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Integrative education as the basis for students' worldview knowledge in the process of teaching biology in high school

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Abstract

Relevance. The research relevance is predefined by the continuously developing system of integrative education, which puts forward new requirements for the process of teaching biology in high schools as the basis for the formation of students' worldview knowledge.

Purpose. The research aims to conduct a theoretical and practical justification of the methodology of the formation of the worldview knowledge of students in the process of teaching biology in high school.

Methodology. The primary research method is a pedagogical experiment, which allows a comprehensive consideration of all the contradictions in the research problem and improves the effectiveness of the process of teaching biology in high school. For this purpose, the auxiliary methods of mathematical statistics and graphical representation of the results of student achievement in the subject "biology" were used.

Results. During empirical research, interviews and questionnaires with the participants of the experiment were also conducted, during which the interests of students in the subjects were determined. The worldview component in the content of school education, especially in biology classes, was identified, principles justified, stages of the process of formation of students' worldview knowledge identified and implemented. This led to the inclusionary approach in which forms and methods of integrative education, which promote the development of worldview skills of young people could be quantified and disclosed.

Conclusions. Research materials are of practical value for graduate students of higher pedagogical educational institutions, and teachers of secondary general educational institutions which implement integrative education in their teaching activities in high schools. Thus, the purpose of education is not just the regurgitated transfer of knowledge in biology, but the preparation and adaptation of students to the new conditions of society.

Keywords: scientific worldview; beliefs; methods of teaching; natural sciences; integration.

Introduction

Education performs one of the main functions of personality formation, especially the formation of worldview ideas. In the process of education, the teacher's attention should be focused on the development of the student's personality, formation of the motivational sphere, and independent worldview as a way of assimilation of social experience. Under the new development strategy of Kazakhstan until 2050, one of the

main strategies in the sphere of education is the search for world outlook and ideological guidelines for teenagers [1]. The problem of the formation of worldview knowledge of high school students has been addressed by many scientists, among those are A. Semenov [2], M. Shomirzayev [3], T. Kondaurova [4], M. Kolesnyk [5], V. Wahono [6], A. Sari [7], L. Trang et al. [8], N. Ibrahim et al. [9] and A. Chatzopoulos et al. [10]. After reviewing their studies, the research relevance in the works on

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pedagogy, psychology, and philosophy is highlighted, and the need for additional research on the methodology of the formation of students' worldview knowledge in biology classes is determined.

At the present stage of development, biological literacy acts as the main worldview knowledge generator since the main object of biology is life and all outstanding discoveries in it make a huge contribution to the solution of the acute social question: how to live in a technogenic society and not harm nature. A. Khasanova [11] determined knowledge of Kazakh students as insufficient. Following the answers from the survey, students have a factual understanding of the material while they cannot integrate their knowledge from other school subjects. This is caused by insufficient integrative education and a very segmented approach to teaching and learning. The "Integrative approach" is the process of summarizing information, knowledge, and science to obtain a unified system of understanding of the world as presented by the educator. In education, this system forms and influences the personality of the student, in which the components of knowledge, in all the disciplines studied, are integrated. Therefore, the student's personality is at the center of the educational process and progress.

S. Pokhlebaev [12] points out the contradictions that adolescents face after graduation. They are related to self-realization and solving the socio-economic problems of the developing world. Society needs citizens with worldview knowledge and more precisely, the theory and methodology of integrative education meet the socio-pedagogical requirements of introducing worldview function in biological education.

B. Wahono [6] highlights that in contrast to differential education, the leading idea of integrative education is to combine the elements and integrate them into a fully formed whole. The student through differential education forms knowledge of the subjects without connection with the world as a holistic system. Such a student has difficulty adapting to society, which leads to the search for interdisciplinary links in pedagogy. Therefore, since the middle of the twentieth century, the development of programs that include interdisciplinary links was started. As a result, the integrative approach was born as a form of learning, which allows students to perceive the world as an interconnection of individual parts integrated into the expanding world system.

Despite the popularity of using integrated lessons, the research utilized the interdisciplinary connection of the disciplines "Biology" and "Computer Science". The use of digital resources currently allows partial solutions to the challenges posed to teachers of science. The integration of biology and computer science allows student interest development in a non-standard form of the lesson. The traditional form of carrying out such a lesson differs in the following factors: time of preparation for a lesson is reduced (most training platforms have ready-to-use video and photographic materials as free access that allows the use of new material in full); while the presence of digital programs for creation of tests allow to diversify check and consolidation of a material. Thus, the use of digital educational resources in the teaching of biology allows you to fully see the processes and phenomena obscure in time and space. The creation of new education strategies in the

Republic of Kazakhstan aspires toward placing increased demands on the development of personality, and resolving the lack of scientifically sound methods of formation of worldview knowledge in high school students. The aforementioned key points formulate the basis for special research of teaching biology through integrative education.

