CREATIVE TEACHING OF ASTRONOMY IN PRESCHOOL AND PRIMARY EDUCATION

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Abstract

The article presents a study of the relevance of the application of creative methods of teaching astronomy in preschool and primary education of Uzbekistan, especially in the context of the modern development of science and technology. During the study, methods for creative teaching of astronomy were developed and described, aimed at shaping children's ideas about the modern scientific astronomical picture of the world. The article analyzes the results of pedagogical experiments, which proved that creative teaching of astronomy significantly increases children's interest in science and contributes to the development of their creative thinking and potential. The main principles of creative teaching of astronomy in preschool and primary education are games, experiments, communication, creativity, and the use of various visualization tools. These methods and principles help children to better understand theory and scientific facts and enable them to participate in activities. Thus, this article can become the basis for the development of new methods and approaches to teaching astronomy in preschool and primary education, as well as for improving the effectiveness of existing methods.

Keywords: astronomy, preschool education, primary education, creativity, development.
Discipline: pedagogy

Absztrakt

A CSILLAGÁSZAT KREATÍV OKTATÁSA AZ ÓVODÁBAN ÉS ÁLTALÁNOS ISKOLÁBAN

A tanulmány a csillagászat kreatív tanítási módszereinek alkalmazási lehetőségeit mutatja be az üzbég óvodai és általános iskolai oktatásban, a tudomány és technológia modern fejlődésével összefüggésben. A tanulmányban a szerzők a csillagászat kreatív tanításának módszereit ismertetik, amelyek célja a gyermekek a világról alkotott elképzeléseinek formálása modern tudományos csillagászat által. A tanulmány elemzi azon pedagógiai kísérletek eredményeit, amelyek bebizonyították, hogy a csillagászat kreatív tanítása jelentősen növeli a gyermekek érdeklődését a tudomány iránt, és hozzájárul kreatív gondolkodás és potenciál fejlődéséhez. A csillagászat kreatív tanításának fő alapelvei az óvodai és általános iskolai oktatásban a játékok, a kísérletek, a kommunikáció, a kreativitás és a különböző vizualizációs eszközök használata. Ezek a módszerek és elvek segítenek a gyerekeknek abban, hogy jobban megértsék az elméleteket és a tudományos tényeket, és lehetővé teszik számukra, hogy részt vegyenek a tevékenységekben. Így a tanulmány alapjául szolgálhat az óvodai és általános iskolai csillagászat tanításának új módszereinek és megközelítéseinek kidolgozásához, valamint a meglévő módszerek hatékonyságának javításához.

Kulcsszavak: csillagászat, óvodai nevelés, általános iskolai oktatás, kreativitás, fejlesztés

Diszciplína: neveléstudomány

Introduction

The current state of society has set the task of restructuring the general education for the lifelong education system. This task involves the development of children's creative potential, which should lead to the modernization of the existing traditional education system. Scientists have established that a student with a high creative potential differs from others in that: has a creative and intellectual initiative, an active life position; - able to generate new original ideas in solving problematic issues; can go beyond patterns and think creatively, resolve conflicts that have arisen; is able to represent ideas from his/her mind and also construct the future result of his activity; a creative child has an original way out of a problematic situation that has arisen in the educational process; a creative one is characterized by a constant research need, which allows him/her to be in a state of constant search for the previously unknown (Runco and Jaeger, 2012). Research of scientists allowed us to identify crea-tive qualities as an integral characteristic of a person, which include imagination, a sense of novelty, originality of thinking, intuition, fantasy, inventing, fine art, logical thinking, etc. (Kaufman and Beghetto, 2009; Mező, 2017; Mező & Mező, 2022). To develop the creative potential of child-ren, the development of a special technology is required, which is the subject of this article.

The model of the process of developing the creative potential of children that we propose consists of three stages, which are applied both in tradetional and innovative forms of education. However, with an innovative form of teaching, the greatest performance is achieved (Cropley, 2010):

- the motivational-indicative stage of the model helps children to formulate the learning task themselves by performing creative tasks and orients them towards learning new material;
- the operational-executive stage allows children to program the process of cognition through the division of the educational task into

private tasks and the solution of problematic issues by organizing individual or group work;

- the reflective-evaluative stage brings children to independent conclusions, assessment and self-assessment of knowledge; Each lesson ends with a creative homework assignment.

The proposed model for the development of the creative potential of children fits well with extracurricular activities, the main components of which are games and research work of the participants. The proposed technology for developing the creative potential of children radically changes the entire course of the educational process. The model allows to organize lessons in a completely differrent way - seminars that activate even the most passive students. In our case, such learning technologies as "technology of technical creativity", "heuristic immersion in the subject", "self-reasoning on the problem", "historical alchemy", "French workshops", "model of binary oppositions", "crossing destinies", etc. help to revitalize the learning process.

It should be noted that there are empirical prerequisites for the development of the creative potential of students.

