foster students as science-literate individuals. Individuals with scientific literacy possess characteristics such as research skills, inquiry, effective decision-making, creative thinking, problem-solving abilities, collaboration skills, self-expression, and entrepreneurship. Additionally, they acquire knowledge and skills while embracing universal, national, and cultural values. Because science subjects are closely related to daily life, science courses often include topics that capture the attention and interest of students. As educators, it is essential to make the lessons even more engaging and to enhance the retention of information. Collaborative learning models offer various methods and techniques in this regard, providing opportunities to create an interactive and participatory learning environment.

The collaborative learning model is a method in which learners take an active role in the process. It consists of heterogeneous groups of students working towards the same goal, both inside and outside the classroom, which facilitates learning from each other. This method contributes to the development of individuals with strong communication skills and high self-confidence (Doymuş, Şimşek, and Şimşek, 2005).

The collaborative learning method, especially effective in learning that requires complex higher-order thinking skills, both enhances academic achievement and positively influences trust that students have in each other, self-efficacy beliefs, interest, attitude, and motivation. Thus, it provides a solution for instilling affective characteristics in education that may be overlooked or challenging to impart through other methods (Hastürk, 2017).

In this regard, collaborative learning activities have been observed to enhance students' learning and critical analysis skills, improve communication skills, and foster teamwork and problem-solving abilities (Munir, Baroutian, Young, and Carter, 2018). Collaborative learning is considered to reduce challenges encountered in integrating social media into education and to generate positive attitudes among students towards collaborative learning (Çankaya and Yunkul, 2018; Hamadi, El-Den, Azam, and Sriratanaviriyakul, 2021).

In the collaborative learning model, various methods are employed, such as team-game-tournament, student team-achievement divisions, cooperative questioning-cooperative learning, consolidation, group research, jigsaw, reading-writing-application, and ask together-

learn together. The current study focuses on the methods of reading-writing-application and ask together-learn together method.

In this study, the aim is to investigate the impact of the "Ask together- Learn together and Reading-Writing-Application" methods on the academic achievements and epistemological beliefs of pre-service teachers regarding the nervous and endocrine systems in humans. The following questions are addressed to determine this impact:

1. Is there a statistically significant difference in the academic achievements of pre-service science teachers in the teaching of the human nervous and endocrine system using the methods of ask together- learn together and reading-writing-application?
2. Is there a statistically significant difference in the epistemological beliefs of pre-service science teachers in the teaching of the human nervous and endocrine system using the methods of cooperative questioning-cooperative learning and reading-writing-application?

2. Method

2.1. *Research Design*

The current study employed ask together-learn together method and the reading-writing-application method in the application of the collaborative learning model. The study utilized an experimental research design, specifically the pretest-posttest comparison group quasi-experimental design, to determine the impact on the academic achievements and epistemological beliefs of teacher candidates in the teaching process of the topic "Human Nervous and Endocrine System" within the theoretical general biology and human anatomy and physiology courses offered as part of university classes. The quasi-experimental design is useful when the effects of teaching materials or methods are examined in different schools or classes, and it is also practical in cases where it is difficult to select the participants equally (Karasar, 2013; McMillan and Schumacher, 2006).

The experimental design for the topic "Human Nervous and Endocrine System" is presented in Figure 1.

Groups	**Pretest**	**Application**	**Posttest**
Experimental group-1	AAT	Ask together-learn together	AAT
Experimental group-2	EBS	Reading-writing application	EBS

Figure 1. Experimental Design of the Study

In the study, before the application, an Academic Achievement Test (AAT) and an Epistemological Beliefs Survey (EBS) were applied as pre-tests to determine the differences in academic achievements and epistemological beliefs between the group where ask together-learn together method was applied and the group where the reading-writing-application method was applied (RWA). After the applications in the study groups, the Academic Achievement Test (AAT) and Epistemological Beliefs Survey (EBS) were applied as post-tests to pre-service teachers in the study group.

2.2. Sampling

The research was conducted in the fall semester of the 2017-2018 academic year with a total of 84 pre-service teachers enrolled in the third grade at the Department of Science Education, Faculty of Education, Atatürk University. The selection of the two different groups was performed randomly. One of the classes, determined by random selection, constituted the Experimental Group-1 (n=39) where ask together-learn together method would be applied. The other class formed the Experimental Group-2 (n=45), where the Reading-Writing-Application (RWA) method would be implemented.

2.3. Data Collection Tools

In this study, the data collection tools used were the Academic Achievement Test (AAT) and the Epistemological Beliefs Survey (EBS).

- **Academic Achievement Test (AAT)**

The "Academic Achievement Test (AAT)" was used as a pre-test and post-test within the scope of the research to determine the readiness levels of pre-service teachers on the topic of "Human Nervous and Endocrine System" and to measure their academic achievements. The AAT consists of multiple-choice questions prepared to cover the topic of "Human Nervous and Endocrine System" included in the general biology and human anatomy and physiology courses (Appendix 1). The questions in this test were prepared by referring to teaching field knowledge and university preparation books. Before formulating the questions, the content scope was examined, and learning outcomes were defined for the topics since there were no predefined learning outcomes at the university level. A table of specifications containing the created learning outcomes was prepared, ensuring the content validity of the questions included in the test. The table of specifications and the prepared questions were presented to three faculty members from the Department of Science Education at Kazım Karabekir Faculty of Education. Based on their feedback, necessary corrections were performed.

After the corrections were finalized, the Academic Achievement Test (AAT) was administered to an upper group of pre-service teachers who had previously covered relevant topics but were not included in the sample, aiming to measure the reliability of the test. This test applied to the upper group was evaluated and analyzed. As a result of the analysis, the KR-20 reliability coefficient of the test was found to be 0.73. The average difficulty index of the test items was calculated as 0.47. Based on these findings, it was concluded that the academic achievement test is suitable to measure the changes in the academic achievements of pre-service teachers. The test consists of a total of 50 questions, and scoring is performed by assigning 2 points for each correct answer and 0 point for incorrect or omitted answers.

- **Epistemological Beliefs Survey (EBS)**

Epistemological beliefs refer to individuals' beliefs about the nature and acquisition of knowledge (Schommer, 1994; Aypay, 2011). The Epistemological Beliefs Survey was developed by Conley, Pintrich, Vekiri, and Harrison (2004) to measure individuals' attitudes toward these beliefs. The survey, which has been translated into Turkish, aimed to evaluate the responses of students using a five-point Likert scale. To examine the significance of the survey items, it was administered to a group of primary school students. After the application, two items were removed from the original 26-item survey to make it more applicable in Turkey (Appendix 2). The Cronbach's alpha reliability coefficient of the survey was determined as 0.76 through the conducted analysis. Among the 24 items in the content of this survey, 15 items were positive, and 9 items included negative expressions. When evaluating responses for this scale, the statement "strongly agree" was scored as 5 points for positive items, "agree" as 4 points, "undecided" as 3 points, "disagree" as 2 points, and "strongly disagree" as 1 point. The reverse scoring method was applied for negative items.

2.4. Application

Application Steps

- ✓ Information about the reading-writing-application method has been collected, and research conducted on the current topic has been reviewed.
- ✓ Information has been gathered about the " Ask Together-Learn Together" method, and research conducted on the current topic has been examined.
- ✓ The learning outcomes created for the "Human Nervous and Endocrine System" topic have been presented to expert opinions.
- ✓ A table of specifications has been prepared taking into account the learning outcomes.
- ✓ The tests (AAT, EBS) to be applied in the context of the study have been prepared.

- ✓ Information has been provided about the teaching methods applied to the experimental group selected as " Ask Together-Learn Together" group and the Reading-Writing-Application group.
- ✓ The study was conducted with a total of two groups: the " Ask Together Learn Together" group where this method was applied, and the "Reading-Writing-Application" group where the "Reading-Writing-Application" method was applied. Before performing the applications to these groups, a pre-test was conducted for one week using the Academic Achievement Test (AAT) and Epistemological Beliefs Questionnaire (EBS) to measure their prior knowledge levels and initial epistemological beliefs regarding the "Human Nervous and Endocrine System". After the pre-tests, the relevant methods were applied to the groups. The application, conducted by the researcher, lasted for six weeks, covering four class hours per week for each group. After the application of the respective methods, both groups were asked to take the Academic Achievement Test (AAT) and Epistemological Beliefs Questionnaire (EBS) as post-tests. The total duration of the application process was six weeks.

The application of the " Ask Together Learn Together" method in the teaching of the topic "Human Nervous and Endocrine System

"Ask Together Learn Together method was applied to pre-service teachers dividing the "Human Nervous and Endocrine System" topic into subtopics. The implementation spanned six weeks, covering four class hours per week.