Materials and Methods

The following theoretical methods were used in the research: analysis and synthesis of Kazakh, Ukrainian, Uzbek, American, British, Indonesian, Finnish, and Turkish scientific literature on pedagogy, psychology, philosophy, biology, and computer science; appreciation and generalization of best practices of integrative education as a basis for the formation of worldview knowledge in high school students; additionally using the method of analogies we modeled a method for implementing integrative education in biology classes. Among the diagnostic methods, the following were used: mathematical analysis of the progress in the subject "Biology" among 11th-grade students, a questionnaire to identify the interests in the subjects, the author's questionnaire "Unfinished phrases", conversation, alongside pedagogical observation [4]. During the empirical study, the experience of educational organizations, normative and educational-methodical documentation of the last 3-5 years was used, and information technology methods were used to work with the material on the subject of biology, namely a digital microscope DMB 130 and scanner, applications for working with text Microsoft Office Word 2021, Adobe Photoshop 2022, application for creating interactive tasks Hot Potatoes 2022, as well as multimedia projector to view videos, photos, and presentations. The pedagogical experiment was conducted in three stages ascertaining, forming, and controlling. Using methods of mathematical statistics and graphical representation of the results, application Microsoft Excel 2022 the results of learning in the subject "Biology" were calculated and conclusions drawn.

The research experimental base included the Chemistry and Biology Intellectual School of Kyzylorda, Kyzylorda Region, Republic of Kazakhstan. At the first, ascertaining stage of research, a theoretical analysis of existing methodological approaches to teaching biology through integrative education as a basis for forming worldview knowledge in high school students was carried out. During the course of this theoretical analysis, the author was able to determine the goal, the problem, and the methods, whilst making a plan for empirical research. The relevance of integrating such school disciplines as "Biology" and "Information Technology" was substantiated at this stage. Before the experiment it was necessary to prepare the material basis for the study, using a: video projector; digital microscope DMB 130, and scanner; to provide individual access to each student's computer with Internet access; and to check the readiness of the applications necessary for the performance of school tasks in biology. The psychological diagnosis of the respondents at the initial stage of the experiment was conducted in parallel, studying the level of achievement in the subject "Biology", with the interest of students in school subjects.

At the second, formative stage of the pedagogical experiment, the methodology of teaching biology using integrative education techniques as the basis of the worldview understanding of high school students was introduced. The experiment started in September-October 2021 and lasted until the end of the school year; 27 students of the 11th grade, aged 16-17 took part. Integrated education in biology lessons is described on the example of the topic: "Biological processes of mitosis and meiosis and their significance", the topic includes two laboratory evaluations and one control test. In all lessons concerning the topic, information technologies were used, in order to implement: demonstration of multimedia presentations with different types of tasks; make use of illustrative material; formulate tests; use of a microscope to study the processes of mitosis and meiosis; utilization of a graphic editor to process photos; and exploitation of spreadsheets to make reports on the completed laboratory work. Participating students were expected to work independently with information equipment in order to: employ microphotographs, edit them, save them, and use them to create a text document of a video or presentation. Each student was assigned a work folder on a personal computer where the student could store the gathered information and use it later in his or her research project. The teacher interacted with students through the Hot Potatoes app, which contained materials and assignments on the topic being studied. Here students also attached their completed assignments, which were checked and evaluated by the teacher. At the final controlling stage of the study, the author of the article summed up the results, described the results, and clarified the theoretical and practical conclusions.

Results

Traditional education provides knowledge of the environment in isolation from real life. However, the modern world has new demands on today's youth. As a result, students must re-learn how to apply what they have learned after graduation. Today's youth must be flexible, creative, adapt easily to the rapidly changing conditions of life, and have competencies in multiple spheres of life. These requirements define the objectives of the integrative approach because integration is the establishment of a deep interdisciplinary connection of knowledge concerning man, the world, and culture [13]. Information Technology and Information Gathering proficiency has become a primary skill and condition of societal development. Integration covers a large amount of information, it allows evaluating, analyzing, and eliminating contradictions by adding new knowledge to the system of holistic perception of the world. Thus, the integrative approach in education serves as a basis for the formation of students' worldview. The worldview function of education is to understand the general trends of the world whilst guiding students to understanding trends and systemic change [14].

This function is best realized in lessons with a science focus. Biology serves as the main subject where human-nature interactions are the domain of natural science [15]. Therefore, the practice of integrative education is common in the teaching of biology. In this study, a variety of practices of interdisciplinary integration of biology and computer science was used. The experiment started with the analysis of the quality of knowledge in the subject "Biology", the results are presented in Figure 1.

