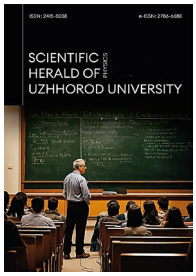
Scientific Herald of Uzhhorod University
Series "Physics"
Journal homepage: https://physics.uz.ua/en
Issue 55, 1205–1216
Received: 20.10.2023. Revised: 27.01.2024. Accepted: 18.03.2024



DOI: 10.54919/physics/55.2024.120bt5

Teaching natural sciences through English for the development of creative activity

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Abstract

Relevance. The relevance of this study lies in the problem of developing the creative abilities of students of pedagogical universities at the level of integrated natural sciences teaching using English, which will allow them to develop their professional competencies at a high level.

Purpose. The purpose of the study is to formulate a model for the development of creative abilities of future teachers based on integrated learning in the framework of natural disciplines using the English language.

Methodology. The leading techniques for the study of this problem were the tests developed by N.P. Fetiskin, V.V. Kozlov, G.M. Manuilov to assess the degree of the creative potential of a person on a par with its implementation to demonstrate their skills at a high pedagogical level and create adapted conditions for cognitive and active work in the classroom with their future students, using the creative component. This component is responsible for many factors at the personality level of the future teacher, along with the ability to organise and conduct high-quality classes in natural subjects in English at the level of integrated learning, with a competent individual approach and a full-fledged discussion.

Results. The identified data enabled the creation of a model for organising the development of creative activity among future teachers during integrated lessons in natural sciences using English. This contributes to the deepening of knowledge in the areas under study with the accompanying substantial opportunities for creative development by including the examination of international thematic journals in English in the educational process, watching specialised integrated popular-science documentaries.

Suggested Citation:
Konyssova A, Atemova K, Konarbayev Z, Omarova G, Konyssova S. Teaching natural sciences through English for the development of creative activity. *Sci Herald Uzhhorod Univ Ser Phys.* 2024;(55):1205-1216. DOI: 10.54919/physics/55.2024.120bt5

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Conclusions. The results improve the understanding of the target area of the integrated lesson in the scientific and practical sphere on the investigation of natural phenomena and develops an understanding of the importance of relationships in life and a value attitude to nature, which determines its practical importance for the field of education.

Keywords: integrated learning; foreign language; natural science subjects; educational materials; education.

Introduction

At present, technical progress is evident; it has been successfully applied in education to improve the conduction of various classes, strengthening the understanding of the essence of disciplines [1]. Given this interaction, which is necessary for the development of the creative component of the personality, it is the visibility and visualisation that enable a better perception of the integrated level of knowledge. This is possible by creating a general appearance, an image that is easier and more familiar for perception and understanding at a deep level, including functioning with targeted knowledge of the basics, expanding the boundaries of views with a versatile vision and design, which is also crucial in the educational process implying most of the presented information to be limited by the boundaries not necessary, but limiting students in their creative motivation [2]. In this case, the design does not mean the semantic ideological part of it, but the level of elements for subject study, fundamental for personal perception and creative fulfilment, which are among the main ones in developing creative abilities. The creation of conditions that restrain creative manifestations of personality does not carry valuable elements in learning, but on the contrary creates conditions for the suppression of both mental and activity-motivated work of the student during their education, which leads to the fade of their interest in learning and suppresses their qualities [3].

Integrated English language teaching enables the preparation of specialists able to communicate fluently in one or more foreign languages, not only in the field of everyday communication but also in their professional activities. The mechanisms of integrated English language teaching assume mandatory consideration of a number of aspects necessary for effective classes: linguistic, communicative, and substantive. A complex combination of these aspects in the learning process allows for achieving the desired result and preparing a qualified specialist. The essence of the mechanism of gradual listening to educational material in English is to develop students' skills of perception of educational information, with its repetition, if necessary, which allows them to enter the educational process smoothly. Step-by-step listening is performed with the direct involvement of the teacher since there is a need to explain the difficulties that inevitably arise for students who do not speak English fluently and those who have not studied this language at school.

The current trend of modifying the educational process should consider all the features that affect the psycho-emotional component of perception, which allows the student's talents to be identified [4]. Notably, each element of creativity has common factors and is within the limits of taste preferences, depending on their emotional state, and considering the state of negative influence on the emotional background. Therefore, it is essential to design the educational process in such a way that teachers simultaneously exclude the areas of creative personality manifestation in the negative area and create a positive, friendly emotional background for learning, which will predispose to a productive educational process with an increase in motivation for self-expression and fulfilment, the disclosure of talents and student's creative potential. Ultimately, talents and inner inclinations are expressed in individual preference against the background of internal values with a motivated and semantic component in life. They will be reflected at the level of any activity within the framework of creative expression, both in communication and mental, physical, and other activities. However, considering the lack of a moral component in students, both in their personal and in the lives of others, the development of creative activity should be within the framework of correction towards value motivations, moral foundations of life and a careful, safe attitude to health and nature, which is of paramount importance at all levels in the global trends of management and development of a prosperous life [5]. The development of students' creative abilities in the study of natural sciences in English achieves the greatest effect when students include the mechanism of reflection. It is a mental process in which students begin to think critically, analyse the information received and make adequate conclusions.