The steps recommended by Açıkgöz (1992) for the implementation of the "Ask together Learn together method were followed as outlined below:

1. Group formation
2. Reading
3. Preparing student questions
4. Preparing group questions
5. Sending group questions
6. Answering group questions
7. Presenting group answers
8. Evaluating group presentation
9. Evaluating group process
10. Whole-class discussion
11. Testing

The implementation was carried out by the researcher using instructional materials (handouts) prepared on the relevant topic. Before starting the application, information about the Ask together Learn together method to be used in teaching the subject was provided to the teacher candidates. The Academic Achievement Test (AAT) was applied to all group members

as a pre-test. After completing the preliminary preparations for the application, teacher candidates were divided into intra-group heterogeneous and inter-group homogeneous groups, taking into account their academic achievement statuses and genders, following the CQLT method. The groups were asked to determine group names for themselves. The groups consisted of four with 6 members and three with 5 members. Considering the need to select a different member from the group for each sub-topic, roles such as postman, spokesperson, etc., were assigned to group members. Then, the reading stage was initiated, and the teacher candidates silently read the materials prepared by the researcher in the classroom. Reading the text and applying the "Ask Together Learn Together" method, teacher candidates individually prepared questions after completing the reading. They then shared these questions with their group members. Subsequently, within the group, they collectively determined the questions that were considered important and relevant to the topic. The group questions, collectively selected by the group members, were handed over to another group through the designated "postman" within each group. The questions that were collectively answered by the group members were presented to the class by a spokesperson selected from each group. The performance of the groups was evaluated using the observation form developed by Açıkgöz (1992), assessing aspects such as collaboration, interaction, the question creation process, and the assignment of roles within the group. This approach aimed to ensure active participation by all pre-service teachers in the learning process. It also fostered an effective discussion environment within the class, allowing the researcher to make necessary corrections and address identified deficiencies collectively. The observation form, developed by Açıkgöz (1992), provided a comprehensive tool for evaluating the performance of each group, offering insights into collaboration, interaction, and the overall effectiveness of the implemented method.

The groups were rewarded based on the multiple-choice results of the midterm exam conducted by the researcher after the completion of the application.

The application of the " Reading-Writing application" method in the teaching of the topic "Human Nervous and Endocrine System

The Reading-Writing-Application (RWA) method was applied to a selected group consisting of 45 teacher candidates. Considering their academic performance and genders, the pre-service teachers were divided into nine groups, each comprising five individuals, with intra-group heterogeneity and inter-group homogeneity. To enhance communication among group members and foster group cohesion, the pre-service teachers were asked to elect group leaders and come up with names for their respective groups.

All pre-service teachers in the group where the Reading-Writing-Application (RWA) method was applied were provided with reading materials, prepared by the researcher through different sources, related to the topic "Human Nervous and Endocrine System." Alongside these materials, the pre-service teachers conducted reading activities by using additional

sources of their choice related to the topic. After completing the reading activities, the pre-service teachers moved to the next stage, the writing phase, by removing all the resources from the study environment. Subsequently, the candidates, together with their group mates, wrote down what they understood about the topic on a piece of paper, turning it into a report. The reports created by the pre-service teachers were evaluated by the researcher, and the groups identified with necessary corrections and deficiencies were directed back to the reading stage. After the corrections were performed, the final stage of the method, the application stage, was initiated. In the application stage, all groups were encouraged to make presentations. During this stage, presentations were supported by various materials such as reading cards prepared by the teacher candidates. In the application phase, other groups were allowed to ask questions to the presenting group, helping to identify any deficiencies. The determined shortcomings were addressed through the participation of other group members in the class, facilitating necessary evaluations and corrections. Thus, active participation of all pre-service teachers in the process was ensured.

2.5. Data Analysis

The data obtained from the AAT and EBS tests administered to pre-service teachers before and after the application were evaluated, and comparisons were performed between Ask together-Learn together and RWA groups. The evaluation and analysis of the data obtained in the study are explained below in order:

1. Descriptive statistics were calculated for the AAT scores administered as pre and post-tests to the pre-service teachers in Ask together-Learn together and RWA groups. To test whether there was a statistically significant difference between the groups based on the scores of these tests, an independent t-test was conducted.
2. Descriptive statistics were computed for the EBS scores administered as pre and post-tests to the pre-service teachers in Ask together-Learn together and RWA groups. Subsequently, an independent t-test was employed to determine whether there was a statistically significant difference between the group means of the scores.

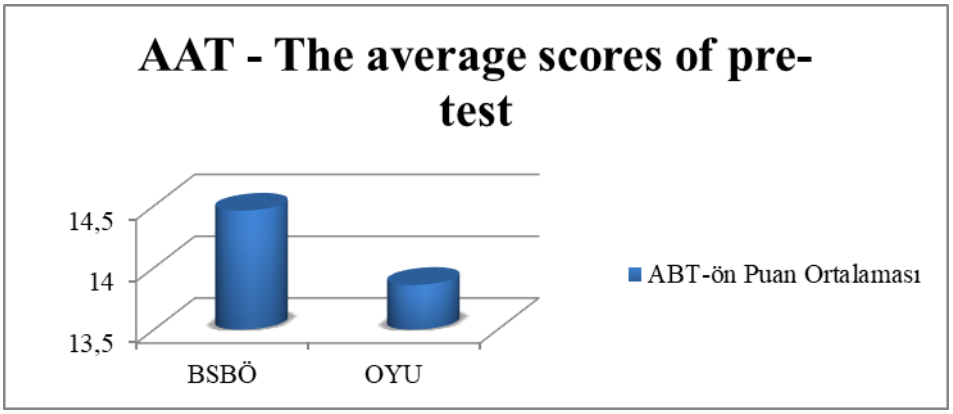
In all statistical analyses conducted, a significance level of 0.05 was accepted.

3. Findings and Discussions

In this part of the study, findings and discussion related to the impact of the " Ask Together, Learn Together" and "Reading-Writing-Application" methods used in teaching the topic of "Human Nervous and Endocrine System " are presented.

Findings and Interpretations Obtained from the AAT Pre-Test

The average scores of pre-service teachers in Ask together-Learn together and RWA groups that participated in the AAT pre-test are graphically presented in Figure 3.



(AA: Arithmetic Average)

Figure 3. Graph of ABT pre-test score averages

In order to determine if there was a statistically significant difference in the prior knowledge level between the Ask together-learn together and RWA groups, the AAT pre-test was administered to both groups before the application. If there is no statistically significant difference between the AAT pre-test score averages of the Ask together-learn together and RWA groups, it is possible to suggest that any possible difference in the ABT final test score averages may be attributed to the applied method. In this regard, the statistical analysis of the ABT pre-test was conducted, and the results are provided in Table 3.

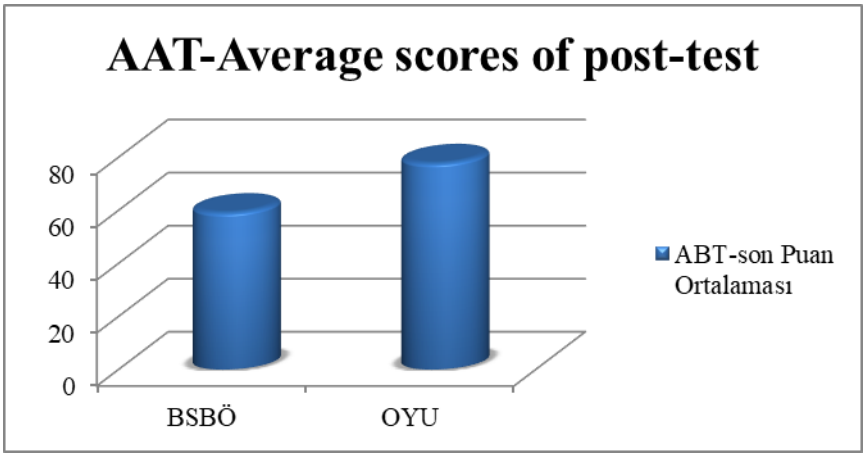
Table 3. Independent Sample t-test Results for the Scores Obtained by the Research Groups from the AAT Pre-Test

Groups		N	X	SS	SD	t	P
Ask together	together-learn	39	14,46	8,21	72,737	0,249	0,804
RWA		44	13,86	13,30			

Table 3 indicates that there was no statistically significant difference between the averages of Ask together-Learn together and RWA groups in terms of the scores from the AAT pre-test, as revealed by the independent t-test (t(72.737) = 0.249; p > 0.05). The average score of pre-service teachers in the Ask together-Learn together group (X = 14.46) on the AAT pre-test was similar to the average score of pre-service teachers in the RWA group (X = 13.86). It is possible to suggest that the prior knowledge of pre-service teachers in the Ask together Learn together group regarding the subject is similar to that of pre-service teachers in the RWA group.