Pedagogical systems have evolved over time, with notable figures such as Comenius (2012) and Pestalozzi (2012) contributing to early education. Later, educational approaches were developed and improved upon by psychologists and educators such as Piaget & Inhelder (1972), Bruner (1976) and Montessori (2007). Today, the search for new forms of education that can effectively assimilate complex information without mental strain or harm to health continues, with a need for creative collaboration between philosophers, psychologists, didacticists, methodologists, and practicing teachers.

To achieve the goal of developing the creative potential of children and testing the effectiveness of this teaching technology, it was necessary to organize experimental training. The results of the control experiment showed the effectiveness of this teaching technology for the development of the creative potential of children.

The conducted research is aimed at developing the creative potential of children in preschool education and students of a primary school, based on the implementation of the proposed teaching technology. During the study, the works of different scientists on the topic of the article were analyzed and the essence of the concepts of "creativity" and "creative potential" was revealed. At the same time, we consider creative potential to be a broader concept than creativity, supplementing its essence with such criteria as "sensitivity to the problem", "ability to analyze and synthesize, to create the missing details of the object under study", "divergence of thinking".

The didactic requirements for the creative teaching of astronomy in a holistic teaching system are determined. These are the requirements: 1) compliance with the mandatory minimum content of astronomical education, 2) interactivity of models, 3) feedback, 4) providing conditions for the formation of research skills, 5) unity of teaching and controlling functions, 6) diversity of types and differentiation of tasks, 7) compliance opportunities for students and the creation of conditions for individual growth.

In the course of the study, a model for the development of the creative potential of children in astronomy was proposed, consisting of the goal, principles, content of the teaching technology. The organization of experimental training contributed to the successful implementation of this technology.

On the basis of the experiment, the relevance of the problem of applying a creative approach to teaching astronomy in the education system is substantiated. Methods for teaching astronomy with a creative approach have been developed for preschool and primary school education. Based on the study of Beghetto & Kaufman (2010) **a**

structure of the complex of creative tools in astronomy is proposed, which ensures not only the achievement of high results in teaching children, but also the development of their personal growth.

Lesson developments have been created using creative methods in teaching astronomy for pre-school education. The effectiveness of the methodology for using the developed set of tools was experimentally tested and the impact of using these tools on the formation of interest in science, the development of students' cognitive independence and the improvement of the quality of knowledge in physics and astronomy was shown.

As preschool education is the initial link in the system of lifelong education and prepares children for schooling, it is of great importance in preparing for further education in general. That is why the issues of introducing astronomical concepts from early childhood, already in preschool education, should be considered more deeply. And here our task is to introduce elements of astronomical concepts with a creative approach into preschool education. As we know, pre-school education is carried out up to the age of 6-7 in state or non-state pre-school institutions and in the family. A preschool institution is a type of educational institution in the Republic of Uzbekistan that implements general educational programs of preschool education.

Bredekamp and Copple (2008) noted that the purpose of preschool education is to form a healthy, developed, free personality of the child, revealing his abilities, fostering a craving for learning and systematic learning.

The main tasks of modern institutions of preschool education according to UNESCO (2016):

- strengthening the physical and mental health of children;
- formation of the foundations of high spirituality and morality;
- introducing children to national and universal ethical and cultural values, the intellectual development of the child;
- purposeful, systematic preparation of children for schooling;
- development of their individual abilities, giftedness and creativity.

It is creativity that will seriously affect the further development of society (Mező et al., 2017). As we know, teaching how to learn and apply the knowledge gained is more important than simply appropriating a specific set of knowledge. It should be noted that the development of creative potential is one of the most important sources and indicators of the prosperity of our society (Sternberg, 2003). Based on the above tasks, it should be noted that instilling information from early childhood will give good results, including what interests us today, the instillation of elements of astronomical ideas.

According to Hayes (2006) primary education is aimed at developing the foundations of literacy, knowledge and skills necessary for obtaining a general secondary education. Based on the fact that the goal of general secondary education is to equip students with a systematic knowledge of the fundamentals of science, the skills and abilities necessary for activities in various areas of the economy, culture and life, as well as for receiving special education, it is of great importance in preparing for further education (Grigg, 2016).

That is why it is necessary to consider more deeply the issues of introducing elements of astronomical concepts from the very first stages in school education.

The beginning of school education is the basis of the future life of the younger generation. The new primary school standards dictate modern requirements for the conduct of classes (Kaur, 2012). And here our task is to introduce elements of astronomy with a creative approach into the teaching of primary grades (grades 1-4), inside

other subjects. One of these acceptable is "The world around us."

The subject "The world around us" in primary school lays the foundation for the development of children's cognitive interest in such natural and social sciences as geography and biology, physics and chemistry, history and social studies, as well as astronomy. It is designed to accustom children to a holistic, rational achievement of the very surrounding world in which we live (Peacock, 2017; Dockett & Perry, 2014).

According to Contant & Bass (2017) and Buxton & Provenzo (2010) the objectives of the subject "The world around us" are not just the formation of elementary ideas about nature, man and society in their interaction, but also the systematization of this knowledge. As well as familiarity with such methods and tools for studying the world in which we live, such as observation, experiment, modeling, etc. Based on this, it should be noted that the inculcation of elements of astronomical ideas from the initial stages of training will give high results.