The purpose of the study is to formulate a model for the development of creative abilities of future teachers based on integrated learning in the framework of natural disciplines using the English language.

Materials and Methods

In the study, diagnostic testing methods were used to identify the main factors affecting the creative sphere of the individual according to the development by a group of authors, including N.P. Fetiskin, V.V. Kozlov, G.M. Manuilov [6], which allows determining the degree of creative potential at the functional level. It enables the implementation of their creative activity and, based on rapid diagnostics, highlights the values of the individual, which together will emphasise the motivation criteria. The component of the individual's creative activity will be aimed at this, based on internal preferences and motivations, which, when creatively expressed, have a profound impact on others in their creative manifestation, including its material, figurative, semantic, and emotional components, and collectively determining the further development of the personality depending on the image created on health, emotions, attitude to other people and the world. This statement is vital since the respondents are future teachers, and their creative activity will affect the health and quality of life of their future students, which is of particular importance in the field of education and imposes responsibility for their upbringing along with preparation for the cognitive activity, clearly expressed through creative elements that affect self-determination, health, and the worldview of the student contingent.

The study was conducted in several stages; at the beginning, students filled out a questionnaire to assess their creative activity based on the qualitative perception of their

talents in their various manifestations, which, with detailed analysis, enables the determination of the creative potential of future teachers according to the choice of the degree of influence on a 9-point scale of 18 semantic, qualitative statements. The second stage included the subjection of respondents to an express questionnaire of value properties that determined the area to aim their creativity while studying the factors of natural science subjects. This diagnosis is based on the authors' developed method, and it strengthens the level of understanding of the data obtained during testing in the first stage. It consists of 16 statements that, with in-depth associative analysis, pedagogical observation and refinement, will identify the value characteristics of the subject. The third stage included an analysis of the interrelationships of the data obtained with a generalisation of the impact on the educational process, the interest in learning at the level of manifestation and the development of the creative activity.

The results of the data obtained were calculated using ready-made keys. A detailed analysis enabled the determination of the main parameters for the model that develops creative abilities in pedagogical students based on an integrated approach to teaching natural science using an international foreign language. Standard methods of mathematical calculation and graphical representation of the data were used to calculate the results. The pedagogical experiment was conducted based on Khoja Akhmet Yassawi International Kazakh-Turkish University in Turkestan, Kazakhstan. The study involved 127 1-4-year students at this university in the age category of 19 to 27 years. The highlighted problem was investigated in three stages. In the first stage, a theoretical and analytical investigation of the available studies and methodological literature on the problem was conducted as part of the creation of a model for the development of creative activity in particular conditions, the existing problem and goal were identified, research techniques were selected, and a work plan was developed. In the second stage, diagnostic testing of students and most of this experiment were conducted with a detailed analysis of the results and formulation of conclusions. In the third stage, the data were verified, the conclusions were clarified, and the results obtained were systematised.

Results and Discussion

The results obtained during this pedagogical experiment were analysed using a system-active approach, which determined the main constituent elements and parameters for a model that can successfully develop creative potential of pedagogical students during the integrated process of studying the natural-scientific disciplines in English, which contributes to the disclosure of the semantic application of a creative approach based on the experimental way of pedagogical activity. Understanding creative self-fulfilment within the framework of the educational process is an active approach to the results obtained. It contributes to the awareness of the tactics of an individual approach, based on the development of creativity and many existing components already created and used as a platform for initiatives and analysis with a greater understanding of subjects and disciplines within the study of nature on an integral level. The exchange of experience with the international component also raises interest in the educational process and independent activity, strengthening motivation and deepening knowledge in a given area [7-10]. The pedagogical experiment was preceded by the preparation of students for the learning process in English. For this purpose, a number of relevant events were held, in particular:

- a list of special terms that are mandatory for understanding the essence of the subjects of study was compiled;
- a plan of special classes with students who do not have a school base of English was drawn up to facilitate their entry into the educational process;
- the training programme was compiled and integrated into the schedule of classes in other academic disciplines to ensure the coherence of the integration of the educational process and its compliance with the tasks set in the experiment;
- the sequence of students' entry into the integrated learning process was determined with interim knowledge controls and a series of advisory classes.

Preparation for entering the integrated learning process took from one and a half to two weeks. During this time, a base was prepared for students to enter the integrated learning programme in English. The procedure of gradually listening to science in the chosen language assumes the possibility of returning to the undigested fragments for repetition. After completing the preparatory course, an interim knowledge test was conducted with the students to determine their ability to perceive the programme information provided in a foreign language. During the pedagogical experiment, the following mechanisms of integrated English language teaching were used:

- creation of a certain structure of classes, involving knowledge, skills, and the results of the analysis of the curriculum material using the methods of other programme disciplines;
- conducting classes with students in non-conventional formats, involving collective interaction and engaging everyone without exception, to maximise involvement in the learning process;
- establishment of interdisciplinary, informational, educational space and exchange of large volumes of educational data.