Findings and Interpretations from the AAT Post Test

The average scores of pre-service teachers from the Ask together-Learn together and OYU groups participating in the application on the AAT post-test are graphically presented in



(AA: Arithmetic Average)

Figure 4. Graph of AAT post-test score averages

Statistical differences in the scores obtained by the groups from the AAT post- test were analyzed using an independent t-test, and the results of this analysis are provided in Table 4 below.

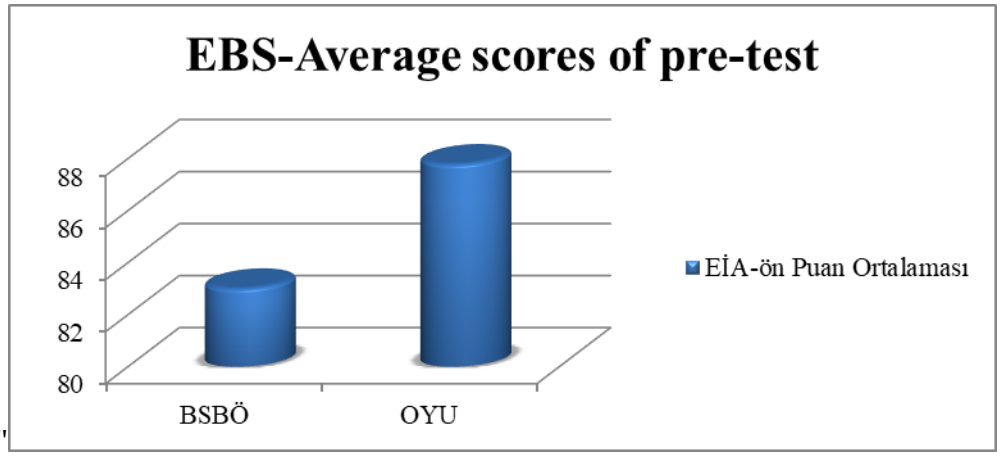
Table 4. Independent Sample t-test Results for the Scores Obtained by the Study Groups from the AAT Post-Test.

Groups	N	X	SS	SD	t	P
Ask together-learn together	39	59,13	11,54	81	-8,335	0,000
RWA	44	77,73	8,73			

Table 4 indicates a statistically significant difference between the average scores of both groups in terms of the AAT final test ($t(81) = -8.335$; $p < 0.05$; $\eta 2 = 0.46$). The average score of RWA pre-service teachers on the academic achievement test ($X = 77.73$) was higher than the average score of pre-service teachers in Ask together- Learn together group ($X = 59.13$). The effect size, calculated as eta-squared ($\eta 2 = 0.46$), is classified as a very large effect according to Cohen (1988). Thus, it is possible to suggest that 46% of the observed variability in academic achievements among pre-service teachers is attributed to the applied teaching methods. The analysis results suggest that the difference in averages is not random, and the higher averages of pre-service teachers in RWA group compared to pre-service teachers in Ask together-Learn together group are attributed to the applied teaching method.

Findings and Interpretations from the EBS Pre-Test

The average scores of pre-service from the Ask together Learn together and RWA groups that participated in the application on the EBS pre-test are graphically presented in Figure 5."



(AA: Arithmetic Average

Figure 5. Graph of EBS pre-test score averages

To determine the epistemological beliefs of teacher candidates in the research groups, the EİA pre-test was administered before the study. The scores obtained by the groups from the EİA pre-test were examined for statistical differences using an independent t-test, and the results of this analysis are provided in Table 5 below.

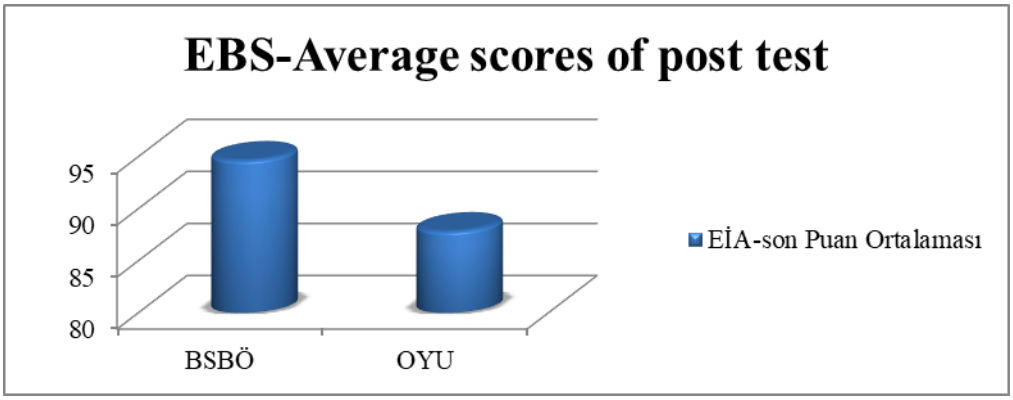
Table 5. Independent Sample t-test Results for the Scores Obtained by the Study Groups from the EBS Pre-Test.

Groups	N	X	SS	SD	t	P
Ask together-learn together	39	83,00	10,39	81,966	-1,933	0,057
RWA	44	87,78	12,26			

Table 5 indicates that there was no statistically significant difference in the averages of the scores of Ask together-Learn together and RWA students on the EBS pre-test, as determined by independent t-test ($t(81.966) = -1.933$; $p > 0.05$). The average score of pre-service teachers in Ask together- Learn together ($X = 83.00$) on the EBS pre-test is similar to the average score of pre-service teachers in RWA ($X = 87.78$). This indicates that there was no statistically significant difference in the epistemological beliefs of pre-service teachers in the RWA group, where the reading-writing-application method was applied, and the Ask together-learn together group before the application.

The Results and Interpretation Obtained from the EBS Post- Test

The averages of the scores obtained from the EBS post- test applied to pre-service teachers in Ask together Learn together and RWA during the application are presented graphically in Figure 6.



(AA: Arithmetic Average)

Figure 6. Graph of EBS post- test score averages.

To determine the impact of the reading-writing-application and ask together- learn together methods on the epistemological beliefs of pre-service teachers after the application, the EBS post- test was administered. Independent t-tests were conducted to determine whether there were statistically significant differences in the scores obtained by the groups from the EBS post- test, and the results of this analysis are provided in Table 6.

Table 6. Independent Sample t-test Results for the Scores Obtained by the Study Groups from the EBS Post- Test.

Groups	N	X	SS	SD	t	P
Ask together-learn together	39	94,64	9,84	73,283	3,341	0,001
RWA	39	87,82	8,10			

Table 6 indicates a statistically significant difference between the averages of the scores of

pre-service teachers in Ask-together Learn together and RWA groups regaridng the EBS post-test ($t(73.283) = 3.341$; $p < 0.05$; $\eta 2 = 0.13$). The average score of epistemological beliefs obtained by pre-service teachers in Ask-together Learn together ($X = 94.64$) was better than the average score of epistemological beliefs obtained by pre-service teachers in RWA group ($X = 87.82$). The calculated effect size eta-squared, 0.13, is classified as a medium effect according to Cohen (1988). Thus, it is possible to highlight that 13% of the observed variability in the epistemological beliefs of pre-service teachers is attributable to the applied instructional methods. The change in the epistemological beliefs pre-service teachers in Ask-together Learn together possibly results from Ask together Learn together method. Result, Discussion and Recommendations

The AAT pre-test was applied to pre-service teachers enrolled in two randomly selected classrooms before the study to determine their prior knowledge levels regarding the "Human Nervous and Endocrine System". An independent t-test was conducted on the pre-test scores obtained, and these results indicated that both groups had similar prior knowledge levels related to the topic. In conclusion, it was suggested that there was no statistically significant difference in the prior knowledge levels related to the topic between the group, where ask together learn together method was applied, and the RWA group, where the reading-writing-application method was implemented before the application. However, according to the results of the AAT post- test, a statistically significant difference emerged between the groups, favoring the RWA group. In light of these results, it can be concluded that the reading-writing-application method, applied within the scope of science education for the biology topic "Human Nervous and Endocrine System," was more effective in improving the academic achievements of participating pre-service trachers compared to the Ask together Learn together group. The success of the RWA group teacher candidates was possibly caused by various factors, such as providing reading exercises from various sources to gain comprehensive knowledge, unintentionally repeated reading exercises due to the diversity of sources, and consequently acquiring the information, grasping what they read, and other similar factors. Additionally, all these factors are possible to be regarded as benefits of the reading stage in the RWA application. Following the reading stage, during the writing activity, pre-service teachers restructured the information formed in their minds during the previous reading stage, shared this information with their groupmates, generated new ideas together, developed different perspectives on the topic through group discussions, and create a joint group product. This process enabled them to use their cognitive skills at a higher level and contributed positively to their learning. As the last stage, pre-service teachers integrated the cognitive structures and skills they have acquired in relation to the topics through the reading and writing process by organizing them. In this stage, by performing activities such as presentations, slides, reports, etc., they ensured lasting learning, actively participated in the process, and acquired the qualities and skills required by teaching. Thus, the positive factors offered by the application phase was considered effective in positively influencing learning in

all three stages of the reading-writing-application method. In this context, the positive impact of these variables on learning in all three stages of the reading-writing-application method has the potential to make this method more effective. The results obtained in this study align with other research results in this field and support the study (Ağgül, 2016; Akçay, Doymuş, Şimşek ve Okumuş, 2012; Akkuş, 2013; Aksoy ve Doymuş, 2011; Aksoy, 2013; Aksoy ve Gürbüz, 2013; Fırat, 2014; Koç, Şimşek ve Fırat, 2013; Okur Akçay, 2012 Avci, 2018, Aydoğan, 2019; Şahin, 2020; Barata Aksoy, 2017).

