

FEATURES OF AN INCLUSIVE APPROACH IN PHYSICS EDUCATION, SAFETY REQUIREMENTS, AND ADAPTATION MECHANISMS

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Abstract

This article highlights the specific aspects of teaching physics based on inclusive education, safety rules for students with special needs, and adaptation strategies. The importance of implementing an inclusive approach in physics education and the requirements for creating a safe environment for students with disabilities in laboratory classes are analyzed. Recommendations are also made on didactic materials, methods and tools used in adapting the lesson process, as well as the role and professional training of the teacher in inclusive education. The conclusions and recommendations presented provide practical suggestions for improving the quality of inclusive physics education.

Keywords: Inclusive education, students with special needs, physics laboratory, safety rules, adapted textbooks, didactic tools, teacher training.

Introduction

ОСОБЕННОСТИ ИНКЛЮЗИВНОГО ПОДХОДА В ОБРАЗОВАНИИ ФИЗИКИ, ТРЕБОВАНИЯ БЕЗОПАСНОСТИ И МЕХАНИЗМЫ АДАПТАЦИИ

Аннотация:

В статье рассматриваются особенности преподавания физики в условиях инклюзивного образования, правила безопасности для учащихся с особыми потребностями и стратегии адаптации. Анализируется важность внедрения инклюзивного подхода в обучение физике, требования к созданию безопасной среды для учащихся с ограниченными возможностями здоровья на лабораторных занятиях. Даны рекомендации по дидактическим материалам, методам и инструментам, используемым

при адаптации учебного процесса, а также роли и профессиональной подготовке учителя в инклюзивном образовании. Представленные выводы и рекомендации содержат практические рекомендации по повышению качества инклюзивного образования физики.

Ключевые слова: инклюзивное образование, учащиеся с особыми потребностями, физическая лаборатория, правила безопасности, адаптированные учебники, дидактические средства, подготовка учителей.

INTRODUCTION

Inclusive education means the full inclusion of all children, including students with physical or mental disabilities, in the general education process. Today, it is noted that there are about 1 billion people with disabilities in the world, and the development of inclusive education is of urgent importance [1, 153-155-b]. In the Republic of Uzbekistan, special attention has been paid to inclusive education in recent years, and the concept of inclusive education was first strengthened in the new Law “On Education” adopted in 2020. In 2021, Uzbekistan ratified the UN Convention on the Rights of Persons with Disabilities [1, 150-154-b]. This legal framework allows for the widespread introduction of an inclusive approach in the education system of our country.

Teaching physics on an inclusive basis, that is, involving students with special educational needs in physics lessons together with their healthy peers, ensures their right to receive knowledge in natural sciences. Since physics serves to study the laws of nature, children with disabilities need to master this subject as well - this is of great importance in their understanding of the environment, developing logical and scientific thinking. Masodikova's research notes that physics is of high theoretical and practical significance for students with special needs, and the use of certain inclusive methods can increase the interest and participation of such students in science [3, 61-b]. Therefore, inclusive physics lessons require adapting curricula, making the learning process as flexible as possible, and introducing additional aids [3, 62-b]. Traditional programs may not be suitable for children with disabilities; The inclusive approach involves differentiating education and teaching through adapted programs based on the abilities and needs of each student. For example, for a student with severe hearing impairment, it is necessary to use subtitled video lessons or the help of a sign

language interpreter. For a blind student, it is necessary to provide texts and audio materials in Braille. Inclusive lessons create opportunities for healthy and disabled students to learn from each other and solve problems together. In this process, the support of healthy peers increases the self-confidence of children with special needs and ensures their participation in the team.

LITERATURE REVIEW AND METHODOLOGICAL APPROACHES

Safety is an important issue in physics lessons, especially in laboratory exercises. All students must follow strict safety rules when conducting experiments with electricity, chemicals, heat sources, or mechanical devices. In inclusive education, additional safety measures must be taken, taking into account the capabilities of students with special needs. To do this, it is necessary to pay attention to the following:

Laboratory environment and equipment: The physics room should be adapted to students with disabilities. For example, for students in wheelchairs, the height of tables and equipment should be adjusted accordingly, and the walkways should be wide and free of obstacles. For visually impaired students, the location of equipment in the room should be explained in advance, and dangerous objects should be placed in clearly designated places [4]. All equipment should be securely installed and provided with protective equipment (dielectric gloves, protective glasses, etc.).