Integrated English language teaching contributes to the systematic implementation of the principle of teaching natural sciences to students at a pedagogical university [11-13]. The introduction of integrated learning mechanisms contributed to developing new knowledge, skills, and abilities among students, based on their already accumulated experience in other disciplines. The result is an increase in the overall efficiency of the educational process, the assimilation by students of new practical skills of working with educational materials, and the development of their highly professional competencies and creative abilities. Students in the conditions of integrated teaching of natural sciences in English are actively involved in the educational process, developing independence in learning and aptitudes in specific subject areas, including mastering English [14; 15]. The educational process is thereby enriched, and students get the opportunity to study programme disciplines from different sides previously unknown to them. The use of

integrated student learning mechanisms in English allows effectively solving the following tasks [16-20]:

1. To strengthen motivation to study natural sciences by saturating the course with interesting information and conducting practical classes for its visual assimilation.

2. To orient reading in English to specific subjects and areas of knowledge to achieve optimal results.

3. To increase the volume of speech practice to consolidate the knowledge gained in studying natural sciences.

4. To strengthen the skills of independent work on individual sections of the course.

5. To increase the level of creative activity of students in the learning process.

The language aspect of integrated learning involves a set of lexemes necessary to express a certain amount of knowledge on a particular subject in English. The communicative aspect of integrated learning can be implemented through the purposeful use of selected lexemes to solve certain tasks of building communication. The subject-content aspect of integrated learning involves the preliminary choice of factual information on the subject under study to prepare students for the course. Techniques and forms of organisation of classes on teaching natural sciences using the English language [21; 22]:

1. Role-based group method. It involves alternating the roles of students during the lesson, in which a part of the class prepares group reports in English on a particular subject and asks questions about the covered material. Afterwards, the groups change places when moving on to the next subject.

2. The method of practical repetitions. It involves repeating the material covered with its presentation in English and highlighting important aspects. During the lesson, all students are actively involved, without exception.

3. A collective practical training. It involves discussing the fundamental aspects of the natural science disciplines using highly specialised terminology and promotes better assimilation of highly specialised terms typical for specific areas of the natural sciences.

4. The seminar. The subjects of the reports relevant to the curriculum are distributed among the students in advance and the order of speeches is determined. A series of seminars throughout the semester covers all sections of the relevant natural discipline programme and involves all students.

Difficulties in reading in English were mainly associated with the insufficient vocabulary of students who did not study the language at school. The situation was resolved by weekly issuing a certain number of special terms for memorisation with regular testing by the teacher. As students assimilated special terms, the number of classes in English gradually increased. Monthly, 3 to 6 academic hours were added to the training plan, depending on students' speed of assimilation of the programme. An interesting and relevant presentation of knowledge within natural science subjects that can be provided at the present stage of education can be conducted with the use of English, which, by increasing the motivating component, will create conditions for activating individual qualities in the classroom and during independent work, including outside the scheduled time. This is an essential factor for the development of a creative component at a conscious level for obtaining and advancing self-education and the level of cognition with the acquisition of professional competencies and their timely improvement, considering the actualisation of new data that allow strengthening cognitive function at the personal level [23]. This study considered the personal qualities of the students and their value motivations. They were identified and compared with the analysis of the psychological and pedagogical foundations to determine the effectiveness of the educational process and develop the creative activity. The creative and cultural image and teaching manner with a positive result of ensuring creative activity regarding its influence on the cultural and aesthetic component of life and safe behaviour towards health and well-being including environmental component were also considered [24].

The use of English in the educational process creates conditions for a relevant form of presenting knowledge, considering the use of high-quality and professional level of information in the context of the international exchange of the knowledge of nature, including the scientific component of an integrated approach in the study of natural disciplines [25]. The conditions of the modern world, with its technological component, provide the best information material for use in classrooms within the framework of health preservation. This allows attending classes with interest and seeing scientific achievements at the world level, which are reflected competently and successfully to preserve the well-being of the habitat and the flow of life, considering a generalised understanding of the structure of concepts in the field of natural science and related disciplines. These disciplines, in their entirety, can reflect the fullness of the situation and the dispensation in this area. The considered level of information cooperation at the international level will strengthen the professionalism of teachers and expand the boundaries of their perception of teaching techniques, which always use a creative component and involve activities that, besides the primary purpose, develop creative potential. The above successfully modifies and combines different pedagogical approaches for a more individual presentation of knowledge with a sensitive attitude to the needs of future students. At the level of perception of their needs, it would be possible to select forms of selective emotional and active approaches to the presentation of the information component, to strengthen the communication contact between the teacher and the student. In turn, this contributes to better assimilation of knowledge, active work in the classroom and the disclosure of talents, and the appearance of creative prerequisites for the potential development of personality at a high level [26].