However, it is worth noting that although there was a statistically significant difference in favor of the RWA group in the scores obtained from the AAT post test in both Ask together Learn together and RWA groups where the reading-writing-application and Ask together Learn together methods were applied, there was also an increase in academic achievements of pre-service teachers of Ask together Learn together based on both the AAT pre-test and AAT post- test.In this application, factors contributing positively to learning included students working together, creating high-level questions, discussing and presenting their answers, strengthening their theories through exchanging ideas, and adding new information to their existing knowledge. Thus, it is possible to say that there was an improvement in the academic achievements of pre-service teachers in Ask together Learn together as well, despite the statistically significant difference in favor of the RWA group in the scores obtained from the ABT final test.

4. Conclusions and Suggestions

The results of the epistemological belief surveys revealed that there was no statistically significant difference in the attitudes of pre-service teachers in Ask together Learn together and RWA groups in their pre-tests. However, the EBS post- test results for pre-service teachers in Ask together Learn together and RWA groups indicated a statistically significant difference between the groups, and this difference was in favor of pre-service teachers in Ask together Learn together. The significant difference observed in pre-service teachers in Ask together Learn together possibly resulted from the pre-service teachers obtaining more opportunities for discussion during the application, accessing information from different sources, collaboratively creating questions by using higher-order cognitive skills, developing problem-solving skills, analyzing problems with various thinking styles, and generating ideas about the accuracy of all these processes. Their active participation in a process that requires both mental and skillful engagement was possible reason for this situaiton. The pluralistic perspective gained by pre-service teachers through this situation suggests that knowledge is not dualistic (definite and absolute) and has no boundaries. It also indicates that disciplines and knowledge have no single authority or source of expertise.

In addition, it is suggested that the approaches of pre-service teachers to epistemological beliefs are positively influenced by various factors, such as the ability of pre-

service teachers to actively and personally structure knowledge over time, effectively form their own views and thoughts, generate new information, access information using various sources, and make the acquired knowledge more meaningful within the framework of questions and answers they create themselves. The results obtained regarding epistemological beliefs in the current study align with those obtained in other studies in this field (Boz, Aydemir, and Aydemir, 2011; Conley, Pintrich, Vekiri & Harrison, 2004; Çalıklar, 2015; Fırat, 2014; Kaynar, Tekkaya, and Çakıroğlu, 2009; Kızılgüneş, Tekkaya, and Sungur, 2009; Özkan, 2008; Qian, & Alvermann, 2000).

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Declaration of Conflicting Interests and Ethics

The authors declare no conflict of interest.

References

Açıkgöz, K. Ü. **(**1992). *İşbirlikçi öğrenme kuram araştırma uygulama.* Malatya: Uğurel Matbaası.

Açıkgöz, K. Ü. **(**2003). *Aktif öğrenme*. İzmir: Eğitim dünyası yayınları.

Ağgül, Ö. (2016). *Bitki ve hayvanlarda üreme, büyüme ve gelişme ünitesinin öğretiminde okuma-yazma-uygulama yönteminin öğrencilerin akademik başarıları, epistemolojik tutumları ve okuduğunu anlamaları üzerine etkisi* (Yüksek lisans tezi). Yükseköğretim Kurulu Ulusal Tez Merkezi'nden edinilmiştir. (Tez No.451210)

Akçay, N.O., Doymuş, K., Şimşek, Ü. & Okumuş, S. (2012). The effect of cooperative learning model on academic achievement in physics. *Energy Education Science and Technology Part B, 4*(4), 1915-1924.

Akkuş, A. (2013). *Fen ve teknoloji öğretmenlerinin işbirlikli öğrenme modeli hakkında bilgilendirilmesi, bu modeli sınıfta uygulamaları ve elde edilen sonuçların değerlendirilmesi: Muş il örneği* (Doktora tezi). Yükseköğretim Kurulu Ulusal Tez Merkezi' nden edinilmiştir. (Tez No.350077)

Aksoy, G. (2013). The effects of learning together and reading-writing- application techniques on increasing 6th grade students' ability of graphic and academic achievement. *Energy Education Science and Technology, Part B, 5*(1), 61-68.

Aksoy, G. & Doymuş, K. (2011). Fen ve teknoloji dersi uygulamalarında işbirlikli okuma-yazma-uygulama tekniğinin etkisi. *Gazi Eğitim Fakültesi Dergisi, 31*(2), 381-397.

Aksoy, G. & Gürbüz, F. (2013). The effect of group research and cooperative reading-writing-application techniques in the unit of "what is the earth‟s crust made of?" on the academic achievements of the students and the permanent. *Balkan Physics Letters*, 21, 132-139.

Aypay, A. (2011). Epistemolojik İnançlar Ölçeğinin Türkiye Uyarlaması ve Öğretmen Adaylarının Epistemolojik İnançlarının İncelenmesi. *Eskişehir Osmangazi Üniversitesi Sosyal Bilimler Dergisi*, *12* (1), 1-15.

Boz, Y., Aydemir, M. & Aydemir, N. (2011). Türkiye‟deki 4,6 ve 8. Sınıf İlköğretim öğrencilerinin epistemolojik inançları. *Elementary Education Online,* 10(3), 1191-1201.

Clark D. C., (2000) Mathis P. M., Modelling mitosis and meiosis. A problem-solving activity, *The American Biology Teacher*, *62*(3), 204-206.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence Earlbaum Associates

Conley, A. M, Pintrich, P. R., Vekiri, I., & Harrison, D. (2004). Changes in Epistemological Beliefs in Elementary Science Students. *Contemporary Educational Psychology, 29,* 186-204.

Çalıklar, Ş. (2015). *atom kuramlarının öğretiminde öğrencilerin akademik başarı, epistemolojik inançları ve öğrenmelerinin kalıcılığı üzerine öğrenci takımları başarı*

bölümleri ve takım oyun turnuva yönteminin etkisi (Yüksek Lisans Tezi). Yükseköğretim Kurulu Ulusal Tez Merkezi' nden edinilmiştir. (Tez No.418208).

Çepni, S., & Çil, E. (2009). *Fen ve teknoloji programı (tanıma, planlama, uygulama ve SBS'yle ilişkilendirme) İlköğretim 1. ve 2. kademe Öğretmen el kitabı.* Pegem Akademi Yayınları, 568 s, Ankara.

Doymuş K., Karaçöp, A. & Şimşek, Ü. (2010). Effects of jigsaw and animation techniques on students‟ understanding of concepts and subjects in electrochemistry. *Education Technology Research Development, 58,* 671–691.

Doymuş, K., Şimşek, Ü. & Şimşek, U. (2005). İşbirlikli öğrenme yöntemi üzerine derleme: İşbirlikli öğreneme yöntemi ve yöntemle ilgili çalışmalar. *Erzincan Eğitim Fakültesi Dergisi,* 7(1), 59-83.

Fırat, M. (2014). *Maddenin yapısı ve özellikleri ünitesinin öğretiminde iki farklı işbirlikli öğrenme yönteminin öğrencilerin akademik başarıları ve epistemolojik tutumları üzerine etkisi* (Yüksek Lisans Tezi). Yükseköğretim Kurulu Ulusal Tez Merkezi' nden edinilmiştir. (Tez No.381617).

Graham, D.C. (2005). *Cooperative learning methods and middle school students* Unpublished Doctoral Dissertation, Capella University, Minnesota.

Johnson, D.W. & Johnson R.T. (1999). Making cooperative learning work. *Theory Into Practice, 38*(2), 67-73.

Karasar, N. (2013). Bilimsel araştırma yöntemi. Ankara: Nobel Yayın Dağıtım.

Kaynar, D., Tekkaya, C., & Çakıroğlu, J. (2009). Effectiveness of 5E learning cycle ınstruction on students‟ achievement in cell concept and scientific epistemological beliefs. *Hacettepe University Journal of Education, 37*, 96-105.