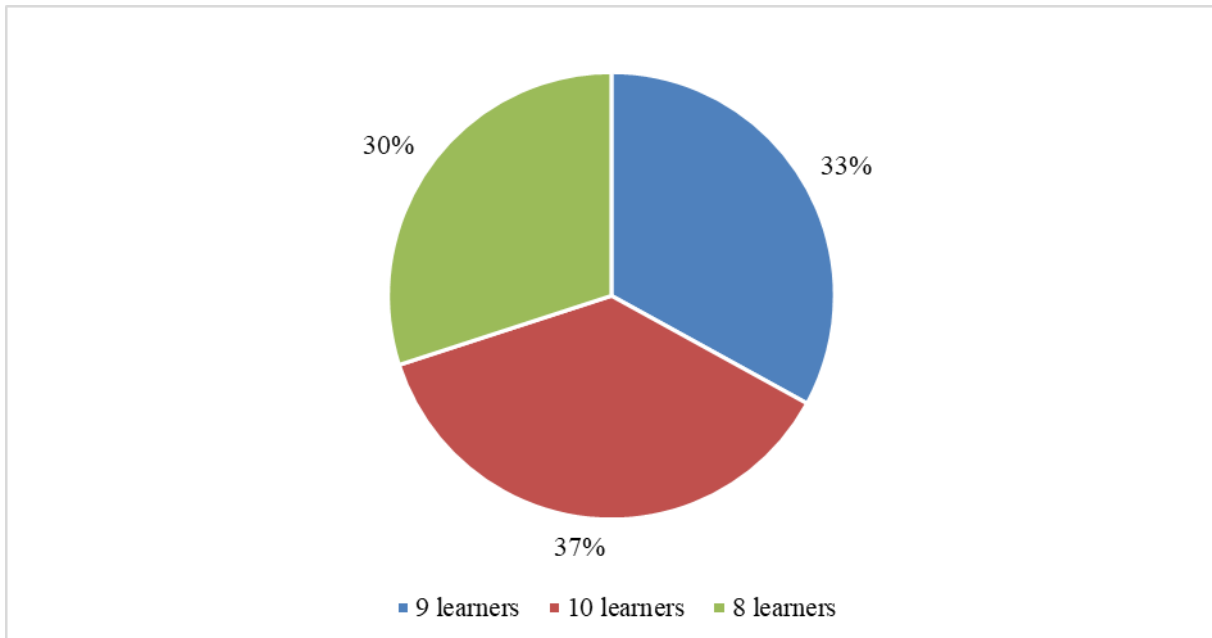


Figure 1. Results of the knowledge quality analysis in the "Biology" subject

The quality of knowledge in the subject "Biology" was assessed by the results of the arithmetic average of the final grades for the control, practical, and monitoring tests in the 10th grade. Figure 1 shows that 30% of students completed their final test with a high score of "5", 37% of students received a "4" for their final test, and 33% of students

completed the test with a satisfactory leveling score of "3". This shows that the level of knowledge in biology is average, although course completion is 100%. At this stage, students' interests in school subjects were also diagnosed, and the results are shown in Figure 2.

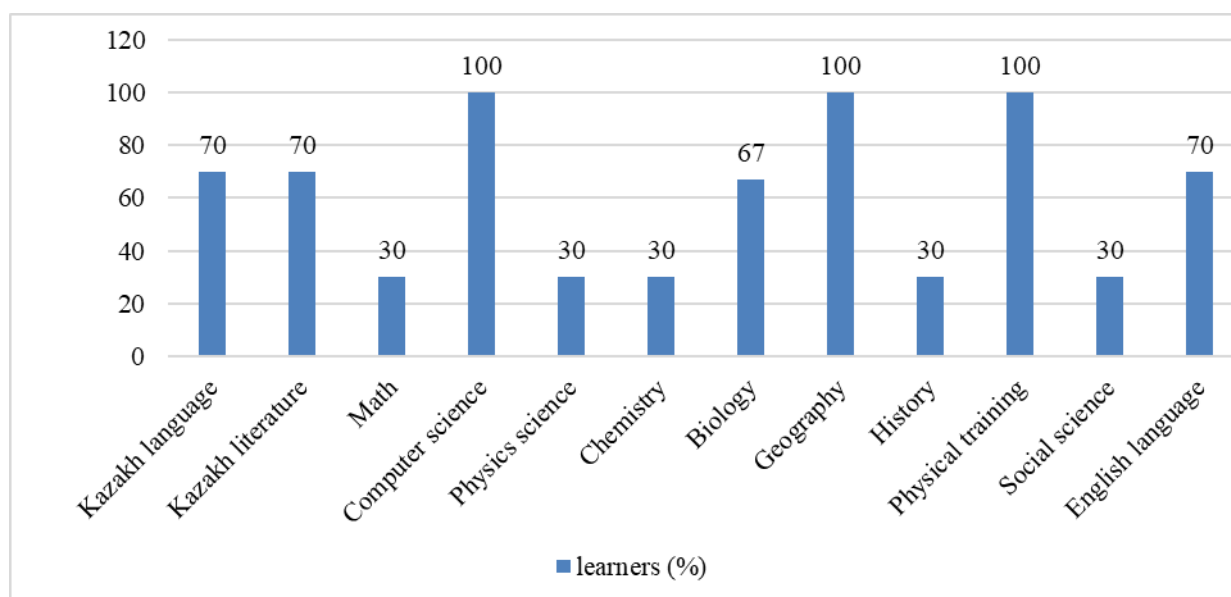


Figure 2. Results of student interest diagnostics in school subjects

Figure 2 shows the level of interest in the subject “Computer science” is 100%, thus, all students in 11th grade will be interested in integrating the disciplines “Computer science” and “Biology”. Given that the latter is of interest only to 67% of students, there is a need to implement a different approach to teaching biology to improve generated interest for this discipline.