Research questions

1. Do teachers use new creative methods in the lessons?
2. Is it possible to substantiate the relevance of the problem of applying a creative approach in teaching astronomy on the basis of an experiment?
3. Does the use of creative methods contribute to the achievement of a higher level in teaching astronomical concepts to schoolchildren?
4. What structure of the complex of creative methods in astronomy ensures not only the achievement of high results in teaching students, but also the development of their personal growth?
5. How effective is the proposed method for applying the developed complex? Is it possible to experimentally test and show the impact of the use of these tools on the formation of interest in Science, the development of cognitive independence of students and the improvement of the knowledge in astronomy?

Method

There are several new teaching methods in creative, playful and interactive forms, that can be used in preschool and primary schools (Table1). Next, we present creative technologies, ways of conveying astronomical concepts in creative, playful and interactive forms of teaching, which we have applied in preschool and school institutions.

Table 1. Creative teaching of astronomical phenomena to children in preschool and primary education. Source: Authors.

№	Stages	Age categories	Name of creative methods and learning technologies
I	**Preschool education**	3-7 years old	Creative games; Technology of "Invention"; Technology of "If ...", Action on the model; Health saving technologies; Integrated learning technology; Collaborative learning;
II	**Primary school education**	7-11 years old	Consulting; The method of semantic vision; Learning together; Error method; Inversion method; Empathy method; Method of projects; Travel method to the future; Synectic's method; Comparison method.

Organization of the pedagogical experiment and its conditions

The purpose of the experimental study was to establish the effectiveness of the introduction of methods for creative teaching of astronomy, the possibility of enhancing cognitive independence and creativity, improving the quality of assimilation of students' knowledge based on creative teaching of astronomy. The given results of psychological-pedagogical and methodical literature served as the basis for putting forward the idea of the study.

The main objectives of the pedagogical experiment were:

1. Finding out the need to create and apply methods of creative teaching of astronomy in the preschool and primary education.
2. Finding out the need to create modern guidelines for the use of creative teaching methods.
3. Checking the possibility of using creative teaching methods, as well as checking the assumption about the effectiveness of the methodology for the integrated application in teaching astronomy, educational and developmental tasks of preschool and primary school, and the development of students' creative, cognition.
4. Implementation of guidelines on the use of creative methods in astronomy and determination of the impact of the integrated use of creative methods on increasing the cognitive independence of students.

Pedagogical experiments were carried out among

Children and educators of preschool institution "Bilimdon" in Tashkent region (Uzbekistan) - Group №9, Group №10 (40 children); Schoolchildren and teachers of primary school №10 of the Tashkent region (Uzbekistan) - Grade 3 "A", Grade 3 "B" (60 children). The experiments were carried out from September 2021 to March 2022 in three stages: 1. ascertaining, 2. main search and 3. final training experiment.

Ascertaining stage

Ascertaining experiment at the first stage revealed the main problems of teaching astronomy. The discrepancy between the existing methods and modern didactic requirements was stated. From conversations with educators and teachers, it was revealed that new methods of teaching astronomy with a creative approach are needed. At the second stage of the ascertaining experiment, a teaching model was created. The ascertaining experiment at this stage consisted in identifying the main problems of the effectiveness of teaching astronomy using creative methods:

- explaining astronomical concepts in preschools, and arouse children's interest in astronomical phenomena;
- explaining astronomical phenomena that can arouse the interest of primary school students in astronomical concepts;
- organizing the preparation of appropriate training for teachers.

At the same stage, the analysis of the state of modern astronomical education began on the basis of conversations with "teachers and students", their questioning and the study of pedagogical experience.

Search stage

In order to test and identify the effectiveness of creative methods and their application in teaching astronomy, it was necessary to organize and conduct an appropriate pedagogical experiment. The purpose of this ongoing experiment was to study the factor on the object of research. Cognitive interest and, as a result, the development of cognitive independence of students is an important reason for improvement and at the same

time an indicator of the effectiveness and efficiency of the learning process. Data on the levels of cognitive independence of students were used as the output variable. The achievement by students of three levels of cognitive independence was considered: reproductive, partially exploratory and research, psychological and didactic aspects of achieving levels of cognitive independence were summarized.

Training stage

The training experiment consisted of conducting lessons using creative methods in astronomy in the preschool and primary education, called experimental ones. The comparison was made with classes where teaching was conducted without the use of creative teaching methods. During the experiment, the requirement of representativeness was taken into account in the selection of experimental and control classes in order to avoid the unreliability of the results of the pedagogical experiment. Since the improvement in the quality of classes and the creative development of students occurs not only from the use of new creative methods and teaching methods, but also from a significant number of other factors, the relationship should not be a functional dependence, but a correlation relationship.

During the experimental work, various research methods were used: observation of students, analysis of diagnostic tests, analysis of the creative growth of students, their degree of participation in the classroom.