Kızılgüneş, B., Tekkaya, C., & Sungur, S. (2009). Modeling the relations among students‟ epistemological beliefs, motivation, learning approach, and achievement. *The Journal of Educational Research, 102*(4), 243-255.

Knackendoffell, E.A. (2005). Collobarative teaming in the secondary school. *Focus on Exceptional Children,* 37 (5), 1-16.

Koç, Y., Şimşek, Ü. & Fırat, M. (2013). Işık ünitesinin öğretiminde okuma-yazma-uygulama yönteminin etkisi. *Erzincan üniversitesi eğitim fakültesi dergisi*, 15(2), 204-225.

Maloof, J. & White, V.K.B. (2005). Team study training in the college biology laboratory. *Journal of Biological Education, 39* (3), 120-125.

McMillan, H. & Schumacher, S. (2006). *Research in education evidence-based inquiry*. (6th Edition). Boston: Allyn and Bacon Inc.

Nammouz, M.S. (2005). *A study of the effects that grouping laboratory partners based on logical thinking abilities have on their problem solving strategies in a general chemistry course.* Unpublished Doctoral Dissertation, Clemson University, USA.

Okur Akçay, N. (2012). *Kuvvet ve hareket konusunun öğretilmesinde işbirlikli öğrenme yöntemlerinden grup araştırması, okuma-yazma-sunma ve birlikte öğrenmenin etkisi*

(Doktora Tezi). Yükseköğretim Kurulu Ulusal Tez Merkezi' nden edinilmiştir. (Tez No.325807).

Özkan, Ş. (2008). *Modeling Elementary Students' Science Achievement: The Interrelationships among Epistemological Beliefs, Learning Approaches, and Self-Regulated Learning Strategies.* Doctoral Dissertation, The Graduate of Natural and Applied Sciences of Middle East Technical University, Ankara.

Prince, M. (2004). Does active learning work? A review of the researc. *Journal of Engineering Education, 93* (3), 223-231.

Qian, G., Alvermann, D. (2000). Relationship between epistemological beliefs and conceptual change.

Schommer, M. (1994). Synthesizing Epistemological Belief Research: Tentative Understandings and Provocative Confusions. *Educational Psychology Review, 6*(4), 293-319.

Siegel, C. (2005). Implementing a Research-Based Model of Cooperative Learning, *The Journal of Educational Research;* Jul/Aug , 339.

Şimşek, Ü. (2007). *Çözeltiler ve kimyasal denge konularında uygulanan jigsaw ve birlikte öğrenme tekniklerinin öğrencilerin maddenin tanecikli yapıda öğrenmeleri ve akademik başarıları üzerine etkisi* (Doktora tezi). Yükseköğretim Kurulu Ulusal Tez Merkezi' nden edinilmiştir. (Tez No.177803)

Tlusty, R. (1993). Cooperative learning in a college chemisry course. *American Educational Research Association*, Atlanta, Georgia.2-11.

Topsakal, S. (2006). *Fen ve Teknoloji Öğretimi*. Nobel Yayınları: Ankara.

Webb, N. M., Sydney, H. & Farivor, A.M. (2002). Theory in to practice, *College of Education,* 41(1), 13-20. Barata Aksoy, Ş. (2017). 7. Sınıf fen ve teknoloji dersi "insan ve çevre" ünitesinin işbirlikli öğrenme modeliyle öğretiminin öğrenci başarısına etkisi (Tez No. 477529) [Yüksek Lisans Tezi, Fırat Üniversitesi-Elazığ]. Yükseköğretim Kurulu Ulusal Tez Merkezi.

Avci, M. (2018). 6. Sınıf fen bilimleri dersi "vücudumuzda sistemler" ünitesinin işbirlikli öğrenme modeliyle öğretiminin öğrenci başarısına etkisi (Tez No. 514625) [Yüksek Lisans Tezi, Fırat Üniversitesi-Elazığ]. Yükseköğretim Kurulu Ulusal Tez Merkezi.

Aydoğan, A. (2019). Simülasyon destekli işbirlikli öğretim yönteminin öğrencilerin akademik başarılarına ve fene yönelik tutumlarına etkisi: DNA ve genetik kod ünitesi (Tez No. 568743) [Yüksek Lisans Tezi, İnönü Üniversitesi-Malatya]. Yükseköğretim Kurulu Ulusal Tez Merkezi.

Şahin, E. (2020). Dijital destekli işbirlikli öğrenci takımları başarı bölümleri yönteminin fen bilimleri dersinin akademik başarısına etkisi (Tez No. 634134) [Yüksek Lisans Tezi, Atatürk Üniversitesi-Erzurum]. Yükseköğretim Kurulu Ulusal Tez Merkezi.

Hastürk, H. G. (2017). Teoriden pratiğe fen bilimleri öğretimi. Ankara: Pegem Akademi.

Cankaya, S. ve Yunkul, E. (2018). Learner Views about Cooperative Learning in Social Learning Networks. International Education Studies, 11(1), 52-63. doi: 10.5539/ies.v11n1p52

Munir, M. T., Baroutian, S., Young, B. R. ve Carter, S. (2018). Flipped classroom with cooperative learning as a cornerstone. Education for Chemical Engineers, 23, 25- 33. doi: 10.1016/j.ece.2018.05.001

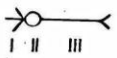
Hamadi, M., El-Den, J., Azam, S. ve Sriratanaviriyakul, N. (2021). Integrating social media as cooperative learning tool in higher education classrooms: An empirical study. Journal of King Saud University-Computer and Information Sciences. 12, 1- 10. doi: 10.1016/j.jksuci.2020.12.007

Appendices

Appendix 1: Academic Achievement Test (AAT)

İnsanda sinir ve endokrin sistemi

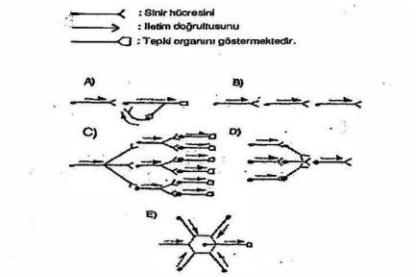
1-) Şekildeki nöron şemasında verilen bölümlerin isimleri aşağıdakilerden hangisinde verilmiştir?



	I	II	III
A)	Dendrit	H. gövdesi	Akson
B)	Akson	Dendrit	H. gövdesi
C)	Akson	H. gövdesi	Dendrit
D)	Dendrit	Akson	H. gövdesi
E)	H. Gövdesi	Dendrit	Akson

2-) Gürültüyle uyandırılan bir bireyde, bir dizi koşullandırılmamış ya da içgüdüsel davranışların ortaya çıktığı görülmüştür.

Bireyin gösterdiği bu dizi davranışların gerçekleşmesi için aşağıdaki sinirsel iletim yollarından hangisi izlenmiş olabilir?



3-) Sinir hücrelerinde impulsların oluşumu ve bunların sinir hücrelerinden geçişleri ile ilgili olarak aşağıdaki açıklamalardan hangisi yanlıştır?

A) Uyartı çok şiddetli olsa bile impulsun hızı değişmez.

B) Bir sinapsı geçen impulsların sayısı uyartının şiddetinden etkilenir.

C) İmpulsların sinapslardan geçişini nörotransmitter maddeler sağlar

D) Bir sınapsı geçen impulsların sayısı, tepkinin derecesini etkiler.

E) Bir sinir hücresi dinlenme halinde iken iç kısım pozitif , dış kısım ise negatif yüke sahiptir.

4) I. Emirleri değerlendirme merkezinden alıp tepki organına götüren nöronlara efferent nöron denir.

II. Merkezi sinir sisteminden çıkmayan nöronlara afferent nöron denir.

Yukarıda, nöron çeşitleri için yapılmış tanımlamaların hangisi doğru olur?

A) Yalnız II

B) Yalnız III

C) I ve II

D) I ve III

E) I, II ve III

5-) Nöronlarda impuls iletilirken, aşağıdakilerden hangisi gerçekleşmez?

A) Karbondioksit çıkışı

B) Sıcaklık artışı

C) Nöron boyunun kısalması

D) Elektriksel yük değişimi

E) ATP'nin hidrolizi

6-) Aşağıdaki yapılardan hangisi sinir iletimini azaltıcı etkiye sahiptir?

A) Aksonlar

B) Dendritler

C) Nörofibriller

D) Sinapslar

E) Dopaminler

7-) Sinir hücrelerinde, aşağıdaki yapılardan hangisinin bulunması impuls iletim hızını artırır?

A) Akson

B) Miyelin kılıf

C) Schwan kını

D) Mitokondri

E) Çekirdek

8-) Aşağıdakilerden hangisi sinir hücreleri (nöronlar) için doğru olmaz?