The natural subjects, as disciplines with an integral approach, have essential aspects for life in their structure from the perspective of practical application; therefore, pedagogical interaction at the level of analysing documentary popular-science films in the field of natural sciences, familiarisation with and analysis of information in international journals on natural science in English will create favourable conditions for obtaining comprehensive information based on the profound knowledge of highly developed countries and leading research institutes with a competent presentation and an overview of a beautiful

visual range. Furthermore, applying the described knowledge, experience, and material in the pedagogical sphere will ensure originality in the presentation of the information and its integral combination, which will also help visually perceive the knowledge about nature. The above will allow future teachers to become successful and highly qualified specialists who possess the most relevant knowledge and skills in the field of natural sciences and learning English involving creative approach, which also contributes to improving the quality of modern education at the theoretical and practical level and increases the various competencies necessary for the future teacher, helping them to conduct their professional activities effectively and productively [27]. Such knowledge in the presented new pedagogical form at the level of model development, considering the profound personal perception and awareness created as a result of the conditions described above, will allow students to acquire the skills concerning the application of the subject in practice. This structure aims to initially teach students in such a way that they form an eco-oriented view of the application of knowledge in various fields and disciplines, which will allow them to use it at a high level and consider the preservation of ecology, well-being for society and nature, and execute the main the purpose of studying the natural subjects [28].

The considered information cooperation will also allow future teachers to identify their professional prerequisites, talents, interests, creative abilities, activating personal creative activity. It carries a generalisation of pedagogical elements and can be manifested in the presence of both an information component with its visual part and an interest in the subject area of natural sciences. Moreover, considering the level of perception in English, it could strengthen communicative connections. In addition, the creative activity that will develop by applying the model allows future teachers to manifest themselves within the interaction and study of changes in natural science. This promptly improves the professional pedagogical level and contributes to international scientific knowledge exploration. Thus, teachers can present themselves more competently using a large arsenal of pedagogical tools with an increased level of organisation of theoretical and practical classes. This is possible only from the position of creative activity, along with the submission of information, considering the international cooperation in the scientific environment. Such cooperation is based on active scientific work in the field of cognition of nature and the structure of the world, considering the great capabilities of world research institutes which publish their findings in popular scientific journals and create documentaries based on them, in which the information is told and illustrated in detail for better perception and familiarising a wider audience with the conclusions reflecting the current discoveries of natural sciences [29].

Therefore, a model for developing creativity among future teachers within the framework of integrated lessons in natural science using English considered the above-described possibilities. As a result, the elements that will contribute to the development of creative activity in the classroom imply the introduction of the examination and analysis of information published in international journals, studies in English, and specialised popular-science documentaries based on research in the field of natural science, also presented in English, which, if necessary, can be duplicated by a translator for a better cognitive process of special terminology, which deepens understanding of the subject and teaches professional speech and terminology in international language, increasing the communication component of future teachers. This form of development of the creative component has many advantages, and reviewing new achievements from the global scientific environment will not only allow students to improve their knowledge in natural science but also teach them to identify associative and logical chains using the provided examples, improving understanding of nature with all its diversity and aggregates, which will also allow future teachers to form value motivations that will be aimed at preserving and restoring all parts of the natural component and ecosystem, considering the vastness of the universe, implied by the scientific area of natural disciplines from an integrated point of knowledge, meeting its main criteria [30].

Thus, the totality of the components described above and their complex consideration covers the organisation of a new pedagogical model for the development of creative abilities among students of pedagogical universities based on integrated lessons in natural science from the perspective of using English as part of the pedagogical process at all levels of its practical application, including methodological features for successful personal development with the acquisition of practical skills and knowledge in the relevant field, which will also be accepted as a result of the functioning the formulated model of creative development. The developed model was introduced into the educational process of the selected university in several stages; at the beginning, creative abilities and value-motivating components were determined to understand precisely how the future teacher will apply their creative ideological positions in their activities with an evaluation factor based on the influence of the creative component on the successful development, with the condition of maintaining health at all levels. The second stage involved the development and implementation of the above-described model in education at all levels. The study covered 127 students receiving pedagogical education. As the results of the study demonstrated, most future teachers have creative potential at an average level, and most of the remaining students had a low degree. Only a sixth of respondents have developed creative abilities, which is displayed in Figure 1.

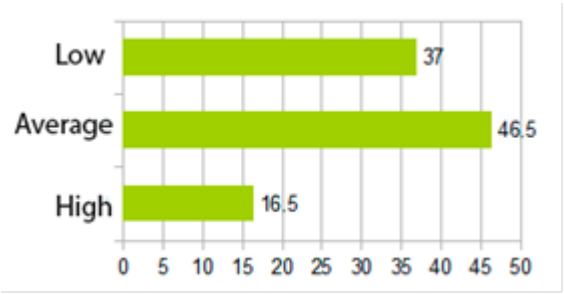

Figure 1. Distribution of students in percentage ratio depending on their level of creative development

The analysis of the test allowed identifying the components that affect creative activity, the data of which are presented in Figure 2.

