

Some Ways of Integrated Teaching of Mathematics and Natural Sciences

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The aim of this study is to identify key concepts for finding ways to integrate teaching mathematics and science, in the context of the prospects for teaching natural sciences in modern educational institutions. The basis of the methodological approach in this scientific study is a combination of methods of system analysis of the methods of teaching mathematics currently used in the practice of educational institutions with an analytical study of the real prospects for building ways of integrated teaching of mathematics and other sciences of the modern natural science system. In the course of this scientific research, results were obtained that testify to the need to develop the principles of integrating mathematics in teaching it with other scientific disciplines, as they have proven their high efficiency in building the educational process. The results of this scientific research formulated on their basis, are of significant practical importance for teachers and students of modern educational institutions involved in the process of studying mathematics in the context of its relationship with other disciplines.

Keywords: education, an integrated lesson, the method of integrated education, integration of inter-subject relations

INTRODUCTION

From the standpoint of global changes in society during the process of globalization, integration has been like a mirror, reflecting all the changes in education. Methods of teaching in pedagogical sciences, including teaching mathematics is one of the main objectives of training a cultural, moral, and all-round developed person, as well as improving the quality of education and assimilation of educational material. In order to improve the quality of teaching along with the use of national pedagogic achievements we have to apply the best practices of modern education system of Kyrgyzstan and the world in this field. As to this day, we cannot say that we have not developed national pedagogical traditions without any integrated

learning ideas. Moreover, along with commonly accepted ideas, progressive ideas, it is very important today to develop new ways through cultivation and education of the new generation (Fredricks et al., 2019).

The decrease of interest of students to subjects in secondary schools, which in certain cases has become one of the problems in the learning process. Therefore, now, using the integration of new ideas in education, searching for new directions to enhance the effectiveness of teaching and educational processes are the best world practices in teaching and assimilation of educational material. One of these practices is the experience of integrated teaching mathematics with natural sciences that will cultivate and develop students' thinking and knowledge (Ignatyshyn and Khimich, 2021). And, this integration will, in its turn, enable a full access to education combining the variety of complex phase of the data lines in one direction (Brame, 2019).

The concept of the integrated education system assumes the integration of didactic processes, methods of organizing and conducting the training process properly (Alvarez et al., 2020). However, the development of integrated training students thinking and promotes the formation as a creative person. Interdisciplinary links to enhance efficiency on the basis of the implementation of the training course is clear. And high school students through a systematic and comprehensive education would win. Interest through integrated subjects for students to learn about the world and the position of the orientation will be strengthened (Francisco et al., 2021). They will be formed as dynamic personalities. Such demands must be made at the time and subsequently integrated with the subject, the subject of mathematics, natural sciences; basic classes in maths class to be used in the rational of the activity of mathematics teachers with a creative approach; it leads to the question of the combination according to the scientific and methodological basis (Schwartz et al., 2021).

Therefore, the primary school pupils in mathematics education program, each student has to get access to a complete and sufficient material sources. For the teacher to integrate the subject of mathematics with natural sciences and with the subject matter of this material is appropriate and rational; that is a creative need to develop the ability to use the didactic process of school to go into the depths of time; this topic is very relevant for the time.

MATERIALS AND METHODS

The methodological approach in this research work is based on a combination of methods of system analysis of methods of teaching mathematics currently used in the practice of educational institutions with an analytical study of real prospects for building ways of integrated teaching of mathematics and other sciences of the modern natural science system. The main scientific research is preceded by the creation of a theoretical base, which is an analysis of the available scientific works of a number of modern authors who considered the problematic issues of finding ways to build an integrated approach to teaching mathematics in connection with other natural science disciplines.

This scientific study was carried out in several main stages. At the beginning of this research work, the theoretical base of the scientific research was formed, which determines its key directions and sequence of implementation. Also at this stage of the scientific research, a systematic analysis of the methods of teaching mathematics used today in the practice of educational institutions was carried out, as being of key importance in terms of finding the relationship of mathematical science with other scientific disciplines.

In continuation of this research work, an analytical study of the real prospects for building ways of integrated teaching of mathematics and other sciences of the modern natural science system was carried out. The main stages of the process of integration of the two scientific disciplines were considered, as well as the key conditions necessary for the qualitative implementation of the integration process. In addition, a qualitative assessment of the problem of applying interdisciplinary links and identifying similarities and differences between two or more integrated disciplines is provided, which is of fundamental importance in terms of building an integrated teaching of mathematics and other scientific disciplines. At this stage of the research a comparative analysis was also made of the results obtained in the course of the research with the results and conclusions obtained by other scientists who have conducted their own research on finding ways to build integrated teaching of mathematics and natural science. This contributes to the refinement of the results obtained and the formation of qualitative conclusions of this scientific study on their basis.