A) Sitoplazmasına karyoplazma denir.

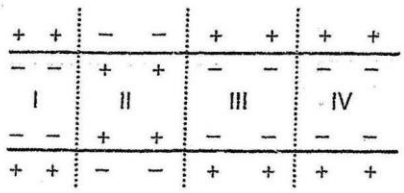
B) Yapısında nissi cisimcikleri bulunur.

C) Uyartıları ileten iplikçiklerine nörofibril denir.

D) Çekirdek, mitokondri ve golgi cisimciği bulundurur.

E) Hücre gövdesinde metabolik faaliyetler gerçekleşir.

9-) Şekildeki bir nöron akson bölümü şematik olarak gösterilmektedir.



Numaralandırılmış bölümlerler ilgili olarak aşağıdaki yorumlardan hangisi doğru olamaz?

A) III ve IV bölümler polarize durumdur.

B) I. bölüm polarize olduktan sonra repolarize olmuştur.

C) I. bölümden yeni bir impuls iletilebilir.

D) II. bölümde dışta Na^+, içte K^+ iyonu daha yoğundur.

E) I. bölümde Na^+ 'lar dışarı K^+ ' lar içeri pompalanırken ATP hidrolizinden oluşan enerji kullanılmıştır.

10-) Bir uyarının duyu organlarıyla algılanması ve tepkime organlarıyla uygun cevabın verilmesinde, salgılanan ilk nörotransmitterin etkileme yönü aşağıdakilerden hangisidir?

A) Duyu nöronundan merkez nörona.

B) Merkez nörondan duyu nöronuna.

C) Salgı bezinden motor nörona.

D) Motor nörondan merkez nörona.

E) Motor nörondan salgı bezine.

11-) İnsanda duyuların alınmasında sorumlu yapılarda, duyu reseptörleri ile ilgili olarak ;

I. Doğrudan dış çevreye açık olma.

II. Eşik şiddetindeki uyarılarla uyarılma.

III. Geniş bir yüzeye yayılmış olma.

özelliklerinden hangileri ortaktır?

A) Yalnız I B) Yalnız II C) Yalnız III D) I ve II E) II ve III

12-) Normal bir etkiye tepki oluşumu için gerçekleşen;

I. Uyartıların alınması.

II. Uyartıların iletilmesi (duyu siniriyle)

III. Uyartının yorumlanması.

IV. Uyarının iletilmesi.

olayların gerçekleşme sırası aşağıdakilerden hangisinde verilmiştir?

A) I, II, III, IV B) I, III, II, IV C) II, IV,III,I

D) IV, III, II, I E) II, III, IV, I

13-) Merkezi sinir sisteminin elemanı olan beyin, ön beyin, orta beyin ve arka beyin olmak üzere üç bölümde incelenir.

I. Beyinin en büyük bölümünü oluşturur.

II. Koku alma hücrelerinin uzantılarının bulunduğu koklama çıkıntılarını bulundurur.

III. Beyin yarım kürelerini bulundurur.

Ön beyinle ilgili olarak yukarıda ileri sürülen yargıların hangisi doğrudur?

A) Yalnız II B) Yalnız III C)I ve II D) II ve III E) I, II, ve III

14-) I. Beyin yarım küreleri

II. Beyincik

III. Ön lob

Yukarıda verilen yapıların hangileri ön beyinde bulunur?

A) Yalnız I B) Yalnız II C) I ve III D) II ve III E) I, II, III

15-) I. İskelet kaslarının hareketini ve vücut dengesini düzenler.

II. Göz bebeklerinin karanlıkta büyüyüp, aydınlıkta küçülmesini sağlar.

III. Kas tonusu ve vücut duruşunu düzenleyen merkezleri bulundurur.

Yukarıdakilerden hangileri orta beyin ile ilgili olarak doğru olan görevlerdendir?

A) Yalnız I B) Yalnız II C) I ve III D) II ve III E) I, II ve III

16-) Beyincik (Cerebellum) için aşağıda verilen özelliklerin hangileri doğru <u>değildir?</u>

A) Beyin gibi iki yarım küreye ayrılmıştır.

B) Dışta ak, içte boz madde buunur.

C) Beyinciğin yarım kürelerini varol köprüsü (pons) birbirine bağlar.

D) Motorik düzenleme ve denge merkezi olarak iş görür.

E) Vücut duruşunu ve iskelet kaslarının kasılma derecesini düzenler.

17-) I. Vücut sıcaklığının ayarlanması.

II. Vücuttaki su dengesinin ayarlanması.

III. Karbon hidrat ve yağ metabolizmasının düzenlenmesi

IV. Kan basıncı ve uykunun ayarlanması

Yukarıdakilerden hangisi arabeyin tabanı (hipotalamus) nın görevlerindendir ?

A) I, II, III, ve IV B) II, III ve IV C) I, II ve IV

D) III ve IV E) I,III ve IV

18-) Beyin ve omurilği dıştan saran meninges adlı zar üç katlıdır.

. İnce zar (Pia mater)

. Sert zar (Dura mater)

.Örümceksi zar (Arachnoid zar)

I. Sert zar ile örümceksi zar arasında beyin omurilik sıvısı (BOS) bulunur.

II. BOS dıştan gelen darbelere karşı beyin ve omuriliği korur.

III. Beyin ile kan arasında besleyici madde ve artık ürün alış verişini sağlar.

Meninges adlı üç katlı zarda rastlanan BOS (Beyin omurilik sıvısı = Serebrospiral sıvı) ile ilgili yukarıdaki yargıların hangileri doğru olur?

A) Yalnız I B) Yalnız III C) I ve II D) II ve III E) I, II ve III

19-) I. Beyine gelen ve beyinden çıkan impulsları iletmek.

II. Bir reflex merkezi olarak çalışmak

III. Alışkanlık hareketlerini denetlemek

Yukarıdakilerden hangisi ya da hangileri omuriliğin görevlerindendir?

A) I ve II B) II ve III C) I, II ve III D) Yalnız II E) Yalnız III

20-) Aşağıdaki refleks faaliyeti omurilik soğanı tarafından yürütülmez?

A) Tükürük çıkarma B) Terleme C) Ağlama D) Öksürme

E) Göz kapaklarını kırpma

21-) I. Hayat ağacı adını alır

II. Dışta ak madde içte boz madde bulunur

III. Kalp atış hızı, solunum, dolaşım ve boşaltımı ayarlama merkezlerini bulundurur.

Omurilik soğanın görev ve özelikleri için yukarıda verilerin hangisi doğru olur?

A) Yalnız I B) Yalnız II C) I ve III D) II ve III E) I, II ve III

22-) Refleks olaylarında; uyartının niteliği belirlenmeden, belli tepkilerle cevap verilmesinin temel nedeni, aşağıdakilerden hangisidir?

A) Uyartı iletiminde enerji harcanmaması .

B) Uyartının; eşik şiddetten düşük şiddette olması.

C) Uyartının, beyindeki duyu merkezine iletilmemesi.

D) Refleks yayını oluşturan nöronlarda sinapsların olmaması.

E) Uyartı süresinin kısa olması.

23-) Çevresel sinir sistemi somatik sinir sistemi ve otonom sinir sistemi olmak üzere iki grupta incelenir.

I. Şarkı söyleme

II. Kan damarlarında büzülüp genişleme

III. Terleme

IV. Yazı yazma

V. Resim yapma

Yukarıda verilen işlerin hangileri somatik sinir sistemi, hangileri otonom sinir sistemi faaliyetlerince gerçekleştirilir?

Somatik sinir Sistemi	**Otonom sinir Sistemi**
A) I ve III	II,IV ve V
B) I ve IV	II, III ve V
C) II ve IV	I, III ve V
D) I, III ve IV	II ve V
E) I, IV ve V	II ve III

24-) I. 12 çifti beyinden çıkar.

II. Beyinden çıkan vagus sinir iç organlara bağlantılıdır.

III. 31 çifti beyinden çıkar

Çevresel sinir sistemiyle ilgili olarak ileri sürülen yukarıdaki yargıların hangileri doğru olur?

A) Yalnız II B) Yalnız III C) I ve III D) II ve III E) I, II ve III

25-) Baş bölgesinden çıkan 10. sinir vagus siniridir. Vagus siniri parasempatik sinir sistemine aittir. Bu sinirden aşağıda verilen organların hangisine uzantı gitmez?

A) Mide B) Bacaklar C) Kalp D) Akciğerler E) Bağırsaklar

26-) Otonom sinir sistemi;

I. Sempatik sistem

II. Somatik sistem

III. Parasempatik sistem

Yukarıdaki kısımlardan hangilerini bulundurur?

A) Yalnız I B) Yalnız III C) I ve II D) I ve III E) I, II ve III

27-) I. Genellikle farklı doku ve organlar üzerinde etkili olurlar.