Figure 2. The percentage distribution of students depending on detailed results of their creative development

Considering that creativity can have different areas, consequences for personality development, and the level of impact on the emotional and physical component of life (both positive and negative), additional testing of students was conducted on their motivated personal manifestation. The criteria were: the moral sphere concerning the life and health of both people and the surrounding world; the effectiveness of their activities in creating benefits for life and indifference in this area from their actions, which, when examined in detail, can aggravate and worsen life situations and the health of others, and initially to suppress, frighten, morally humiliate others, which was assessed as worsening the component of the surrounding life. The obtained data of the personal target determination demonstrated that only a fourth of the students want to bring a positive component to the educational process at all levels for the successful development of the student's personality and the improvement of their life with the maintenance of a positive emotional background. The rest, in their totality, or considering an inert perception of their words, actions, and behavioural reactions that will be imposed on the course of students' lives, are those who consciously consider their future professional activity under the influence of an aggressive-suppressive factor that initially suppresses and harms both health and the entire atmosphere of the educational process with the oppression of personal qualities of students. The generalised results, based on the parameter of the positive and negative influence of the individual creative component, are displayed in Figure 3.

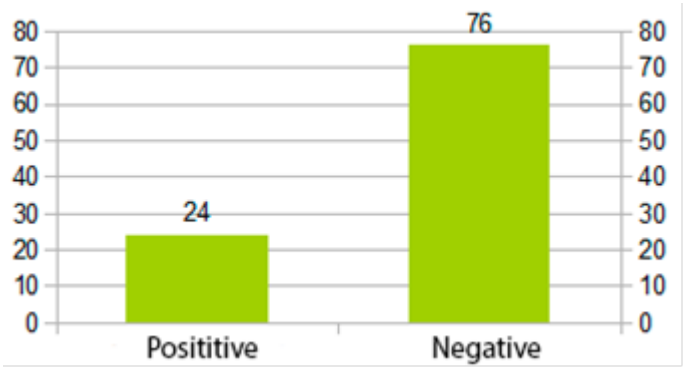

Figure 3. Distribution of students in percentage ratio depending on their personal creative fulfilment

The data obtained show that initially, students who receive pedagogical education need to create value motivations and realise that in their professional activities, they must develop the personality of students at the level of preserving their health, including psycho-emotional, which directly depends on the emotions arising from visiting lessons and communication with teachers. Future teachers, developing their creative abilities, should aim them at a creative area that improves the conditions of students' stay in the appropriate institution and strengthens the individual approach to students. In fact, as part of the development of the creative activity, future teachers need to form a psychological culture of health preservation and environmental orientation, which will reflect the relevance of the area of pedagogy in general and influence the conduct of their professional activities with creative

implementation within the framework of a positive impact on students [31]. The pedagogical clarification also identified that most teachers want to develop creative potential, which is reflected in Figure 4.

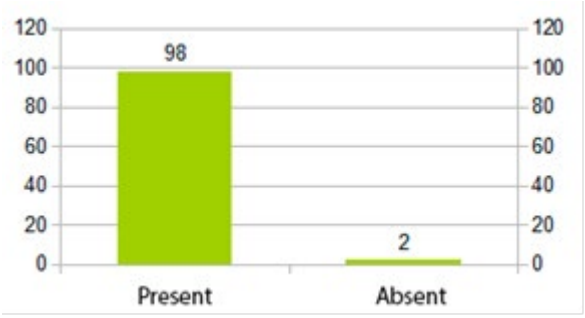

Figure 4. Distribution of stud ents in percentage ratio depending on whether they have aspirations regarding personal creative potential development

The result of creative activity affects the appearance of emotions that profoundly impact students` personalities and the development of their attitude to the world around them, explored within the natural sciences framework. Therefore, creative abilities should be aimed at improving and perfecting the splendour of the environment, the world, and cognition of nature; teachers should open the world to the planet's population from the level of their deep knowledge on the cultural and aesthetic levels. This will develop a worldview for the restoration and preservation of nature, which is the basis of the semantic orientation of the study of natural science subjects. The creative component should initially develop on the example of the positive application of knowledge in the field of natural science and with a competent prioritisation for proper understanding in productive communication and future activities with students, allowing them to develop harmoniously in the created conditions, both concerning the emotional background and physical stay in an educational institution on the laid foundations of healthy development of their personality with the productive development of their creative abilities. The described is possible only with the established level of the positive, creative potential of the teacher, which is expressed in their creative activity. Such potential will allow future students to express themselves at different levels of their knowledge, and they will be provided with a sharp correction in their educational activities aimed at successful development and improving the prosperous component of life. This should be reflected by the laws of pedagogy and its main areas. Creative potential should be enhanced by the level of knowledge received during theoretical and practical classes in natural sciences, generalised in integrated education with English, which will create conditions for creative potential and activity, both for the teacher and their future student [32].