At the final stage of this scientific study final conclusions were formulated, serving as their final reflection and summing up the entire range of research implemented within the framework of the stated subject of this scientific study.

RESULTS

Through the integration of subjects including mathematics explained by the need to deal with learning carious, prejudices and stereotypes. So, if we want to teach through the integration of math lessons to teach math, then pursue it with the state standards adopted for classroom teaching requirements, with strict adherence to principles, and organizing the training process is needed to be carried out. At the same time mathematics community, social and personal well-being of every individual, position, role and importance of the activities in the first place, and kept a strong connection between theory and practice, practice and theory, theory and practice should be guided by that principle. If we, the teachers, make students aware of assuring the success that learning about self-recognition and recognition, explaining that if they were interested in it, mathematics is regarded as the culmination of the integration (Bekboev, 2011).

As a consequence of the importance of integrated lessons students studying a variety of subjects (skills) of the values of unity and the development of education as a whole, in fact, is that the awareness towards the same goal. The value of the knowledge of the students is, firstly, the relations between people. Clearly, integrated teaching of Math is fully in line with the main goals and objectives. The issue of teaching Math is in the implementation of the norms and principles of law in connection with the required didactic teaching (Kirkwood, 2018).

Before the organization of the integration lessons are required to integrate the contents of the taught material. Integration of learning content is aimed at the development of the student and self-development, in order to create a single integrated concept and the world around them within the education system (subjects) participated in a content-identification and verification process. The following levels of integrating the content of educational materials are expressed.

In the first, the integration of concepts, knowledge, and values are within the subject.

In the second, interdisciplinary relations – the syntheses of two subject or more objects, facts, concepts, principles, rules. At the same time, the integration of content is the synthesis of mathematics and physics, mathematics and chemistry, geography, biology, mathematics and other subjects. Mathematics teacher's teaching classes in math and physics joined, makes teaching much easier.

The use the concept of the function coincide with teaching materials in physics and math classes that may fill in the functional dependence on the program dedicated to. In Grade VII math and physics lessons coincide in learning functional dependences of variables. For example, in math class, students learn the inverse correlation of their properties of direct and proportional dependences coefficient. At the same time, in Physics class, they learn the average speed of uniform motion, the non-uniform motion, the speed of uniform motion in a way that during the past, and movement time calculation of a body, according to the calculation of density, mass, density and other concepts (Mambetakhunov, 2004; Bondar et al., 2021).

The process of integration of disciplines require certain conditions. Pedagogical recent studies establish the following elements:

1. Match the objects of study subjects or be too close to each other.
2. Integration of the study subjects close to each other or to the same methods used.
3. Of course, an integral part of the content of communications, and the need to ensure the unity of the leading idea.

There are three types of lessons can be integrated. The whole lesson taught by one teacher, a teacher and helped him hold selected class has been prepared in advance, and 2 or 3 student participation, and third, to integrate subjects (such as mathematics, physics, chemistry, biology, geography, etc. together, the teachers) planned in sequence in a single lesson.

Sufficient opportunity to host the first type of math teachers, for their training (teaching) as two of discipline (math and physics) in the preparation of teachers prepared to teach the subject matter of the two. Thus, the teacher integration, before teaching these related two subjects they should seek common ground.

Two practitioners of creative and experienced teachers in the subject of integration, combined with a specific focus, the success of the experiments must be noted (Mambetakhunov, 2015). In mathematics teaching integrated with other subjects it is necessary to identify one issue. It is the creation, application of the interdisciplinary links, identification of similarities and differences between the integrated disciplines (Cooperman, 2017).

The novelty of the didactic processes can be outlined as follows:

- connection between subjects, keeping the links, taking into account the basic requirements of didactic teaching in the education process. As mentioned above, the basis of the science of pedagogy is created on the nature of the integration process. Therefore, both the link between subjects and integrated course is intended to reach the one single goal.
- the process – two, two didactic phenomena, combined or certain subjects that are connected in common, is carried out with reference to the overlap.
- the courses are interdisciplinary, integrated, and maintains a connection to certain governing ideas. He thought the teacher of the course objectives and content shall be determined in accordance with.
- Features of interdisciplinary communication and integrated lessons can be displayed as these:
- in interdisciplinary relations, the main subject (math) retain full status as a subject of self-learning. Data obtained from other subjects, materials, materials of the main subjects (mathematics), serves as a means of explaining the content of additional material or subsidiary;
- in interdisciplinary relations, which connects the main subject (math) will retain full autonomy as other subjects. Accordingly, the relations with the outer nature do not allow it to blend in two or more subjects;
- integrated in the classroom or personal autonomy of the purpose and content of the object lose a certain extent, the goal is to expand the limits of the content and implementation of consolidation, a number of goals through the integration of (a) a single purpose;
- in integrated classes, one way or the personal autonomy of the purpose and content of the curriculum of the subject to lose to some extent and extending the limits of the content of the curriculum, the implementation of several goals through integration pursues the same goal;
- in integrated classes range of subjects participating falls in the traditional limits. Such impairments, rather than a rejection of objects and processes by combining them with the creation of a whole new education, teaching is carried out on the basis of integrity;
- the main feature of integrated interdisciplinary communication training courses is explained by developing and enhancing capabilities.