The experiment continued during the academic year 2021-2022. As an example of the introduction of integrative education in biology lessons, the author described the topic: “Biological processes of mitosis, meiosis, and their significance”. During all stages of studying the topic, computer technologies were used to study the stages of cell division in laboratory works: photo cameras, digital microscopes, and scanners. Recorded microphotographs of biological processes of mitosis and meiosis were used for writing reports, consolidating knowledge, and practicing skills. The use of integrating equipment in the course of laboratory experiments increases the interest of students in the studied topic through familiarizing them with scientific methods of biological processes. The results of laboratory research were presented in the form of multimedia presentations with the use of digital photos created by themselves with the help of a microscope or camera.

During the first laboratory work, students studied the process of cell division (mitosis) using a digital microscope with a built-in digital camera DMB 130. Before each laboratory work, students were instructed on microscope operation and safety, and the theoretical focus of the biological process explored was on the instruction card in the Hot Potatoes app. Using the digital microscope, students saved and displayed images in a graphical editor, in which students viewed the nature of the mitosis process.

The next laboratory work on this topic involved the same process of interaction of students with digital equipment, but this time participants looked at the process of cell division – meiosis. The students prepared their reports outside of class time and chose a presentation format from the provided options: a gallery with pictures and a description of the processes on them, a multimedia presentation, or a video clip. The report could be prepared

either individually or in a group, and at the end of the presentation, the speakers were asked questions, and time was given for discussion. Thus, students were required not only to reproduce knowledge of biology but also the skills of using information technology to study the discipline of “Biology”. While traditional teaching methodology pertaining to biology is limited to reviewing a paragraph in the prescribed textbook.

Students received all assignments through the Hot Potatoes application, where the teacher created a comprehensive program for studying biology pertaining to 11th grade topics, with the use of interactive techniques: crosswords, terminological dictations, creation of charts and tables, comparative characteristics of opposing biological processes and phenomena; as well as tests, attached text, video and photo documents. The knowledge test at the end of each topic was in the format of tests, which were created in the Microsoft Excel program. The questions prepared for the test contained both open questions (e.g., “Why was life formed on Earth?”) and narrowly focused questions within the curriculum. The entire list of questions was provided on the biology teacher’s page created on the school’s website. The freely accessible content allowed pupils to get acquainted with the control questions outside of school hours.

Integrative lessons provide both the teacher and the student with great opportunities for intellectual creativity and mastery of complex material. For example, in the field trip lessons, the main requirement was the use of digital cameras for detailed recording of all phases relevant to the field trip. Reports of observations, made during the field trip, were prepared by the students in the following lessons using an editor with ready-made templates for inserting photos and captions. This report is much less time-consuming than a text document. If desired, the class can prepare a generalized report on the excursion by combining the knowledge and observations with their classmates.

The students could also demonstrate their creative potential in their project-research activities with further performance at inter-school conferences, and Olympiads both offline and via the Internet. Tracing the effectiveness of the introduction of integrative education in biology

lessons in high school, a survey was conducted at the end of the school year. The “Unfinished phrases” questionnaire form was developed by the author of the article and contained the following unfinished statements: “I

learned...”, “I understood ...”, “I realized that I can...”, “I liked...”, “I acquired...”, and “I wanted to...”. The results of the survey are shown in Figure 3.