In our case of selective observation, the parameters of the entire set of objects to be examined are unknown. They can only be judged hypothetically. To assess these parameters in pedagogy, the null hypothesis is used, which proceeds from the assumption that the observed changes in properties do not depend on the action of an organized parameter, but are determined by secondary, unregulated random causes in the educational process.

Hypothesis

As a null hypothesis H0, we put forward the assumption that the development of cognitive independence did not increase after the experiment, there was no correction of knowledge, skills and abilities. Let us form the opposite hypothesis H1: the application of creative methods of teaching astronomy in preschool and primary education contributes to the development of creative potentials. In the course of hypothesis testing, we will decide which of the statements is true in the light of empirical evidence. Let us take the probability of erroneous rejection of the hypothesis - the level of significance with the usual value of $p = 0,05$. We extract the sample and for the obtained empirical data we determine the statistical criterion and determine the probability of which of their hypotheses is correct.

Correlation coefficient, plotting will be obtained using the Statistica system. The Statistica system is an integrated system for statistical analysis and data processing. Data in Statistica is entered in the form of a table, the correlation coefficient r is calculated automatically.

In the course of testing the hypothesis, a comparison was made of the knowledge and skills of all the participants in the experiment in completing the district diagnostic test in astronomy. During the experiment, the requirement of representativeness was taken into account in the selection of experimental and control classes in order to avoid unreliability of the experimental results.

The experimental group, at the first stage of the experiment, was the group - №9 of the preschool institution "Bilimdon". Group №10 of this preschool institution was chosen as a control group.

At the second stage of the experiment, grade 3 “A” of secondary school №10 was chosen as an experimental class among primary classes. Grade 3 “B” class was chosen as a control class. Children of

a preschool institution, primary school teachers also took part in the expert assessment of the work of students according to the proposed model using creative methods and with a creative approach.

Results

Stage I. The results of the survey of preschool educators

At this initial stage, an analysis of the assessments of educators regarding the use of creative methods in instilling astronomical concepts from an early age showed that most educators believe that creative methods make the process of cognition more visible and develop creative potential by 93%. According to them, only 25% of the creative approach makes the education process more intense. By 45%, creative methods facilitate the assimilation of specific concepts of astronomy. At the same time, they were less gullible about the idea of applying creative methods in line with the preschool curriculum and helping to create the integrity of learning in the next stages of education (Table 2, Figure 1).

After applying the development of classes using creative methods for teaching astronomical phenomena, a second survey of educators was conducted to study the opinions about the possibilities of a creative approach to teaching astronomy (Table 3, Figure 2).

Table 2. Assessment of educators on the possibilities of introducing astronomical concepts with a creative approach in preschool education (before the experiment). Source: Authors.

Survey options	Yes	No	Sometimes
A creative approach makes the learning process more visible and develops the creative potential of children	93%	0%	7%
Creative approach makes the learning process intense	25%	60%	15%
Creative techniques make easier the assimilation of elements of astronomical concepts	45%	24%	31%
The use of creative methods is accordance to the preschool curriculum and helps to create the integrity of learning in the next levels of education	5%	85%	10%

Figure 1. Assessment of educators before the experiment. Source: Authors.

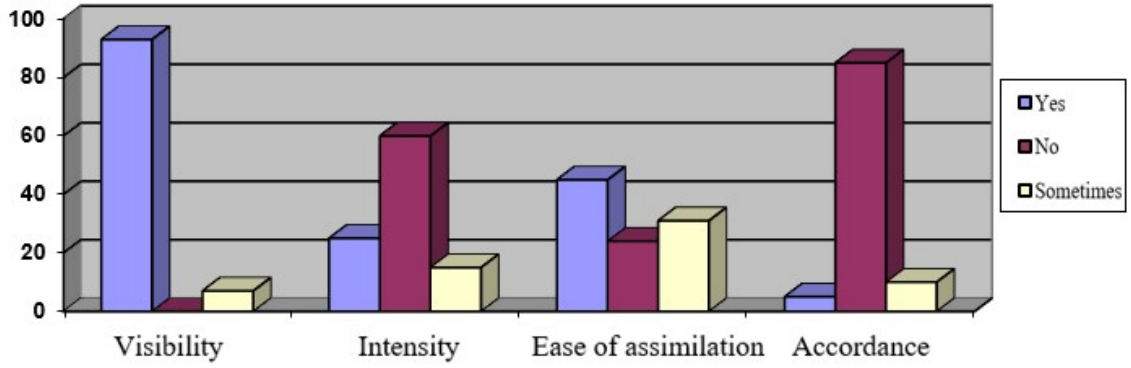
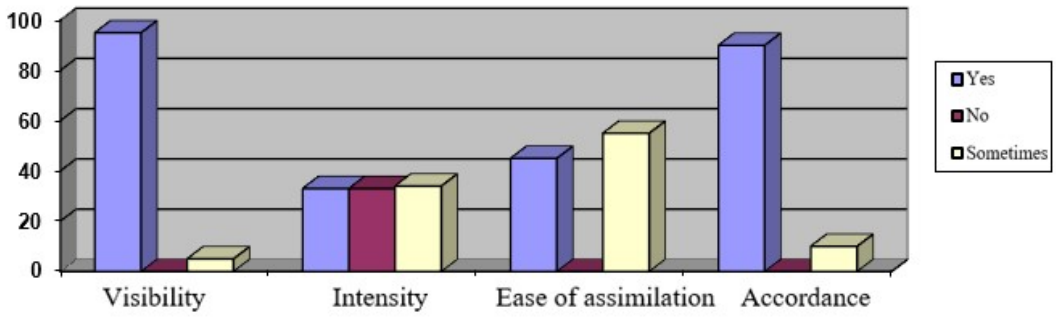


