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The Role Of Biological Sciences In Developing Students' Creative Thinking

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Abstract: This article discusses modern approaches to developing students' creative thinking in the teaching of biological sciences.

Keywords: Student, creativity, creative work, thought, scientific research, innovation, activity, task, analysis, lesson, research, research competition, experience, creativity, tool, method, idea, experiment.

Introduction: In our republic, interest and attention towards the use of innovative technologies, interactive methods, and pedagogical and information technologies in the educational process are growing stronger day by day. One of the reasons for this is that traditional education has, until now, primarily taught students to merely acquire ready-made knowledge. Innovative technologies, however, teach them to seek out the knowledge they acquire themselves, to learn and analyze independently, and even to draw conclusions on their own. In this process, the teacher creates conditions for the individual's development, formation, acquisition of knowledge, and upbringing, while simultaneously performing the functions of guidance and direction. It should be noted that even among students of higher education institutions, qualities such as inquisitiveness, creativity, and inventiveness are not always at a high level. Considering these aspects, shaping the skill of creative thinking in pupils and students is considered important in the pedagogical process.

Specifically, for the effective formation of creative thinking skills, attention is paid to the inclusion of necessary verbs within questions that prompt students to think. For example, if this is explained with examples,

a control question asking students to "describe the relationship between unicellular and multicellular animals" does not foster creativity in them. This is because the concept "describe" in the question is essentially equivalent to saying, "recite your existing knowledge one by one." Using words (verbs) in control questions that prompt students to think facilitates their creative thinking. Therefore, according to one of the primary ways to form creative qualities in an individual, it is advisable for teachers to use various, unconventional, non-traditional, and words (verbs) that compel a thorough response. For example, using words (verbs) such as "find the connection," "create," "predict," "explain the idea logically," "imagine" is considered practically effective [1].

A student possessing creative qualities will, in their future professional activities, demonstrate initiative in generating ideas that contribute to developing a creative approach to organizing work and personal qualities, independently study advanced pedagogical achievements and experiences, and also possess skills in exchanging ideas with peers [2].

Creative thinking is the ability to effectively participate in the process of finding innovative (new, pioneering, original, non-standard, unusual, etc.) and effective (practical, result-oriented, economical, optimal, etc.) solutions, acquiring new knowledge, and developing, evaluating, and refining ideas aimed at expressing imagination in impactful ways. Indeed, methods aimed at enhancing the creativity of students in teaching the natural sciences are now considered one of the significant innovations in the process of biological education. This is because students possessing qualities of creative thinking are helped to generate new ideas distinct from traditional approaches in organizing the educational and upbringing processes, to think outside the box, and to exhibit individuality and initiative. If you look around, you will encounter incomparable and astonishing examples of human creativity everywhere: electronic services, virtual reality, square watermelons, soilless crop cultivation—these are just a few examples we can mention. All of these are products of human imagination and thought. Things that seem ordinary to us today—books, music, buildings, airplanes, even lamps—were once dreams and figments of imagination, later created as fruits of intellect and reason.

Innovations create conveniences in our daily lives, lighten our burdens, and bring the distant nearby. In this way, creativity has become an inseparable part of progress. There is a great demand for creatively thinking specialists in all fields. Companies producing world-famous software and mobile phones require new ideas from their experts every day.

As the demand for creatively thinking specialists in the labor market continues to grow, the formation and development of the unconventional thinking ability of pupils and students during the educational process becomes critically important. It must be acknowledged that many approaches and methods in the education system are still directed not at creative thinking, but merely at interpretation and analysis—that is, understanding and correctly conveying given information, or at best, synthesizing several pieces of information to draw a conclusion [3].

Creativity, as a category that develops the individual, is considered an inseparable part of human intellect and spirituality. It manifests not in the multiplicity of knowledge a person possesses, but in the striving for new ideas, in reforming and changing established stereotypes, and in making unexpected and unconventional decisions when solving life's problems. In other words, creativity cannot be achieved through the repetition of given knowledge; the emergence of new thought, of a new idea, is a fundamental condition in the process of creative thinking. For example, even if you have memorized English words and "gulped down" grammar rules, it is all in vain if you cannot write an essay. Therefore, imagination plays a crucial role in the creative thinking process. When Albert Einstein said, "Imagination is more important than knowledge," he was precisely referring to this aspect. Often, unconventional ideas and solutions come to a person's mind unexpectedly. To achieve this, the monotony and routine in the thinking process must first be eliminated.

Thomas Edison said, "Creativity is an involuntary process." Yet, every day, many specialists feel the need to find unconventional solutions to problems. Can they make this involuntary process voluntary? There is no "magic wand" in nature that generates new ideas, but there are many methods that can assist any specialist in thinking creatively. For this, it is necessary to allocate time for creative thinking and to understand creative potential. Creative thinking helps us find unconventional solutions when solving problems. According to the model for assessing students' creative thinking in PISA studies, solving scientific or social problems and expressing one's ideas in written or visual form is required [6].