From this position, the elements were identified that generalise allow creating conditions for the development of creative abilities in the above-described level of influence of the creative component on the personality of the individual. It enabled the establishment of a pedagogical model for organising the development of creative activity among future teachers within the framework of the scientific originality of the study. It is implemented at the level of conducting lessons in natural sciences with an integrated character based on the use of English and includes the investigation of international scientific journals in a foreign language, popular-science documentaries on natural science and related disciplines with subsequent discussion. Such actions help cognise a positive image and expand the boundaries of perception at the level of existing models of presenting knowledge in the world and relevant scientific discoveries, teach in-depth thinking and analytical process, and increase academic performance. This will contribute to understanding the importance of developing and allowing others to express themselves on a positive, creative level from the constructive perspectives of the results obtained during the course of creativity, aimed at improving the world's well-being. Within the framework of natural sciences, nature should be perceived at the level of the planet and the universe, expanding the boundaries of the worldview on preserving, restoring, and saving the entire natural component of life [33]. At the control stage of the study, the developed model was put into practice as a pedagogical experiment, after which repeated testing was conducted to identify the creative component of the surveyed students. The results are displayed in Figure 5.

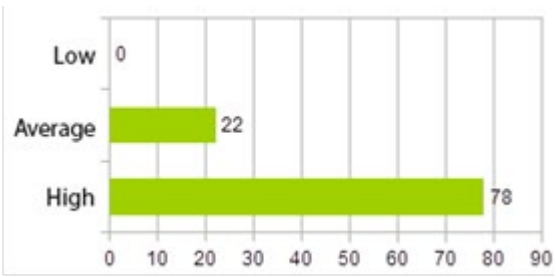

Figure 5. Distribution of students depending on the level of their creative development at the control stage of the experiment

A detailed study of the selected diagnostic test identified positive trends at the level of increasing qualitative indicators of creative activity, the data of which are reflected in Figure 6.

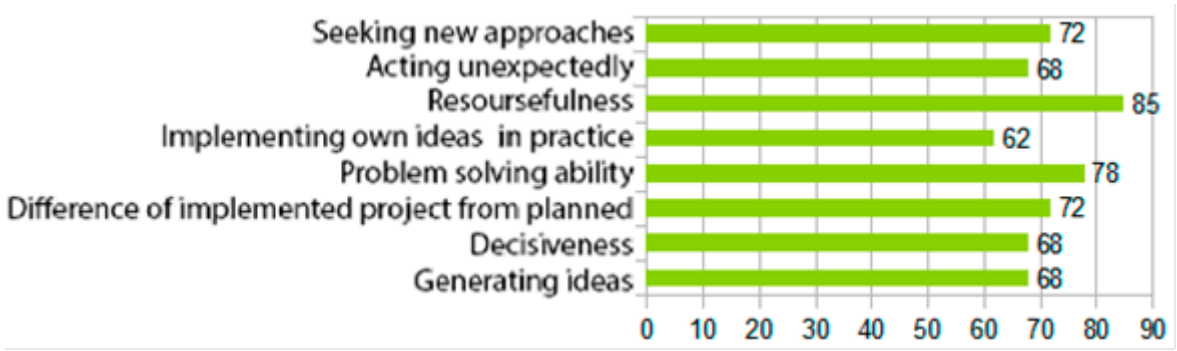

Figure 6. The distribution of students depending on the level of their creative development at the control stage

The pedagogical clarification identified the positive attitude of future teachers to the application of the newly developed model of teaching natural science subjects while using the English language to improve the creative activity, which is displayed in Figure 7.

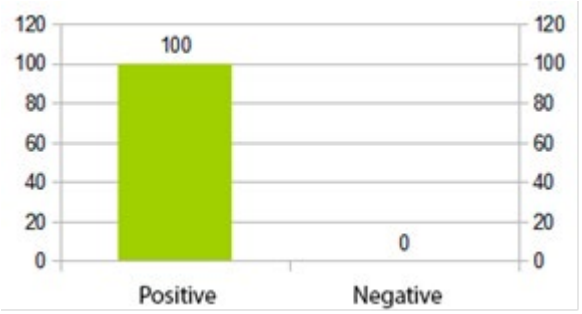

Figure 7. Distribution of students depending on their attitude to the application of the developed model at the control stage

The dynamics data displayed the effectiveness of the created pedagogical model for the development of creative activity at the level of studying natural sciences using the English language. Figure 8 shows a diagram of the change and growth of foreign language skills among natural sciences students. The percentage ratio reflects the students' mastery of reading (1), writing (2), oral presentation (3), and listening (4) in English at the beginning and end of training. As follows from the presented data, the use of integrated teaching techniques in natural sciences has a positive effect on the development of students' skills in mastering English. For example, if these skills were present in 20-25% of students at the beginning of training, numbers reached 75-85% by the end.