Table 3. Assessment of educators on the possibilities of introducing astronomical concepts using creative methods in preschool education (after the experiment). Source: Authors.

Answer options	Yes	No	Sometimes
A creative approach makes the learning process more visible and develops the creative potential of children	95%	0%	5%
Creative approach makes the learning process intense	33%	33%	34%
Creative techniques make easier the assimilation of elements of astronomical concepts	45%	0%	55%
The use of creative methods is accordance to the preschool curriculum and helps to create the integrity of learning in the next levels of education	90%	0%	10%

Figure 2. Assessment of educators after the experiment. Source: Authors.



As the analysis of the survey shows, after the experiment, the opinion of educators regarding the use of creative methods in instilling astronomical concepts from an early age has changed in a positive direction.

What is very important to note, educators have increased interest in the further application of creative methods, and also noted that this method corresponds to the preschool program and helps to create the integrity of learning in the next levels of education.

Further, to study the state of using creative methods in teaching astronomy, studies were conducted in secondary school №10.

Stage II. Analysis of the survey of primary school teachers

From the analysis of the results of answers to this part of the questions, it can be seen that the number of teachers who use creative teaching methods in the classroom has increased dramatically (from 19% to 58%) (Table 4, Figure 3). Analyzing the answers of teachers to this question of the questionnaire, it can be concluded that the number of teachers choosing a creative type of lesson has increased. It is worth noting that the teachers emphasized that with the use of creative methods, the quality of the lesson has changed significantly, and the interest and discipline of the students have been improved (Table 5).

Table 4. Answers of primary school teachers to question №1. Source: Authors.

Question №1. What modern teaching methods do you use in astronomy lessons?			
	Answer options	teachers' answers before the experiment (%)	teachers' answers after experiment (%)
1)	Cooperation pedagogy	57	40
2)	Gaming technologies	17	16
3)	Problem based learning	42	36
4)	Project method	23	51
5)	Study	15	14
6)	Level differentiation	32	31
7)	Group technologies	27	25
8)	Individualization of learning	18	14
9)	Programmed learning	7	3
10)	Creative teaching methods	19	58

Figure 3. Use of modern teaching methods in primary schools. Source: Authors.

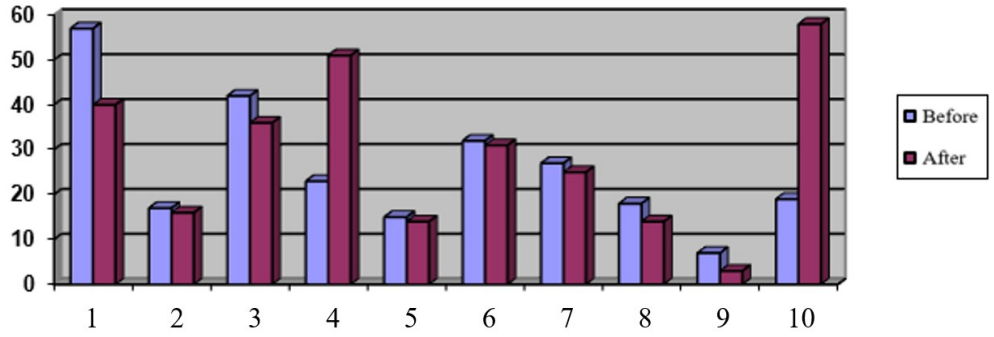


Table 5. Answers of primary school teachers to question №2. Source: Authors.

Question №2. How often do you use the following types of lessons?						
Type of lesson	Before the experiment			After the experiment		
	never	rarely	often	never	rarely	often
Lecture	1	16.5	60	1	17	57
Story lesson	2	11	55	2	10	54
Video lesson	8	29	40	5	23	41
Seminar	3.6	30	36	3	22	33
Research lesson	17	28	3	18	27	3
Conference	11	32.8	6	10	35	5
Creative lesson	37.6	8.2	6	16	18	67

Table 6. Answers of primary school teachers to question №3, Source: Authors.

Question №3. Do you consider yourself ready for active work using creative methods in explaining astronomical concepts?				
Members	Teacher responses before the experiment		Teacher responses after the experiment	
Primary school teachers	Yes	No	Yes	No
	47%	53%	75%	25%

Table 7. Answers of primary school teachers to question №4. Source: Authors.