Math is integrated with any subject is distinguished as the main or leading subject. To know the priority given to math is understood to be a tool, a tool for learning linked to consciousness.

DISCUSSION

Integration – the concept of a number of sciences, involving complex scientific topics. The interdisciplinary integration is the knowledge and belief of the courses, practical activities internal consolidation. The combination of subjects and content can be achieved by ordering. For example, the integrated nature of the subject matter of mathematics. In particular, the subject of mathematics, physics, geography, chemistry, biology and other subjects in close contact with each other form an indivisible whole and complete. This entity, which does not eliminate the autonomy of subjects, but expands the content of the subjects (McGregor et al., 2010).

Integration of subjects is a complex and lengthy process in public practice depending on the requirements of the development, production and personal with the inherent logic of the scientific recognition. But the main purpose of the integration is to be understood that students of different subjects, the subject of the unity of knowledge, education, explaining that they form an indivisible whole. The

ultimate goal is to make students aware of the unity of the world around them to treat, according to him, the activities of teaching and adaptation.

The role of students' emotions in the perception of an integrated approach to the study of mathematics in conjunction with other academic disciplines is extremely important. This circumstance necessitates the development and practical implementation of an effective interdisciplinary approach to the study of the emotional sphere of students and its role in education and knowledge of the world. Such an approach should include consideration of ways to establish links between the emotional sphere of students and their success in the study of mathematics in direct connection with other program disciplines. Special attention should be paid to the study of problematic aspects of the social sphere, directly related to the integrated study of mathematics by students (Ahamed, 2016).

Developing a student's understanding of a high level of understanding of the studied mathematical patterns focuses on typical and atypical learning of complex arithmetic skills and higher-order math concepts. Recent advances in understanding the development of children's skills in working with integers, fractions and rational numbers have been achieved through the implementation of an integrated approach to the study of mathematics in close connection with other scientific disciplines. For a qualitative understanding, these topics should be covered from different perspectives, including genetic disorders, cognition, learning, and neural networks (Geary et al., 2016).

The most important feature of an integrated approach to teaching mathematics in the context of reflecting its close relationship with other program disciplines is the formation of a student's understanding of mathematics as a science, the laws and principles of which are manifested in many other areas of life, and this can be observed in specific practical examples. Certain numbers, as well as their combinations, as well as numerical sets and mathematical functions in this context can be represented by analogy with various physical entities. The principle of constructing analogies is relevant in the implementation of an integrated approach to the study of mathematics in conjunction with other natural science disciplines, as it reflects the main aspects of the application of mathematical laws in everyday life.

The nature of mathematics has been studied by many scientists for a long time in order to establish its relationship with other scientific disciplines, as well as to determine its role and place in the data system of scientific disciplines. This contributed to the development of mathematics in the system of world knowledge and the understanding of the existing relationships between mathematics and other disciplines of the natural science system (Irvine, 2009).

In the process of teaching mathematics in educational institutions, significant differences are found between mathematical research and mathematics education, which leads to the introduction of many proposals for making small and medium changes in lectures, tutorials, problem development or problem solving. The situation necessitates the development of practical guidance for effective teaching of mathematics in today's technological environment, addressed to teachers who are dissatisfied with the results or experience, or those who are currently teaching teachers or new to the profession (Mason, 2002). Starting with a number of student behaviors and attitudes that have struck and amazed faculty and faculty, many partial diagnoses should be presented, followed by specific advice and suggestions for corrective action.

The perception of students of the curriculum in the field of mathematics and its relationship with other disciplines often proceeds at the level of various emotions. This circumstance necessitates the implementation of an interdisciplinary approach to understanding the role of emotions in numerical cognition, mathematical education, learning sciences and affective sciences. This approach should take into account the ways in which emotions are associated with cognitive processes associated with learning and mathematics, including the processing of numerical and physical quantities (for example, time and space), results in arithmetic and algebra, attitudes towards problem solving and reasoning, learning technologies and achievements, in mathematics (Xolocotzin, 2017). In addition, it covers social and emotional issues such as identity and attitudes towards mathematics.