II. Etkileri hızlı ve uzun sürelidir.

III. Sentezleri ve parçalanmaları ile ilgili organlardaki enzimler yardımıyla olur.

Yukarıdakilerden hangileri hormonların genel özellikleriyle ilgili olarak doğru olur?

A) Yalnız I B) Yalnız III C) I ve II D) I ve III E) I, II ve III

28-) Kapalı ve karma bezlerden salgılanan hormonların vücudun özel bir bölümündeki özel bazı yapılarla etkileşip diğer yapılarla etkileşmemesi aşağıdakilerden hangisiyle açıklanabilir?

A) Hormonlar kimyasal bileşimlerdir.

B) Hormonların hedef organ hedef hücreleri vardır

C) Hormonlar kan yoluyla taşınırlar

D) Hormonlar kısa zamanda bozulurlar

E) Karaciğer hormonların çoğunun yıkım merkezidir

29-) Birden bire karşısına çıkan yayaya çarpmamak için hemen fren yaparak aracını durduran bir sürücüde, kalp hızının artması, tansiyon yükselmesi, ağız kuruluğu gibi, sinirsel ve hormonal olarak kontrol edilen tepkiler ortaya çıkar.

Tehlikenin geçmesine karşın, sürücüdeki bu tepkilerin bir süre daha kalması ve daha sonra bireyin eski haline dönmesi, hormonlarla ilgili aşağıdaki özelliklerden hangisiyle açıklanabilir?

A) Salgıladıkları yerden farklı bir yerde iş görmesi

B) Küçük miktarın bile büyük etki göstermesi

C) Yıkımının belli bir zaman sonra başlaması

D) Bireyde metabolizma hızını değiştirebilmesi

E) Etkilenen dokuya (organa) kan yoluyla taşınması

30-) Aşağıdakilerden hangisi STH (Büyüme hormonu) ile ilgili değildir?

A) Kemik ve kas gelişimini etkiler.

B) Az salgılanması halinde cücelik yapar.

C) Hipofiz salgısıdır.

D) Büyüme evresinden sonra miktarı artar.

E) Akromegaliye neden olabilir.

31-) I. Metabolik olaylar yavaşlar.

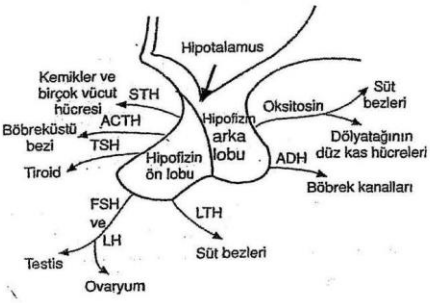
II. Kandaki kolesterol seviyesi yükselir.

III. Hücreler arası sıvıda Na^+ ve K^+ artar.

Yukarıdakilerden hangisi tiroksin az salgılanması sonucu ortaya çıkan değişimlerdir?

A) Yalnız I B) Yalnız III C) I ve II D) II ve III E) I, II ve III

32-)



Yukarıdaki hipofizin salgıladığı hormonlar ile denetlediği yapılar şematik olarak gösterilmiştir.

Buna göre;

I. Hipofiz, hipotalamus tarafından denetlenmektedir.

II. LTH ve oksitosin dişilerin salgıladığı hormonlardır.

III. FSH ve LH, dişi ve erkek üreme hormonlarına etki eden hormonlardır.

IV. ACTH ve ADH hipofizin farklı loblarından salgılanmasına rağmen aynı yapıları denetleyen hormonlardır.

V. STH ve TSH doğrudan yada dolaylı olarak vücut hücrelerini etkileyen hormonlardır.

Yarılardan hangileri doğrudur?

A) I ve III B) II ve IV C) III ve V D) I, II ve IV E) I, II, III ve V

33-) Aniden korkup birden kaçmaya çalışan insanda, kas aktivitesinin artması için;

I. Böbrek üstü bezi korteksinin uyarılması

II. Adrenal kortikotropik hormonunun (ACTH'un) salgılanmaya başlaması

III. Hipotalamusun uyarılması

IV. Hipofizin uyarılması

V. Epinefrinin (adrenalinin) salgılanmaya başlaması

Olayları hangi sıraya göre gerçekleşir?

A) I-II-IV-III-V B) II-III-IV-V-I C) III-IV-II-I-V

D) IV- V-III-I-II E) V-I-II-IV-III

34-) ADH salgılanmasını düzenleyen en önemli etken kanın osmotik basıncında meydana gelen değişmedir. Hipotalamusta bulunan osmo reseptörler, kanın osmotik basıncında meydana gelen değişimleri algılar.

I. Kanın osmotik basıncı artarsa ADH hormonu salgısı azalır.

II. Kanın osmotik basıncı azalırsa ADH hormonu salgısı artar.

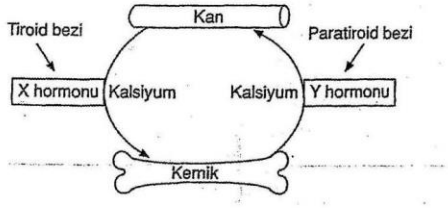
III. ADH hormonu böbreklerdeki kanalcık hücrelerini uyarır ve hücrelerin su emmesini artırır.

IV. ADH etkisiyle vücudun su kaybı önlenir.

Hipofiz bezinden salgılanan ADH hormonu ile ilgili yukarıdaki yorumların hangileri doğru olur?

A) I ve II B) II ve III C) III ve IV D) I,III ve IV E) II,III ve IV

35-)



Kalsiyum metabolizmasını düzenleyen X ve Y hormonları ile bu hormonların salgılandığı bezlerle ilgili olarak çizilen yukarıdaki şemaya göre;

I. X hormonu, kandaki kalsiyumu azaltır.

II. Y hormonunun aşırı salgılanması , kemiklerin yumuşamasına neden olur.

III. X troksin, Y kalsitonin hormonudur.

IV. Troid ve paratroid bezleri kandaki kalsiyum miktarını ayarlarken birbirine zıt çalışır.

yargılarından hangisine ulaşılamaz?

A) Yalnız III B) I ve II C) II ve IV D) III ve IV E) I, II ve III

36-) I. Kan şekerini düşürücü yönde etki yapar.

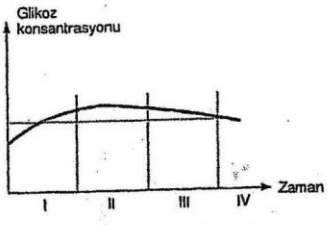
II. Pankreasın α hücreleri tarafından salgılanır.

III. Adrenalin hormonu ile antagonist etkili çalışır.

Yukarıdakilerden hangileri insülin hormonu ile ilgili olarak doğru olur?

A) Yalnız II B) Yalnız III C) I ve II D) I ve III E) I, II ve III

37-)



Sağlıklı bir insanın kanındaki glikoz konsantrasyonunun zamanla değişimi verildiği kabul edilirse , söz konusu zaman dilimlerindeki glukagon konsantrasyonunun çoktan aza değişimi aşağıdakilerden hangisi gibi olmalıdır?

A) I, II, III B) I, III, II C) II, III, I D) II, I, III E) III, II, I

38-) I. Damarları daraltarak kan basıncının yükselmesine neden olur.

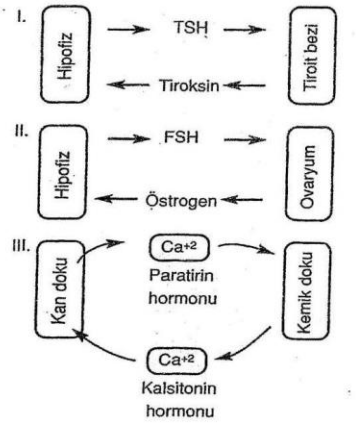
II. Kan şekerini düşürücü etki gösterir

III. Eşey bezlerinin gelişimi üzerinde durdurucu etki yaratır

Yukarıdakilerden hangileri norepinefrin (nöroadrenalin) hormonunun vücut üzerindeki etkilerindendir?

A) Yalnız I B) Yalnız II C) I ve III D) II ve III E) I, II ve III

39-) Endokrin bezlerinin karşılıklı etkileşimi ile kanda hormon dengesinin sağlanması olayı feed back (geri besleme) olarak bilinir.



Yukarıdaki değişimlerin hangileri anılan geri besleme olayına örnek verilebilir?

A) Yalnız II B) yalnız III C) I ve II D) I ve III E) I, II ve III

40-) Aşağıda verilen hormonlardan hangisi karşısındaki olayı gerçekleştiremez?