Question №4. Are you interested in the organization of creative methods in astronomy lessons in the system of continuous education?				
Members	Teacher responses before the experiment		Teacher responses after the experiment	
Primary school teachers	Yes	No	Yes	No
	53%	47%	75%	25%

The analysis of teachers' answers to these questions prompted the development of creative lessons, cooperation with teachers and heated discussions on the further use of such methods step by step, interest is increased in the integrity and continuity of teaching astronomy, as well as its further results (Table 6, 7).

The developed creative methods for teaching astronomical phenomena and astronomy in general, in preschool institutions and for primary grades of schools, were applied in the classroom, tested for effectiveness, amendments were made, recommendations and ideas of primary school teachers were studied.

Search experiment results

The achievement by students of three levels of cognitive independence was considered: reproductive, partially exploratory and research, psychological and didactic aspects of achieving levels of cognitive independence are summarized in the table 8.

In accordance with the main ideas of the study, we set tasks, the solution of which was to confirm the correctness of the proposed hypothesis. During the search stage, tests were carried out. They were attended by groups of participants from preschool and school institutions. Thus, after the results of the test questions, it finally confirmed the assumption that the use of creative methods in teaching contributes to the achievement of a higher level of development of cognitive independence (Table 8).

During the exploratory phase of the experiment, the didactic tasks of astronomy teaching tools, the search for various forms and methodological teaching methods, the search for models of creative lessons in astronomy, the selection and specification of tasks for independent search and research activities using creative methods were identified. Participants noted that one of the benefits of using a variety of creative tools is that participants can organize their work in an interesting creative format. An important part of the search stage of the experiment was the analysis of the practical application of creative lesson development, the search for a structure for advanced training of astronomy teachers, which contributes to the introduction of new creative technologies in teaching astronomy.

Table 8. Psychological and didactic aspects of the formation of cognitive independence through the methods of educational activity. Source: Authors.

Ability Development	**Level characteristic**	**Achieved level of development of cognitive independence**
Development of copying ability	It is characterized by the student's desire to understand, remember and reproduce knowledge, to master the way of its application according to the model. The criterion for this level of activity is the desire of students to understand the phenomenon under study.	Reproductive
Reproducing creative activity	It is characterized by the student's desire to reveal the meaning of the content being studied, to penetrate into the essence of the phenomenon, to know the connection between phenomena and processes, to master the ways of applying knowledge in changed conditions.	Partial search
Development of the ability of constructive and creative activity	It is characterized not only by interest and desire to penetrate deeply into the essence of phenomena and their relationships, but also to find a new way.	Research

For these schools, a chart of the results of the average grades for the two groups was constructed (Figure 4). On the results diagram, built in three dimensions, two areas of correlation were clearly distinguished. The same result can be seen in the more well-known two-dimensional diagrams (Figure 5).

Figure 4. Data entry into the integrated system of statistical analysis STATISTICA. Source: Authors.

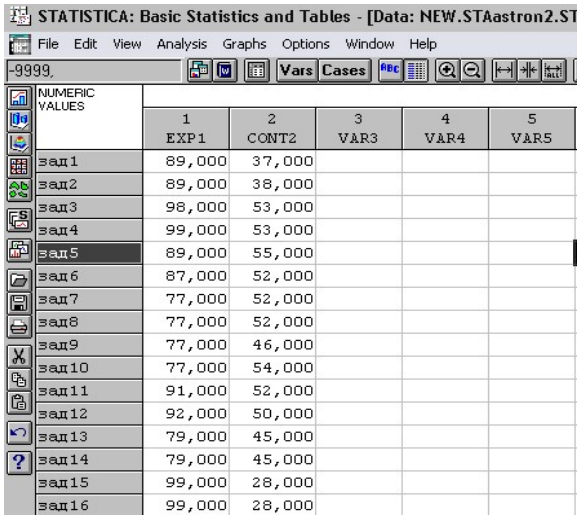
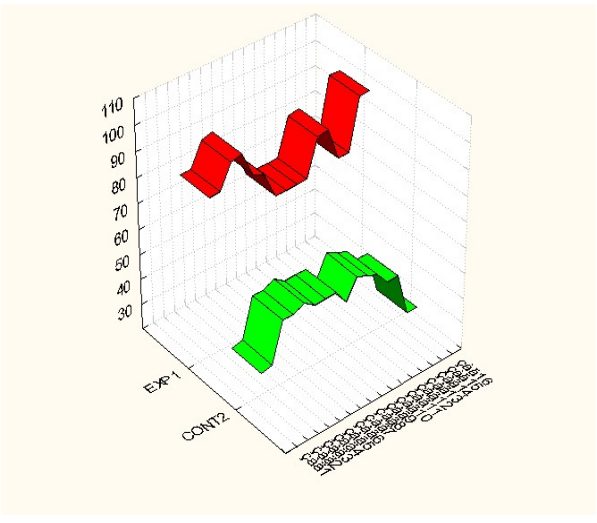


Figure 5. Volumetric diagram of the test results. Source: Authors.