The integration of mathematics with other sciences is essential in terms of the quality of learning by students of the curriculum. In particular, integrated lessons at school make it possible to create a unified system of world perception among students through the use of mathematical topics that students will have

to study as part of the educational process. When building integrated learning, it is important to observe a single structure for presenting lessons, while maintaining the principles of integrated presentation (Sukhai and Mohler, 2016).

One of the key tasks of the modern education system is to empower the student, and one of the ways to implement this task is to introduce the principles of integrated study of mathematics with other sciences. Integration entered pedagogical science in the 1980s, and this became possible due to the consistent development of integrative processes in the education system over the previous decades, which led to a deep interpenetration of sciences into each other. Integration is a deep interpenetration, a merger, as far as possible, in one educational material of generalized knowledge in one or other area.

The result of integration is a new reality, in which each of the components retains its essential qualities. Integration excludes destruction, subjugation, dissolution of one in another. Integrated lessons give the student enough a broad and vivid view of the world in which he lives, about the interconnection of phenomena and objects, about mutual assistance, about the existence of a diverse world of material and artistic culture (Popova and Rekk, 2010).

The need to introduce an integrated learning system for young children is due to a combination of a number of reasons. The surrounding world is known by children in its unity and diversity, and often the subjects of the school curriculum, aimed at studying individual phenomena of this unity, do not give an idea of the whole phenomenon, splitting it into separate fragments. In addition, integrated irradiation contributes to the development of the potential of the students themselves, encourages them to be active in learning, develop logical thinking and communication skills. Also, the integrated lessons themselves are unusual and non-standard, contribute to the education of non-standard thinking in children and develop their imagination (Sarama et al., 2017).

The integration of the study of mathematics with other disciplines of the program of the educational institution serves the tasks of ensuring the general cultural, personal and cognitive development of students (Geary et al., 2019). The main task of this kind of training is to instill in the child the skills of independent learning, teaching him the process of thinking in the context of the ability to think, analyze and make the right decisions in specific life situations. The integration of mathematics with other subjects in the learning process contributes to the qualitative solution of such problems, as well as the involvement of each student in an active cognitive process. At the same time, the process consists not only in the passive acquisition of certain skills and knowledge, but also in the active participation of the student in the educational process, with the acquisition of certain skills and competencies that will be necessary in later life.

Conducting scientific research in the development and implementation of methods for integrated teaching of mathematics with other scientific disciplines will contribute to a gradual improvement in the quality of modern education and an increase in the level of student achievement in the study of mathematics (Povidaychyk, 2021). In addition, integrated learning will contribute to the accelerated development of students' intellect and the expansion of their understanding of the world around them, which in general contributes to a general improvement in the quality of understanding the role and place of mathematical science in the system of modern natural science.

In learning physics students get acquainted with the properties of various natural phenomena, their mutual relations, mutual dependence and values which characterize them. Any kind of dependence may be explained in the mathematical way and any change in the nature may be a reason of a second change makes students believe that because of dependences. Therefore, students' obtaining correct understanding of function and the functional dependence create favorable conditions to learn the basis of mathematical and physical knowledge by the students. The concept of function is the concept of natural sciences and mathematical sciences. For most of us, it is especially important to understand that function used not only math classes to learn the basis of the mathematical methods used in other sciences, we think.

CONCLUSIONS

The lessons integration is not something completely new, it is originated with the foundation of pedagogy, it has been an integral component. Integration of subjects and training requirements of public

welfare, public demand has intensified the necessity of education, education and training a new level of use of integrated processes, we think that it must be considered as the height of the present time. To settle theoretical and to solve actual problems, didactic issues in this area is one of the duties to promote the practice of teaching math.

Mathematics is inextricably linked with other scientific disciplines in the field of natural science, and this should be taken into account when planning the educational process in the context of integrating mathematics with other sciences. At the same time, the issues of finding effective ways to integrate mathematics in the process of teaching it to students with other sciences of the natural science system are largely determined by the level of preparedness of both the teacher and the students themselves.

The teacher's ability to convey to the students the main aspects of the relationship between mathematics and a specific related science largely determines the level of perception of the material presented by the listener, as well as the ability to apply the information received in practice. Therefore, on the stage of preparing and planning the educational process, one should take into account the need to prioritize the integration of mathematics with other disciplines, in order to educate students in a holistic view of the existing relationship between mathematics and other sciences, which will contribute to its popularization as a scientific discipline as a whole.

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