Signals and warnings: Children with special needs may not be able to hear simple warnings about some dangers. For example, students with hearing impairments may not hear simple warning bells or sirens. Therefore, fire or emergency alarms in the laboratory should be equipped with additional signs in the form of light or vibration. Similarly, warnings should be provided in an audible form for students who are blind.

Explaining instructions: Before any experiment or practical activity, the teacher gives detailed safety instructions to all students, especially children with disabilities. If necessary, he uses additional methods such as translating the text of these instructions into Braille or distributing them in large print, explaining them through sign language. The activity should only begin after making sure that the students fully understand the instructions given.

Supervision and assistance: During laboratory work, the teacher and laboratory director constantly monitor the safety of students. It is recommended that

students with special needs be accompanied by an assistant (for example, a defectologist, tutor, or experienced volunteer student) whenever possible. These assistants can closely assist the student in experimenting and quickly respond to emergencies. For example, if children on the autism spectrum are worried about unexpected noise or light, the assistant can help them concentrate. Also, creating a calm, friendly environment for all students during the lesson, maintaining respect among peers, is especially important in an inclusive classroom in terms of psychological safety. In general, general safety rules in physics lessons should be more carefully followed in inclusive classrooms [6]. Limiting and protective mechanisms must be fully operational when using laboratory equipment and instruments, and tools such as a first aid kit and fire extinguisher must always be available in the room. The teacher should adapt the experimental methods, taking into account the health and capabilities of each student - for example, some dangerous processes can be demonstrated using a demonstration video or a virtual laboratory. This approach ensures equally safe and effective learning activities for all children.

RESULTS

In inclusive education, adapting the content and form of the lesson is an integral part of the educational process. Since mastering physics often requires complex formulas, observations, and experiments, it is necessary to use additional didactic materials and flexible methods for students with special needs. With the help of didactic adaptations, it is easier for children to perceive knowledge through various sensory organs and abilities. From the point of view of didactic materials, the share of visual and interactive materials is increased, first of all. For students with visual impairments, it is important to use real objects and models to imagine objects and phenomena. For example, models representing physical processes, relief drawings, and Braille printed materials should be used. For children with hearing impairments, factors such as providing written text and graphics along with audio materials, and having the teacher stand face-to-face during explanations for the opportunity to read from the lips are taken into account. By following the principle of demonstrability, it becomes easier for students to clearly imagine the phenomena of the surrounding world and form concepts. Researchers note that the reliance on only verbal and abstract methods of education for children with visual impairments creates serious disadvantages

- if there is not enough visual material and technical means, they are forced to formally memorize knowledge. Therefore, for such students, additional special didactic tools that emit sounds, work with light, or can be felt by touch should be introduced.

Teaching methods are also selected in accordance with the inclusive environment. A differentiated approach, group work, game, and project methods are more effective than traditional lecture or monotonous methods. The differentiation method involves giving tasks that are appropriate to the individual interests and capabilities of each student - for example, a highly capable or curious student is given a project assignment on a deeper issue, while a more difficult student is offered a simple practical exercise [9]. Working in groups involves mixing children of different levels in the class and completing collective tasks in a way that complements each other; in this case, students with special needs participate in communication and cooperation with their peers in the group, which also develops social skills in them. Game technologies and competitions increase students' interest in the lesson, and project activities create conditions for each child to demonstrate their unique approach. For example, using the "Small Physics Projects" method, each student (or small group) prepares an individual project based on their capabilities - one draws a poster, another shows a simple experiment, and another prepares and explains a slide. As a result, each child contributes to the common goal [5].

The use of technical tools and ICT (information and communication technologies) also creates great opportunities in inclusive physics education. Nowadays, there are electronic textbooks, multimedia applications, and virtual laboratories, which are especially useful for students with special needs. For example, the blind can use Internet information through screen-reading programs, and subtitled video guides have been created for those with hearing impairments. Virtual laboratories reproduce real experiments using computer graphics - this, on the one hand, ensures safety, and on the other hand, allows children who are not physically able to conduct experiments to "see" the experiment and analyze the results. At the same time, some experiments that are difficult to implement in a regular lesson (for example, astronomical phenomena, very small or very large-scale processes) can be demonstrated equally to everyone through virtual simulations. Computer technologies also help students with disabilities to independently perform laboratory work - with the help of

special programs, they can enter measurement results, draw graphs, or perform calculations automatically.

In short, the goal of adaptation strategies is to “create equal opportunities for children with different abilities”. By enriching didactic materials, using new pedagogical technologies, and adapting teaching aids, conditions are created for each student to understand and master the subject of physics deeply. In this process, the teacher’s creativity and knowledge are important: he must simplify complex concepts and involve each child in the activity, combining several methods and tools in one lesson.