The correlation coefficient r = -0,37, which for p < 0,05 indicates that there is a moderate relationship. A more visual representation of the correlation can be obtained by analyzing the graphs of the dependences of the control and experimental groups relative to each other (Figure 6). Thus, the alternative hypothesis is accepted. Consequently, the distribution of the results of performing diagnostic test after the application of creative teaching methods in the system of continuous education is statistically significant. The analysis of this pedagogical experiment confirms our hypothesis with a certainty of at least 95% that the use of creative teaching methods improve the quality of knowledge, this is not due to random factors, but has a natural character (Figure 7).

Figure 6. Correlation calculation. Source: Authors.

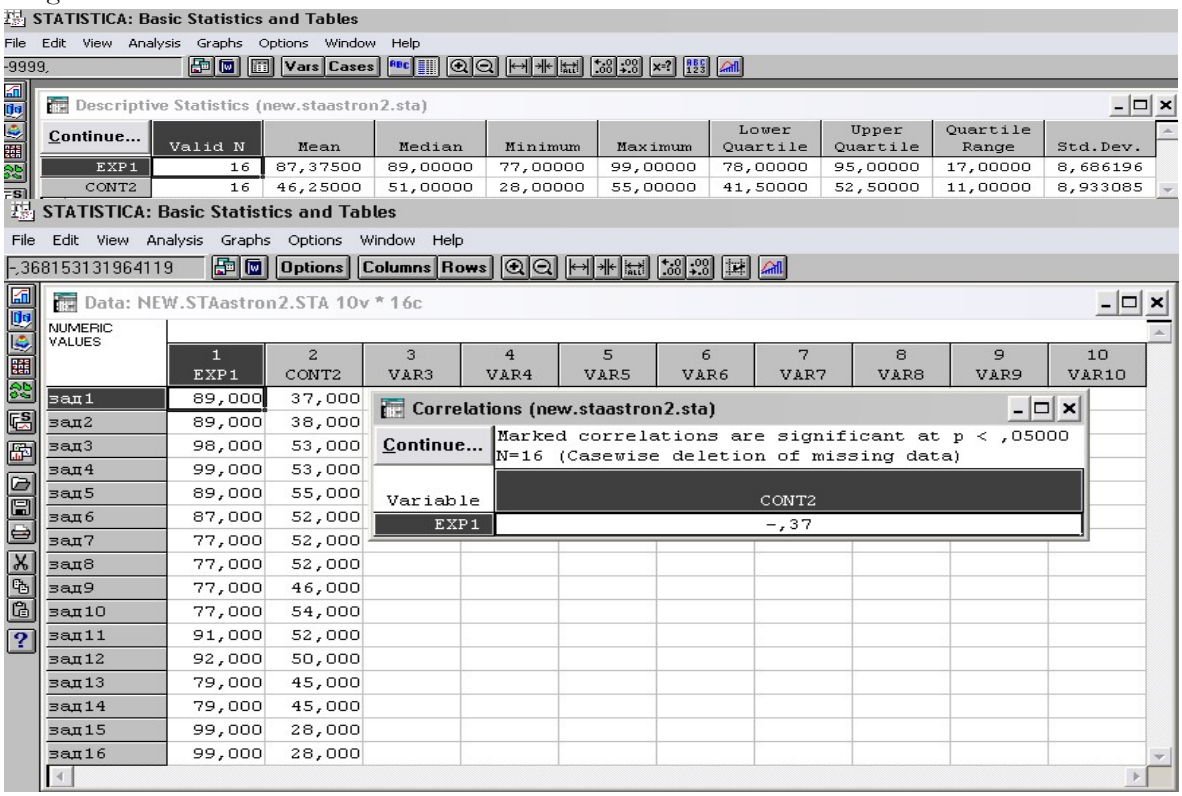
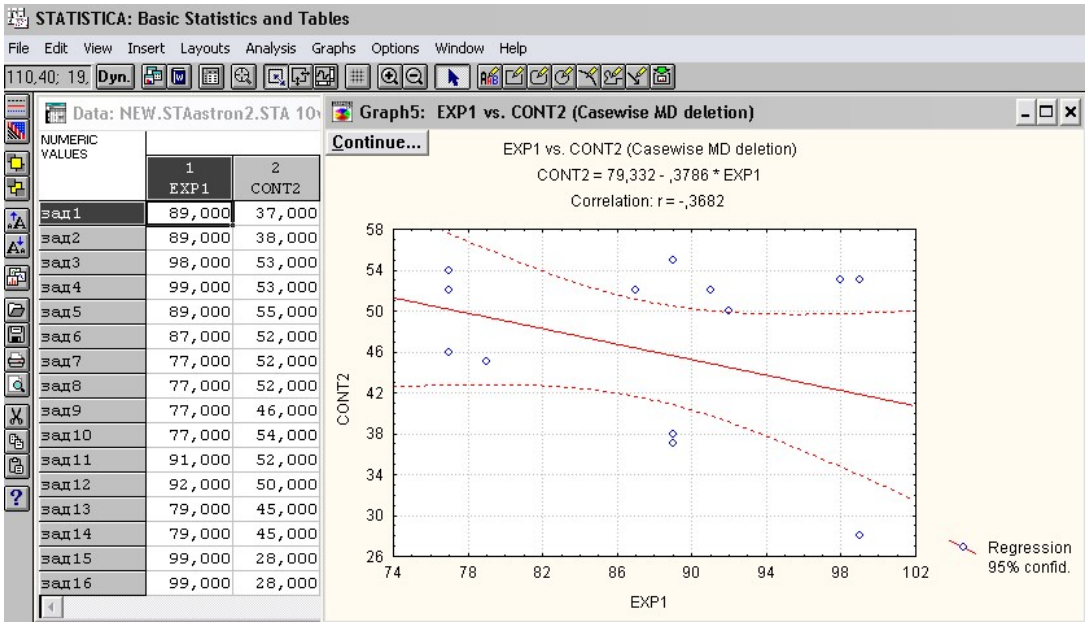