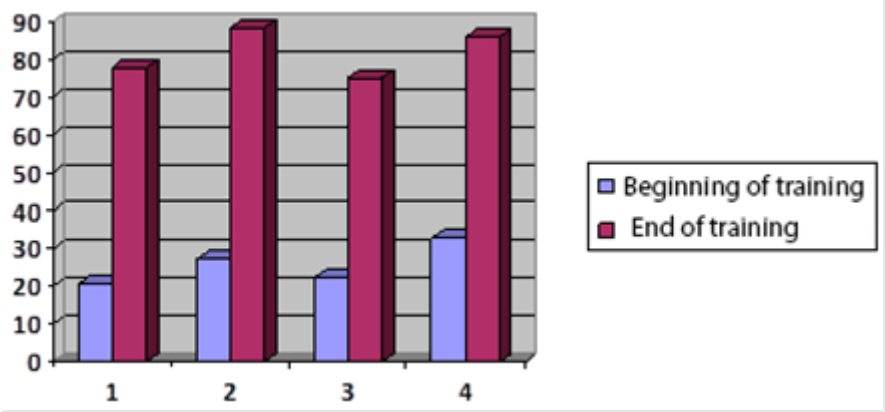

Figure 8. Change of the foreign language skills of natural sciences students as a result of integrated learning.

105 of the participating 127 students studied English in high school. As the examination demonstrated, the study of the language in the school course greatly facilitated mastering the natural sciences programme within the university. Figure 9 shows data on the level of mastering English language skills after completing the described pedagogical experiment.

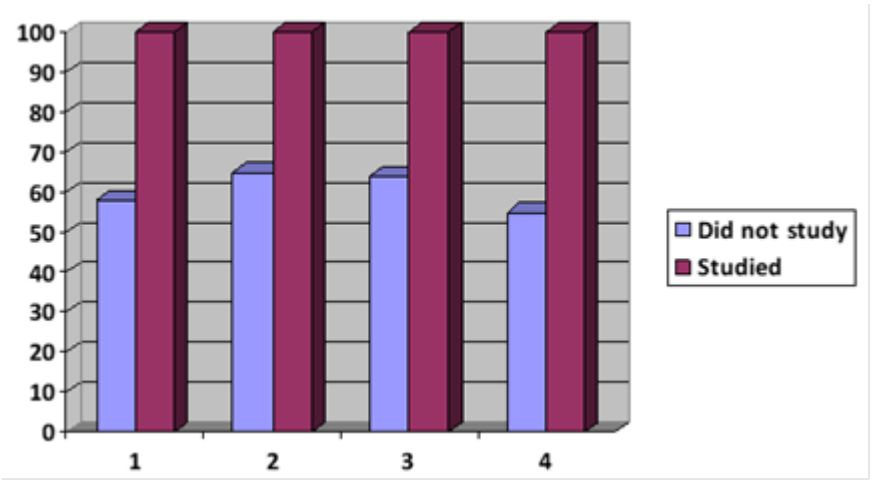

Figure 9. The level of mastering English language skills in groups of students who did not study English in high school and the ones who did.

According to Figure 9, students who did not study English in high school had difficulties completing an integrated natural sciences course using English. If the level of mastery of language skills among students who studied it as part of the secondary school programme is taken as 100%, then the level of mastering reading, writing, oral presentation, and listening skills among 22 students who have not studied English before is in the range of 55-65%. The difficulties were caused by the following circumstances:

1. Lack of knowledge and misunderstanding of highly professional terms, inability to apply them in everyday communication;
2. Difficulties in the perception of educational information, which is provided in separate compressed blocks in a limited time.
3. The need to spend academic time studying the rules of English grammar, substantially slowing down the learning process.
4. The need to learn the technique of reading in English, which takes time and delays the course of the educational process.
5. The need to go back in the learning process to repeat what has been learnt and consolidate the information received, also decreasing the speed of the learning process.

Additional classes were held with students who did not study English as part of the school, both as part of the curriculum and after the end of the main classes. They included grammar, reading, and listening classes. Oral communication classes began in the second week of the course. This allowed them to integrate into the educational process gradually, but the level of development comparable to the level of students with a school base could not be achieved. The study of natural sciences in English contributed to the discovery of several creative abilities among students. In particular, integrated learning develops the ability to analyse the interrelations of programme disciplines and independently search for such interrelations. This is facilitated by using authentic audio and video materials and other media products containing various information within the framework of the curriculum. The flexibility of students' minds develops, the practical orientation of learning increases, and students acquire the ability to link together the skills and abilities obtained in studying various programme disciplines. During the experiment, it was noted that integrated learning in English develops the following creative abilities in students:

1. The ability to improve one's own oral and written speech in English through constant repetition of educational material.
2. The ability to find differences between the options for teaching programme disciplines in English and to see opportunities for improving the presentation of the material.
3. The ability to find optimal options for presenting complex aspects of the submitted material, which is important for a future teacher.
4. The ability to independently increase the volume of speech practice necessary for the qualitative presentation of the submitted programme material.
5. The ability to increase the flexibility and adaptability to the situation of speech skills necessary for free communication in English.