DISCUSSION

The role of the teacher in inclusive education is crucial. To work with children with different abilities and needs, the teacher requires not only thorough knowledge of their subject, but also additional knowledge and skills in the field of special pedagogy and psychology. In particular, an inclusive class teacher must have such skills as individual work with each child, differential lesson planning, and cooperation with defectologists and psychologists. The teacher must have an inclusive mindset - that is, he must be able to approach each child according to his abilities and manage the class as a single team. Researchers note that in inclusive education, the teacher's professional skills and training are the main criteria for the quality and effectiveness of education. Therefore, the issue of training future physics teachers in inclusive teaching methods is relevant. Special courses and practices are being introduced in pedagogical institutes, where students are taught methods of working with children with various types of disabilities (hearing, vision, mental, etc.). In particular, topics such as the basics of using Braille in the classroom, techniques for delivering material to children with hearing impairments, and the psychology of teaching students on the autistic spectrum should become part of teacher training. Mamatrakhimova, in her study, emphasizes the organizational and methodological work plan necessary for implementing inclusive education in practice, paying particular attention to the issues of improving the skills of teachers and creating a team environment. In an inclusive classroom, teamwork is effective not only among subject teachers but also among assistant teachers (tutors), speech therapists, and psychologists. In such cooperation, the teacher plays a leading role, harmonizing the recommendations of various specialists in the lesson plan and implementing

them in the classroom [7].

The teacher's methodological support should also be solid: he or she should form a bank of inclusive lesson plans, study relevant literature and manuals for each category of special needs. For example, if there is a student with hearing impairment in the classroom, it is useful for the teacher to be aware of the IMO (Special Education for the Disabled) methodology, and if necessary, learn sign language. Similarly, a teacher working with a blind student should know how to use relief-drawing materials, audiobooks, and computer programs designed for him or her. These skills are regularly strengthened in advanced training courses and seminar trainings [8]. As world experience shows, in many countries, special state programs have been established to prepare teachers for inclusive education, where they conduct training for teachers in inclusive pedagogy, classroom management, conflictology, and various designs (UDL - universal design). In our country, resource centers for inclusive education are currently being established under the Ministry of Preschool and School Education. In these centers, teachers and specialists, while studying foreign experience, are developing innovative methods suitable for local conditions. Another important aspect is the personal qualities of the teacher. A teacher working in an inclusive classroom must be patient, empathetic, and strive to deeply understand the problems of each child. His high level of communication culture, his approach to students with love and trust, create a positive psychological environment in the classroom. In such an environment, a student with special needs also feels free and protected and participates more actively in lessons. The teacher must apply fair criteria in interpreting all children in the classroom, encourage their achievements, and motivate them to overcome difficulties. An inclusive teacher is constantly working on himself - he analyzes after each lesson and looks for what can be improved, communicates with parents, and takes into account their suggestions. Thus, the high professional competence and constant search of the teacher are among the main factors ensuring the success of inclusive education [10].

Implementing an inclusive approach to physics education is an important step towards realizing the right of every child to receive a quality education. The above analysis shows that to attract and support students with disabilities in physics, it is necessary to comprehensively adapt the educational environment. In particular, it is necessary to adapt physics textbooks and laboratory

equipment, and to ensure safety rules in a form that all children can understand and follow. In inclusive lessons, a differentiated approach, demonstrative and interactive methods, and the use of ICT tools are justified - such strategies guarantee that each student receives knowledge according to his or her abilities.

The success of inclusive education largely depends on the preparation and attitude of the teacher. The teacher must have a thorough knowledge of not only the subject, but also the basics of special pedagogy, constantly improve their skills, and reflect on their lessons. At the same time, the school administration and society should provide teachers with methodological and material support, and classrooms should be equipped with the necessary equipment and resources.

CONCLUSION

In conclusion, we present the following recommendations for implementing an inclusive approach to physics education: 1) introduce the position of an inclusive education coordinator (advisor teacher) in each secondary school and provide teachers with the necessary advice and assistance through him; 2) create a bank of additional textbooks, audio-video materials for physics for students with special needs; 3) increase the share of training and practices on inclusive education methodologies in the system of training and advanced training of pedagogical personnel; 4) form an inclusive culture among parents and healthy students, improve the culture of communication with peers. Supported by these measures, an inclusive approach to teaching physics will create a beneficial educational environment not only for children with special needs but also for all students, paving the way for achieving high results through joint learning.

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