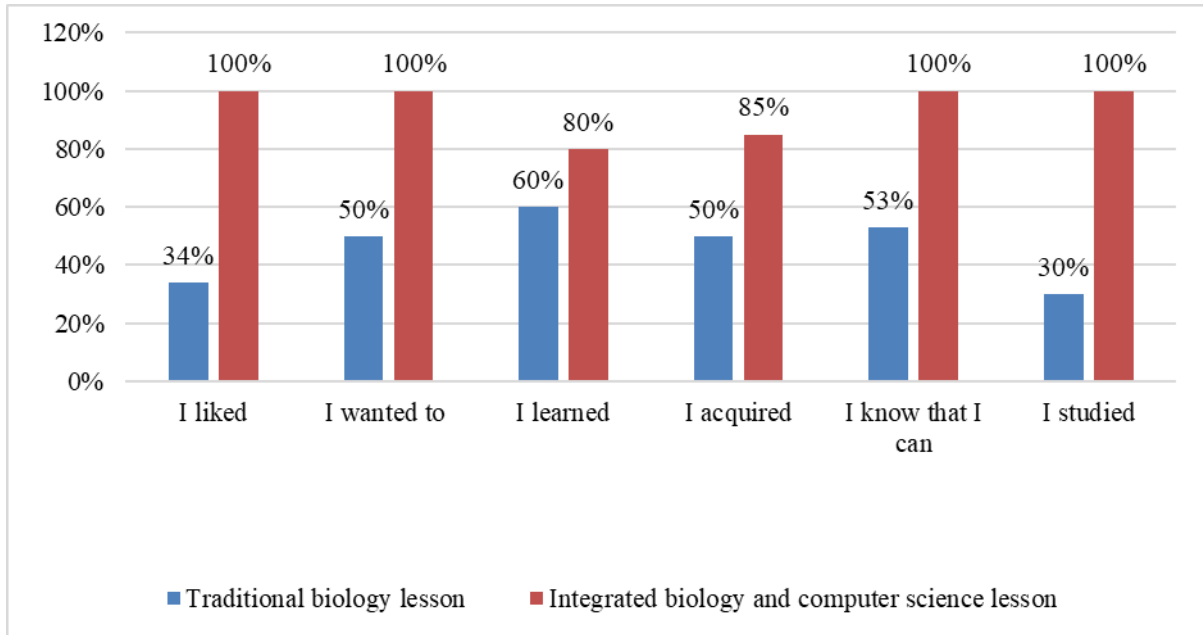


Figure 3. The results of the author’s “Unfinished phrases” questionnaire

The integrated biology and information technology lesson elicit more positive responses from students than the traditional biology lesson forms. From the results of the survey: 100% of students like the use of information technology in biology lessons, on average, 20% of students have improved their knowledge in the natural sciences, and 100% want to deepen this knowledge in the future. Thus, the process of education with the use of integrative

teaching solves the urgent problems of the education sphere in the Republic of Kazakhstan, in particular the integration of worldview into the current system. Reflection of students’ interests was carried out monthly with the help of an anonymous survey “What lessons are more enjoyable: with or without the use of computer science?”, the results of the survey are shown in Figure 4.

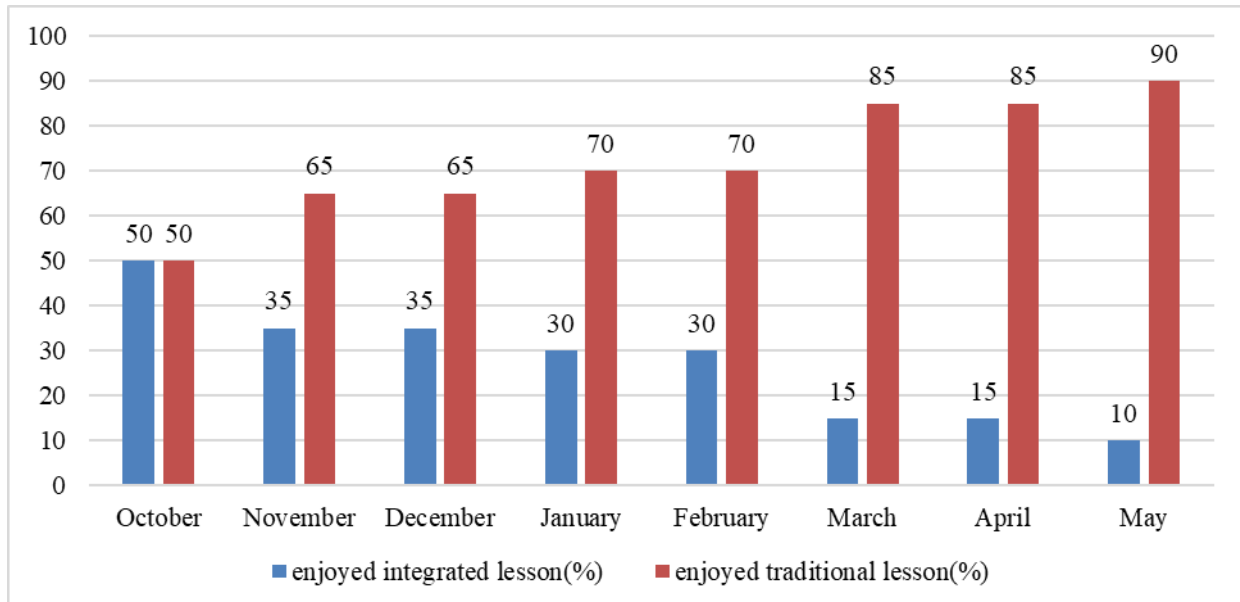


Figure 4. Comparison of student interest concerning the traditional and integrative form of teaching biology in high school

The results shown in Figure 4 conceptualizes that high school students are interested in learning biology through the integration of information technology, as evidenced by increased motivation and improved performance in the subject. This interest is shown by the depth of concepts and patterns learned in biology with the use of digital

technology, due to which the cognitive interest of high school students grows, and students show a desire for independent work in after-hours activities. The result of additional activities and creative activities are observed in scientific projects, which reflect the student’s inquisitions into certain phenomena and processes in the environment.