There is a great demand for creatively thinking specialists in all fields. Companies producing world-famous software and mobile phones require new ideas from their experts every day. As the demand for creatively thinking specialists in the labor market continues to grow, the formation and development of the unconventional thinking ability of pupils and students during the educational process becomes critically important. It must be acknowledged that many

approaches and methods in the education system are still directed not at creative thinking, but merely at interpretation and analysis—that is, understanding and correctly conveying given information, or at best, synthesizing several pieces of information to draw a conclusion [3].

As a category that develops the individual, creativity is an inseparable part of human intellect and spirituality. It manifests not in the multifaceted nature of the knowledge a person possesses, but in the aspiration for new ideas, in reforming and altering established stereotypes, and in making unexpected and unconventional decisions when solving life's problems. In other words, creativity cannot be achieved merely by repeating given knowledge; the emergence of a new thought, a new idea, is a fundamental requirement in the creative thinking process.

Therefore, imagination plays a vital role in the creative thinking process. When Albert Einstein said, "Imagination is more important than knowledge," he was precisely referring to this aspect. Often, unconventional thoughts and solutions come to a person's mind unexpectedly. For this to happen, the monotony and routine in the thinking process must first be eliminated. It is important to emphasize once again that in secondary schools, even among upper-grade students, qualities such as inquisitiveness, creativity, and inventiveness are not always at a high level. Taking this into account, developing the skill of creative thinking in pupils and young people is considered crucial in the pedagogical process. Specifically, for the effective formation of creative thinking skills, teachers should focus on using necessary verbs within questions that stimulate students' thinking. For example, if explained through examples, a control question asking students to "describe the relationship between unicellular and multicellular animals" does not foster creativity in them. This is because the concept of "describe" in the question is essentially equivalent to saying, "recite your existing knowledge one by one." Using words (verbs) in assignment questions that prompt students to think facilitates their creative thinking.

Therefore, according to one of the primary ways to develop creative qualities in an individual, it is advisable for educators to use various, unconventional, non-traditional, and precise words (verbs) that compel a thorough response. For example, using words (verbs) such as "find the connection," "create," "predict," "explain the idea logically," "imagine" is considered practically effective [4].

In biology education as well, assigning tasks oriented towards creative thinking is considered important for enriching students' imagination, enhancing their thinking ability, and focusing their attention. This can involve various unconventional activities related to biology, such as naming, drawing, or describing different unusual pictures, as well as posing interesting questions. For example:

- "Draw a picture of an animal that doesn't exist on Earth."
- "Which flower or tree would you compare yourself to, and why? Draw a picture of that flower."
- "Write about your feelings if you were a caterpillar inside a cocoon."
- "Imagine you were a butterfly for a day and write about your experience."

Assigning such tasks is very purposeful.

These kinds of creative tasks are considered important for engaging students in learning activities, increasing their motivation, guiding them towards independent learning through independent and creative work, systematically organizing this work, ensuring its continuity, and establishing control and monitoring.

- In teaching biological sciences, the use of innovative methods aimed at developing the creative thinking of pupils and young people—such as the Diagnostic Method, the Empathic Imagination Method, and the Evidence-Based Method—are considered important pedagogical approaches aimed at developing non-traditional education. Such methods help pupils and young people to be creative, to strive to solve pedagogical problems, to carry out research work or scientific projects, and to achieve mutual creative collaboration. As an example, we will also familiarize ourselves with the following tasks:
- 1.2. Creative Task: Using the words "Why?" and "What for?", come up with 10 questions about the amoeba.
- 1.3. Task: Using theoretical materials, fill in the table.
- 1.4. Creative Task: Imagine what would happen if all flagellates disappeared? (Diagnostic Method)
- 1.5. Creative Task: Imagine what would happen if all insects disappeared? (Diagnostic Method)
- 1.6. Creative Task: Write a short essay from the perspective of a leech. (Empathic Imagination Method)
- 1.7. Task: Define "Protozoa" as "Extremely Dangerous Criminals." (Based on the Evidence-Based Method)

It is evident that if presented to students in the format shown above, they would complete these tasks with great interest.

Conclusion

In summary, pedagogical situations that foster the research activity of students and pupils are of paramount importance. During lessons, students and pupils benefit from situations where they are encouraged to express their own opinions, defend them, provide supporting arguments and instructions, engage in mutual questioning and answering, clarify misunderstood concepts, and deepen their understanding of knowledge. Research results indicate that the use of creative tasks aimed at developing students' creative thinking helps achieve specific goals in organizing effective classroom and extracurricular activities, and in developing students' research skills and activities. It increases students' interest in acquiring knowledge and guides them towards achieving better results. Thus, organizing classroom processes by enhancing the thinking abilities of students in the teaching of natural sciences within the educational process is one of the demands of the modern era.

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