A) Adrenalin → Kan şekeri seviyesi artışı

B) Parathormon → Kemikten kana Ca^2 iyonu geçişi

C) TSH → Metabolizma hızının artışı

D) Kortizol → Yağ ve proteinden karbonhidrat yapımı

E) Melatonin → Hipofizden FSH ve LH artarak salgılanması

41-) Aşağıdakilerden hangisi, insanda yumurtalıkların, hipofiz bezi faaliyetlerini bir dereceye kadar kontrol ettiğine bir kanıt olarak gösterilebilir?

A) Kanda östrogen artıkça FSH'nın azalması

B) FSH hormonunun foliküleri büütmesi

C) Korpus luteumun LTH etkisi ile parçalanması

D) LH'nın folikülleri korpus luteuma çevirmesi

E) Progesteron salınmasını LTH'nın uyarması

42-) I. Amino asitlerden glikoz sentezini gerçekleştirmek

II. Karaciğerde glikojen sentezini gerçekleştirmek

III. Böbreklerde süzülen sıvıdan Na^+ iyonunu emerek kana vermek

Böbrek üstü bezlerinin korteksinden salgılanan kortizol hormonunun görevleri için yukarıdakilerden hangileri doğru olur?

A) Yalnız I B) Yalnız III C) I ve II D) II ve III E) I, II ve III

43-) I. Hedef dokusu böbreklerdeki idrar tüpleridir

II. Sodyum iyonunun geri emilimini hızlandırır

III. potasyum iyonunun boşaltımını hızlandırır

Görevleri numaralandırılmış olarak verilen hormon aşağıdakilerden hangisidir?

A) Kortizol B) Aldosteron C) Östrojen

D) Testosteron E) Kalsitonin

44-) Aşağıdakilerden hangisi adrenalin hormonunun görevlerinden biri değildir?

A) Vücudu strese karşı hazırlamak.

B) Kan kalsiyumunu kemiklere aktararak azaltmak.

C) Kan basıncını artırmak.

D) Kalp atışını hızlandırmak.

E) Metabolizma hızını artırmak

45-) Aşağıdaki hormonlardan hangisi karşısında verilen anormalliğin nedeni olamaz?

A) ADH → Şekersiz diyabet

B) Tiroksin → Guatr

C) Aldosteron → Tunç hastalığı

D) STH → Akromegali

E) Parathormon → Diyabet

46-) Aşağıdaki olayların hangisinde, böbreküstü bezleri ile pankreasın salgıladığı bazı hormonlar birlikte rol oynar?

A) Ovulasyonun gerçekleşmesi

B) Spermatogenezin gerçekleşmesi

C) Kemik ve kandaki kalsiyum tuzlarının dengelenmesi

D) Süt bezlerinin salgı çıkarması

E) Kandaki glikoz miktarının dengelenmesi

47-) Aşağıdaki hormonal bezlerden hangisinin çalışması hipofizin kontrolünde değildir?

A) Korteks B) Testisler C) Ovaryumlar

D) Pankreas E) Troid bezi

48-) Normal bir insanda, yeterli miktarda su alınmamasına bağlı olarak vücutta su yetersizliği ortaya çıktığında,

I. Hipofizden salgılanan antidiüretik hormon miktarının artması

II. Kanın osmotik basıncının artması

III. Böbrekten suyun geri emiliminin artması

Olaylarının gerçekleşme sırası aşağıdakilerden hangisinde verilmiştir?

A) I, II, III B) I, II, II C) II, I, III D) II, III, I E) III, II, I

49-) _Devlik

_Cücelik

_Akromegali

Yukarıdaki hastalıklar hangi hormonun düzensizliğinden kaynaklanır?

A) Trotopin (TSH)

B) Adrenokortikotropik hormon (ACTH)

C) Folikül Stimulan hormon (FSH)

D) Büyüme hormonu (STH)

E) Antidiüretik hormon (ADH)

50-) * Ovaryumdan östrogen ve progesteronun salgılanmasını devam ettirir.

* Annelik iç güdüsünü oluşturur.

* Meme bezlerinden süt salgılanmasını başlatır.

Verilen fonksiyonların oluşumundan sorumlu hormon ve salgılandığı hangisinde doğru eşlenmiştir?

A) Prolaktin _Ovaryum

B) Lüteinleştirici hormon _Hipofiz bezi

C) Paratirin _Paratiroit bezi

D) Vasopressin _Hipofiz bezi

E) Prolaktin _Hipofiz bezi

Appendix 2: Epistemological Beliefs Survey (EBS)

Açıklama: Bu ölçekte yer alan cümleler sizin bilim, bilimsel bilgi ve bilimsel bilgi kaynaklarına ilişkin düşüncelerinizi içermektedir. Her cümlenin karşısında KESİNLİKLE KATILMIYORUM, KATILMIYORUM, KARARSIZIM, KATILIYORUM VE KESİNLİKLE KATILIYORUM olmak üzere beş seçenek verilmiştir. Her cümleyi dikkatle okuduktan sonra kendinize uygun seçeneği işaretleyiniz.	KESİNLİKLE KATILMIYORUM	KATILMIYORUM	KARARSIZIM	KATILIYORUM	KESİNLİKLE KATILIYORUM
1.Tüm insanlar, bilim insanlarının söylediklerine inanmak zorundadır.	1☐	2☐	3☐	4☐	5☐
2.Bilimsel deneylerdeki fikirler, olayların nasıl meydana geldiğini merak edip düşünerek ortaya çıkar.	1☐	2☐	3☐	4☐	5☐
3.Günümüzde bazı bilimsel düşünceler, bilim insanlarının daha önce düşündüklerinden farklıdır.	1☐	2☐	3☐	4☐	5☐
4.Bir deneye başlamadan önce, deneyle ilgili bir fikrinizin olmasında yarar vardır.	1☐	2☐	3☐	4☐	5☐
5.Bilimsel kitaplarda yazanlara inanmak zorundasınız.	1☐	2☐	3☐	4☐	5☐
6.Bilimsel kitaplardaki bilgiler bazen değişir.	1☐	2☐	3☐	4☐	5☐
7.Bilimsel çalışmalarda düşüncelerin test edilebilmesi için birden fazla yol olabilir.	1☐	2☐	3☐	4☐	5☐
8.Fen Bilgisi dersinde, Öğretmenin söylediği her şey doğrudur.	1☐	2☐	3☐	4☐	5☐
9.Bilimdeki düşünceler, konu ile ilgili kendi kendinize sorduğunuz sorulardan ve deneysel çalışmalarınızdan ortaya çıkabilir.	1☐	2☐	3☐	4☐	5☐
10.Bilim insanları bilim hakkında hemen hemen her şeyi bilir, yani bilinecek daha fazla bir şey kalmamıştır.	1☐	2☐	3☐	4☐	5☐
11.Bilim insanlarının bile yanıtlayamayacağı bazı sorular vardır.	1☐	2☐	3☐	4☐	5☐
12.Olayların nasıl meydana geldiği hakkında yeni fikirler bulmak için deneyler yapmak, bilimsel çalışmanın önemli bir parçasıdır.	1☐	2☐	3☐	4☐	5☐
13.Bilimsel kitaplardan okuduklarınızın doğru olduğundan emin olabilirsiniz.	1☐	2☐	3☐	4☐	5☐
14.Bilimsel bilgi her zaman doğrudur.	1☐	2☐	3☐	4☐	5☐
15.Bilimsel düşünceler bazen değişir.	1☐	2☐	3☐	4☐	5☐
16.Sonuçlardan emin olmak için, deneylerin birden fazla tekrarlanmasında fayda vardır.	1☐	2☐	3☐	4☐	5☐
17.Sadece bilim insanları, bilimde neyin doğru olduğunu kesin olarak bilirler.	1☐	2☐	3☐	4☐	5☐
18.Bilim insanının bir deneyden aldığı sonuç, o deneyin tek yanıtıdır.	1☐	2☐	3☐	4☐	5☐
19.Yeni buluşlar, bilim insanlarının doğru olarak düşündüklerini değiştirir.	1☐	2☐	3☐	4☐	5☐
20.Bilimdeki, parlak fikirler sadece bilim insanlarından değil, herhangi birinden de gelebilir.	1☐	2☐	3☐	4☐	5☐
21.Bilim insanları bilimde neyin doğru olduğu konusunda her zaman hemfikirdirler.	1☐	2☐	3☐	4☐	5☐
22. İyi çıkarımlar, birçok farklı deneyin sonucundan elde edilen kanıtlara dayanır.	1☐	2☐	3☐	4☐	5☐
23.Bilim insanları, bilimde neyin doğru olduğu ile ilgili düşüncelerini bazen değiştirirler.	1☐	2☐	3☐	4☐	5☐
24.Bir şeyin doğru olup olmadığını anlamak için deney yapmak iyi bir yoldur.	1☐	2☐	3☐	4☐	5☐