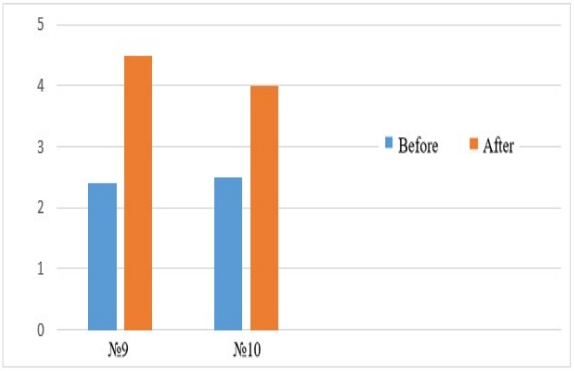
Figure 7. Graphical representation of the dependences of the experimental and control groups with correlation calculation, Source: Authors.



Results of the training experiment

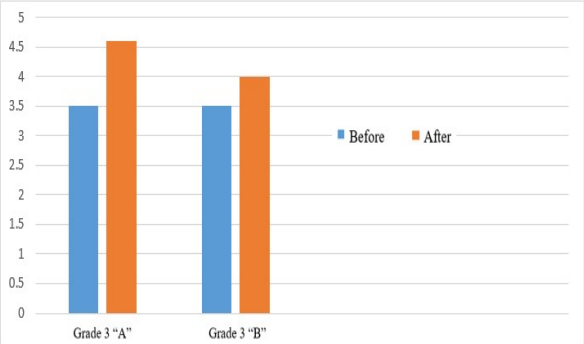
Comparison of the results of the element-by-element analysis of the tests of the experimental and the averaged results of the control classes leads to the following conclusions: the average percentage of completing tasks in terms of complexity is the same for the experimental and control classes, that is, the general trends in completing tasks are the same, but the level of completion of all tasks in the experimental class is higher. Further, we can see this in the following figures (Figure 8), which show the results of the tasks, before and after the experiment, among the experimental and control groups.

Figure 8. The average assessment of the test performance of the experimental and control groups of the preschool institution "Bilimdon". Source: Authors.



The result of the experiment shows that the quality of knowledge and the level of assimilation are higher by 0.5 in the experimental group №9 than in the control group №10 on a 5-point assessment scale.

Figure 9. The average assessment of the performance of tasks in the experimental and control classes of school №10. Source: Authors.



According to the results of the experiment, it can be seen that the quality of knowledge and the level of assimilation are higher in the experimental grade 3 "A", and the average score for completing tasks is 4.6 points, on a 5-point scale. While the average score for completing tasks in the control grade 3 "B" is 4 points (Figure 9).

Discussion

These studies are reduced to the following provisions:

1. The number of teachers using creative methods in the classroom has increased, teachers have begun to apply new creative methods constantly.
2. The complex application of creative techniques contributes to the achievement of a higher level of personal development.
3. Analysis of the results of the pedagogical experiment as a whole confirms the hypothesis with at least 95% confidence that there is a relationship between the use of creative methods and improving the quality of knowledge, achieving a research level of cognitive independence.
4. On the basis of the experiment, the relevance of the problem of applying a creative approach in teaching astronomy is substantiated.
5. Such a structure of the complex of creative means in astronomy is proposed, which ensures not only the achievement of high results in teaching students, but also the development of their personal growth.
6. The effectiveness of the methodology for using the developed set of tools was experimentally tested and the impact of using these tools on the formation of interest in science, the development of students' cognitive independence and the improvement of the quality of knowledge in astronomy was shown.

Conclusion

In conclusion, the study presented in this article highlights the importance of using creative methods of teaching astronomy in preschool and primary education in Uzbekistan. The article discusses the theoretical and practical aspects of creative teaching of astronomy and presents various methods and principles that can be used to make learning more effective and enjoyable for children. The results of pedagogical experiments conducted as part of the study demonstrate that creative teaching of astronomy can significantly increase children's interest in science and contribute to the development of their creative thinking and potential. This study has important implications for the development of new and improved methods of teaching astronomy in preschool and primary education, and for promoting the scientific and creative potential of children in Uzbekistan.

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