Adolescence investigates the fundamental worldview problem question, “Who am I?”. The need for self-determination becomes the meaning of life and determines it. Perception and experience of the nature of this psychological process affect the nature of learning activities as well as the student progression further into adulthood [16]. Therefore, the main task of school education is the formation of a scientific worldview, which as a complex form of social consciousness arises from the personal life experience of an adolescent. Being a product of the integration of knowledge, experience, and views reflecting social relations, the worldview of a high school student determines the meaning and direction of all further life activity. The worldview understanding of students is most successfully formed through natural science and humanities disciplines, where elements of the problem question are indirectly addressed and alluded to. Modernization of the education system requires new methodological methods of integrative education implementation. In this regard, the author identifies the following methods of lessons used in the process of teaching biology in high schools throughout this study.

The first method is the formation of new knowledge. In contrast to the traditional form of the lesson, in integrative education, such a lesson can be held in the format of an excursion, a trip, or research. Organization of a lesson in this form allows the teacher to integrate various methods, means, and technologies. To combine lecture material with illustrations, to encourage a research interest through an independent search for advanced research in biology. This form of the lesson allows for extensive use of online technologies. Students have the opportunity to establish communication skills, as the form of work involves group, frontal, and pair interaction. These elements culminate in solving cognitive problems, to develop their creative potential and personality of the student.

The second method is a lesson of discovery of new knowledge. The teaching, pedagogical, and developing functions of this direction can be performed in the form of a workshop, essay, business, or role-playing game. With the help of this method of integrative education, the main goal of education is achieved – the mastery of new universal learning activities within the curriculum scope of biology.

The third method is used in the concluding lesson. The main goal is to assess the level of the assimilated and systematized knowledge, and to generalize it in the context of the studied topic. The lesson may be conducted in the form of a conversation and discussion, at the discretion of the teacher. In such an informal setting, students do not experience the stress and anxiety that are present in a traditional summarizing lesson.

Thus, the system of integrated lessons puts forward requirements for the teacher, who needs to master the theoretical aspects of integrative education and the peculiarities of its use. Integrative learning involves the use of modern pedagogical technologies, the use of which sometimes requires the presence of an assistant. For example, in this study, the teacher was assisted by students who attended extracurricular classes in biology and were trained to work with digital equipment when preparing for the lessons.

The application of such methods of integrative education in biology classes serves as a basis for worldview knowledge development in high school. Students’ interest in such forms of studying biology increases because they meet the needs of the younger generation. Computer technology reinforces the teaching material with visual perception, which makes it more vivid and convincing, to focus attention on the information presented through the creation of visually appealing and intriguing images.

Discussion

With the development of industrial society, the level of human culture began to decline rapidly, causing global environmental problems, which can lead to the death of society itself. Overcoming these negative effects of the human factor projects to be possible by practicing adequate reality of social existence as the basis vision of the new world, where people have an ecological consciousness. Under the classification created by H. Narbutaev [17], the meaning of integrated education is to move away from differentiation in traditional education and teach children to use the knowledge gained in various life processes.

S. Poulter and A. Tosun [18] state that the assimilation of scientific worldview knowledge is the basis of the efficiency of the formation of a scientific worldview. A qualitative indicator of the effectiveness of such a worldview will be the strength and consistency of knowledge, and the level of assimilation serving as a quantitative indicator. Researchers identified the main principles on which the scientific worldview is formed, conceptually noted as: methodological – is the systematic and humanization of the learning process; psychological and pedagogical – is the inseparability of learning, education, and development; and dialogical – the truth is born in a dialogue, which can be both interpersonal and intrapersonal. This scientific worldview is believed to establish a trusting dialogue between the student and the teacher which creates a genuine student interest in biology as a science. In the studies of these authors, the content component of worldview knowledge is formed in the process of assimilation of biological knowledge, perceiving natural phenomena through the prism of the modern scientific picture of the world, in which the value of nature, life, and biological diversity comes to the fore.

Integration in the process of formation of worldview knowledge in the biology lesson, following V. Ahs et al. [19], already begins with the joint activity of the teacher and the student, as the gap between the participants of the educational process, inherent in the traditional lesson, is narrowed. Utilizing lesson forms such as a seminar, evaluation essays, conferences, and excursions to nature, the teacher and the student become a small scientific community, the inclusion of which optimizes the views and beliefs that contribute to the development of an ever-expanding worldview. Therefore, the researching authors, in their experiment, empirically proved the effectiveness and necessity of using the methodology of forming a scientific worldview in biology lessons. Resultantly students acquired their views and beliefs based on worldview knowledge and mastered the evaluation skills that contribute to the understanding of the laws of the course of life processes [20]. The authors used new

worldview constructs as an indicator of the formation of worldview knowledge in the respondents during the control stage of the experiment.