The developed model not only provides conditions for creative self-fulfilment and personal creative activity among students at a productive level of improving the educational process by obtaining relevant knowledge in the field of modern research but also develops many accompanying elements of the creative component, which improves personal indicators and characteristics that create conditions for more successful assimilation of knowledge [34]. Thus, the proposed form improves the quality of perception of information at the level of acquiring pedagogical flexibility, which will allow for a detailed and positively motivated acceptance of a greater number of diverse answers by the teacher from the students, expanding the boundaries of what is written verbatim in the textbook by including scientific journals and documentaries, which substantially increases the level of knowledge and gradation of the degree of answers. This will make a qualitative change in the educational and evaluation process, allowing the development of the mental and speech component of future students. In addition, the proposed option increases the speed of information perception, understanding of the details of many processes, attentiveness, perseverance, and the ability to notice details and analyse them. At the same time, the knowledge taught in the natural sciences and disciplines also increases in various forms and spheres at

the integral level of study, which is essential for developing practical education [35].

Increasing the creative activity of teachers will also allow them to implement their pedagogical ideas, create a more interesting presentation of educational material in the classroom (both theoretical and practical areas), and create an atmosphere of creative realisation at the level of increasing interest in the subject, and given the factor of its integrated study, the above will affect the study of both English at the level of its practical application and the field of natural sciences [36]. Thus, the developed model was proved to be effective and can be used in practice to improve the teaching of natural science using integrated learning at all levels of education and to advance professional knowledge, skills, and competencies, which is vital for the entire field of education.

Conclusions

Introduction to the practical education of integrated lessons for the study of the subject and information part within the disciplines of the natural sciences dictate the improvement of the model of presenting knowledge with the strengthening of the individual's creative component, which implies the creative development of creativity and activity. The above contributes to the successful conduct of practical and theoretical classes, in which an individual approach to the presentation of knowledge and conscious creative work on the development of motivation and interest in creative self-expression during the educational process with a positive result of personal creative potential occupy the first place. The originality of the study lies in the presented model of organising the development of creative activity in future teachers. It is based on integrated lessons in natural science subjects, during which the material is presented in English to enhance the informativeness of the discipline by studying and analysing information presented in international scientific journals and documentaries, followed by a detailed and semantic discussion of the learned facts at the level of development of creative understanding and activity.

This will be enhanced by the listed components and based on the studied relevant information in the discipline with the proposed examples of figurative perception of data in the factor of various semantic characteristics of natural sciences and the global scientific and cognitive practice of this field of study, it will carry an example of creative activity and develop creative thinking in this area. The result will be a substantial experimental and cognitive contribution to the field of education and science in general, improving its structure at all levels due to the implementation of a system-analytical approach and structured successful scientific, cognitive, and pedagogical experience of colleagues at the international level, which is of practical importance for the entire field of education. The materials of this study are helpful for teachers, researchers, methodologists, and other workers in the field of education.

Acknowledgements

None.

Conflict of Interest

None.

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Викладання природничих дисциплін англійською мовою для розвитку творчої активності

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Анотація

Актуальність. Актуальність даного дослідження полягає в проблемі розвитку творчих здібностей студентів педагогічних університетів на рівні інтегрованого викладання природничих дисциплін з використанням англійської мови, що дозволить їм розвивати свої професійні компетенції на високому рівні.

Мета. Мета дослідження - сформулювати модель розвитку творчих здібностей майбутніх учителів на основі інтегрованого навчання в рамках природничих дисциплін засобами англійської мови.

Методологія. Провідними методиками для дослідження даної проблеми стали тести, розроблені Н.П. Фетіскіним, В.В. Козловим, Г.М. Мануйловим для оцінки ступеня творчого потенціалу особистості нарівні з його реалізацією для демонстрації своїх умінь на високому педагогічному рівні та створення адаптованих умов для пізнавально-активної роботи на уроці зі своїми майбутніми учнями, використовуючи творчий компонент. Цей компонент відповідає за багато факторів на особистісному рівні майбутнього вчителя, поряд з умінням організовувати та проводити якісні заняття з природничих дисциплін англійською мовою на рівні інтегрованого навчання, з грамотним індивідуальним підходом та повноцінною дискусією.

Результати. Виявлені дані дозволили створити модель організації розвитку творчої активності майбутніх учителів під час інтегрованих уроків з природничих дисциплін з використанням англійської мови. Це сприяє поглибленню знань у досліджуваних галузях із супутніми значними можливостями для творчого розвитку за рахунок включення в освітній процес вивчення міжнародних тематичних журналів англійською мовою, перегляду спеціалізованих інтегрованих науково-популярних документальних фільмів.

Висновки. Отримані результати поглиблюють розуміння цільової спрямованості інтегрованого уроку в науково-практичній сфері щодо дослідження природних явищ та розвивають розуміння важливості взаємозв'язків у житті та ціннісного ставлення до природи, що визначає його практичну значущість для галузі освіти.

Ключові слова: інтегроване навчання; іноземна мова; природничі предмети; навчальні матеріали; освіта.