S. Pokhlebaev [12] considers integrative teaching of biology with philosophy as a basis of worldview knowledge. The application of knowledge of philosophy in the lessons of biology will allow the formation of a universal picture of the world in young people, which further contributes to the definition of true values, and the progressive development of culture and civilization in general. The study of the integrative interaction of philosophy and biology has led to establishing a new scientific direction – biophilosophy, which allows a delineation of the ideas related to modern worldview knowledge [21-23]. Interdisciplinary concepts which

determined the theme of integrative education in the disciplines of “Philosophy” and “Biology” to be studied in the author’s research. Life was identified as the underlying principle of understanding the essence of the world and human existence in it. In this regard, the concept of “Life on Earth” became an actual research objective. This phenomenon is difficult for students to assimilate due to its uniqueness, vast applicability, and the complexity of understanding the abstractness of its origin. Therefore, the research author proposed a model specifying this concept. Establishing the interest and level of student awareness in this topic, 1st-year biology students were tasked to describe the “Emblem of Life” modeled by the author of the study in Figure 5.

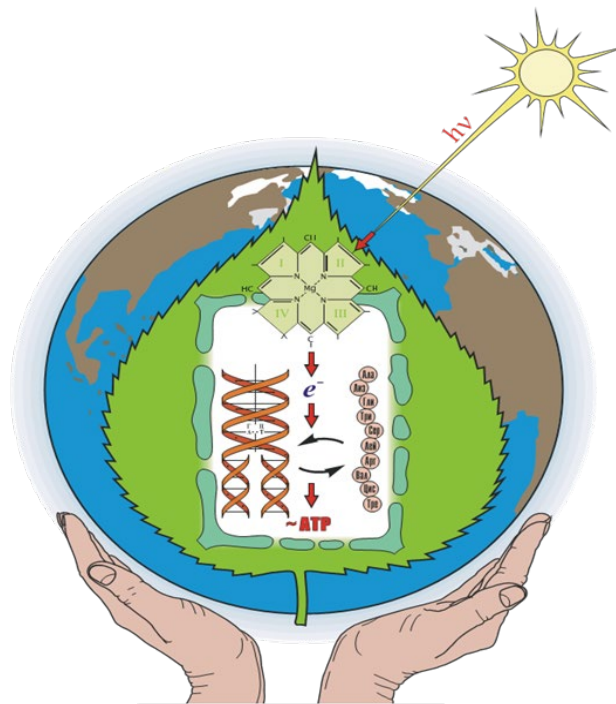


Figure 5. “Emblem of Life”

As a result of the analyzed answers the author of this article noted that not a single student was able to give an accurate, clear answer reflecting the understanding of the “Emblem of Life”, all answers were reduced to the description of what they saw, directly linked to the concept “DNA”. The research author encountered the same problem in his study; students lacked their perspective on the problem of life as the greatest value. High school students resorted to searching for information in a textbook or on the Internet, expecting to find a perfect answer to this diversely complex question [24]. Assuming such an outcome of the ascertaining stage of his empirical research, the author offered the students instruction to understand the presented model of life. The core of the experiment was an individual study of theoretical material describing the “Emblem of Life” and its role in forming a picture of the world through the prism of biological processes. Simultaneously students answered problem questions relating to: specified principles and approaches of philosophical and natural-science directions which formed the basis of this model; conceptualizing the concept of “living” in natural science and philosophical directions as designated entities; and to

determine the necessity of biologically active molecules for life and to cipher them with a sign system. The report on the work done by the students was designed in the form of multimedia presentations, which once again proves the relevance of the use of information technology during biology classes.

While preparing the report presentation, students went through all stages of the formation of a scientific concept of the world around them. During scientific conceptualization the transition from the particular to the general is the basis for integrative education of student worldview as a part of the process of teaching biology by methods of philosophy [25; 26]. In addition, this approach fully meets the requirements of the new educational strategy of the Republic of Kazakhstan, which is based on the integration of approaches important for learning. The strategy encompasses methodologies such as systematic activity and personal components. Each of these approaches has a methodological potential, the unification of which allowed to model the figurative and symbolic “Emblem of Life” as the highest form of integration of philosophical and biological disciplines [27-29]. Preparing

for the presentation, the participants of the educational process deepened the essence of the concept of “life” as the center of the worldview understanding pertaining to that of man.

S. Jumaev [20] as a basis for the formation of a holistic worldview also identified the learning material of natural sciences and humanities cycles combining them with the synergetic content of a generalized integrative picture of the world. Until now, synergetic knowledge has not been used in all school disciplines [30]. The traditional lesson did not provide in itself didactic means aimed at the use of elements of synergetics for the formation of worldview concepts. Therefore, in the study, the author conducted a theoretical analysis of the substantiation of attitudinal knowledge through the application of synergetic ideas in the content of education. During the study of this problem, it was determined that as a result of interdisciplinary students’ understanding of the spiritual, social, and natural world the theory of self-organization showed itself in the best way. The author paid insufficient attention to the students’ self-organization of the learning process with the reasoning that the support of a mentor was necessary at any age, especially during scientific experiments. However, this form of conducting a biology lesson allows effective assimilation of the system of combined worldview knowledge. In the course of the experiment, the author of the study created a course “Synergy in the World Around” for high school students and tested it in several high schools in the Republic of Kazakhstan.

With the help of this course, synergetic knowledge from different school disciplines was systematized and the methodology for effective implementation of this elective course was developed. Students were offered the opportunity to get acquainted with the main points of the theory of self-organization. During the biology laboratory lessons, the experiments were set up, utilizing information technologies enabling pupils to observe the self-organizing processes of different natures. By performing integrated interactive tasks while studying school subjects one can achieve several didactic goals: enriching secondary education with attitudinal knowledge; strengthening the connection between the natural sciences and humanities; students practice analytical thinking; and attitudinal knowledge is carried out systematically for content mastery [31-33]. In his experiment, S. Jumaev [20] used all pedagogical methods of integrative education, described by the author of this article in the previous section, and as a result, concluding that the introduction of synergetic elements in integrative courses activates the learning process and provides a better implementation of the worldview function of education. The author concluded that the implementation of synergetic ideas in the educational process contributes to the understanding of cultural values of the worldview character, and the formation of spiritual and moral qualities of the individual. Thus, the problem of introducing interdisciplinary links in the educational process is solved by using integrative education. Integrative education contributes to the formation of value orientations, which form the basis of students’ worldview. The priorities of worldview values for modern young people are aimed at the preservation and protection of the environment. Therefore, the structure of

natural sciences and humanities serves as a basis for the formation of a generalized systemized worldview.

Conclusions

The theoretical and practical substantiation of the methodology of forming worldview knowledge of students in the process of teaching biology in high school is based on the introduction of integrative education disciplines “Biology” and “Information Technology”. Integration contributes to the formation of holistic knowledge about the world around us. Mastering the system of universal human values contributes to the implementation of one of the goals set by the educational standards in the Republic of Kazakhstan.

Comparing the specifics of integrative and traditional lessons, the author of the article concluded that the educational material of a traditional lesson is presented after repeating previously studied topics, thus supposing the attainment of the unity of the material world. The education material of an integrative lesson is presented in a more varied way, which allows you to use a variety of objects of study alongside requiring a diversification in the application of teaching methods. The main advantage of integrative education is the development of students’ interest in the subject due to the predominance of interdisciplinary connections between biology and advanced information technology. The effectiveness of this integration is proved in this article. Most of the pupils positively approached and worked on the lessons, and were interested in a deeper study of the subject “Biology”. This positive approach acclaimed the 33% increase in subject interest compared to the beginning of the school year, and the quality by 70%, that is, the level of knowledge in biology increased from average to sufficient. Such an increase in the level of knowledge occurred due to the integration of biology lessons with computer science. More specifically, in October 2021, the interest in integrative and traditional lessons was 50/50%, and already in May, the percentage is 90/10% respectively.

The community of biology teachers sees the need to implement integrative education as the basis for forming worldview knowledge in biology classes, especially in the upper grades. However, they often encounter obstacles to the systematic application of this methodology in education. The main difficulties are imperfect scientific and methodological support for schools of all levels of accreditation, insufficient material support, and lack of personal motivation or training of the teacher in applying their creative abilities. All this predetermines the prospects for further research, which consists of the structuring of teaching aids in science and humanities with the use of interdisciplinary programs. Last but not least, the transformation of Natural Science centers on the search for extracurricular forms of classes (conferences, excursions, hobby clubs) in order to firmly establish the congruence of the positive feedback obtained during this research.

Acknowledgements

None.

Conflict of Interest

None.

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Інтегративна освіта як основа світоглядних знань учнів у процесі навчання біології в старшій школі

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Анотація

Актуальність. Актуальність дослідження зумовлена безперервним розвитком системи інтегративної освіти, яка висуває нові вимоги до процесу навчання біології в старшій школі як основи формування світоглядних знань учнів.

Мета. Метою дослідження є теоретичне та практичне обґрунтування методики формування світоглядних знань учнів у процесі навчання біології в старшій школі.

Методи дослідження. Основним методом дослідження є педагогічний експеримент, який дозволяє всебічно розглянути всі суперечності досліджуваної проблеми та підвищити ефективність процесу навчання біології в старшій школі. З цією метою використовувалися допоміжні методи математичної статистики та графічного представлення результатів навчальних досягнень учнів з предмета "біологія".

Результати. Під час емпіричного дослідження також було проведено бесіди та анкетування учасників експерименту, під час яких визначалися інтереси учнів до навчальних предметів. Визначено світоглядний компонент у змісті шкільної освіти, зокрема на уроках біології, обґрунтовано принципи, визначено та реалізовано етапи процесу формування світоглядних знань учнів. Це зумовило інклюзивний підхід, в рамках якого кількісно визначено та розкрито форми і методи інтегративної освіти, що сприяють розвитку світоглядних навичок молоді.

Висновки. Матеріали дослідження мають практичну цінність для аспірантів вищих педагогічних навчальних закладів, вчителів середніх загальноосвітніх навчальних закладів, які впроваджують інтегративну освіту у своїй педагогічній діяльності в старших класах. Таким чином, метою освіти є не просто банальна передача знань з біології, а підготовка та адаптація учнів до нових умов життя суспільства.

Ключові слова: науковий світогляд; переконання; методика викладання; природничі науки; інтеграція.