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THE RELEVANCE OF INTEGRATION OF MODERN DIGITAL TECHNOLOGIES IN TEACHING MATHEMATICS

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АКТУАЛЬНОСТЬ ВНЕДРЕНИЯ СОВРЕМЕННЫХ ЦИФРОВЫХ ТЕХНОЛОГИЙ В ПРЕПОДАВАНИИ МАТЕМАТИКИ

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Abstract. Mathematics acts as the basic subject of higher education. Most students around the world, particularly in this study, in Uzbekistan, sometimes lack motivation to be good at mathematical disciplines. The work presented in this article is aimed to promote the development of new teaching and learning methods by using modern digital technologies, in order to encourage studying mathematics.

Аннотация. Математика выступает в роли базового предмета высшего образования. Большинству студентов во всем мире, в частности, в этом исследовании, в Узбекистане, иногда не хватает мотивации, чтобы преуспеть в математических дисциплинах. Работа, представленная в этой статье, направлена на содействие развитию новых методов преподавания и обучения с использованием современных цифровых технологий, для формирования мотивации к изучению математики.

Keywords: mathematics, students, teaching methods, digital technologies, development of skills.

Ключевые слова: математика, студенты, методы обучения, цифровые технологии, развитие умений.

The informatization of higher education in the modern world plays a key role. This process is the “engine” of the future, determining the quality of education in the country, its technical capacity. Its success directly depends on highly qualified specialists who are able to solve scientific and technical problems and provide the growth of the national economy and transfer to the digital future [1].

What counts when it comes to using digital technologies in university mathematics courses? Is technology there to help students get ‘the answer’ more quickly and accurately, or to improve the

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way they learn mathematics? The way people answer this question is illuminating and can reveal deeply held beliefs about the nature of mathematics and how it is best taught and learned.

The nature of mathematics learning continues to be a dominant theme in current debates about reforms in mathematics teaching. In so doing, the mathematics education community at large is focusing on issues concerning how individuals come to understand mathematics and how teachers can better scaffold deep learning.

The use of digital technologies in teaching and learning of mathematics is an emerging research area and is expanding and growing quickly. However, we must be cautious: even though digital technologies and their characteristics appear to offer vast opportunities to enrich and transform the practice of mathematics education at all levels, the introduction of these digital technologies in the classroom also pose a number of challenges of a different nature. Also, students today often turn to online mathematics learning resources, such as digital libraries and learning objects before consulting a teacher or a textbook. As mathematics educators, we need to develop and organize these resources in such a way that they facilitate access and foster conceptual understanding.

On the other hand, the swiftness with which the education system is immersing itself in digital technology today is not just amazing, it provides the basis for a serious analysis and pedagogical justification of many of the things that are offered in the information space today.

The purpose of this article is to present a description, analysis of the effects of integration of modern digital technologies in teaching mathematics. Consideration is given to the types of experiences students encounter and how best to develop the curriculum to engage students in using skills to explore a variety of aspects of mathematics. Usage of digital technology within university mathematics course has been predominantly teacher-led and mainly focused on presentational software such as PowerPoint and interactive whiteboard software [2–4].

Today’s technology standards challenge teacher education programs across the nation to address the need to produce computer literate teachers who are confident in their ability to choose and incorporate instructional technology into their classroom teaching. For this reason, it is crucial for universities math teachers to share effective ways to integrate modern digital technologies into the mathematics classroom.

Digital technology is essential in teaching and learning mathematics to understand the basic concept and the way of problem-solving technique. Digital technologies refer to a wide range of devices which combine the traditional elements of hardware and software to perform a wide range of tasks. They include communication applications; technical applications; educational applications and consumer applications. Teachers’ ability to select appropriate software and websites is an essential component of the ultimate success of effectively integrating digital technologies into classroom teaching.

A key issue facing the Republic of Uzbekistan is how to inspire and develop the next generation of innovators, creators, scientists, and mathematicians on which our future well-being and economy depends. There is a need to build on and improve our country’s capacity for technological innovation and creativity. Education at all levels has its part to play in engaging the interests and enthusiasm of young people so that they pursue education, training and career paths which contribute to the nation’s needs while themselves achieving satisfaction and reward.

Digital technologies cannot be effective in the classroom without teachers who are knowledgeable about both the technology itself and its implementation to meet educational goals. While digital technologies use in the classroom is increasing, improving learning through its application should remain the goal.

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In our research, we explored 50 universities math teachers' beliefs about and use of digital technologies through a technology, pedagogy and content knowledge lens from various professional communities engaging in face-to-face and online professional development and teaching activity. In the process of this study we would like to understand how universities math teachers use and perceive digital technologies in practice and the factors influencing their pedagogical decisions to incorporate technology into their practice. Data included surveys, mathematics outreach program and teachers' interviews. Findings revealed that both internal and external barriers were present and influenced how teachers situated their pedagogy in terms of modern digital technologies integration in teaching mathematics. It was also found that teachers were confident in content, pedagogy, and technology; however, most viewed digital technologies as a tool rather than an embedded part of the learning process. This research contributes knowledge about professional development initiatives and the need to address not technology knowledge as much as the interdependence of technology, pedagogy, and subject content matter [5].

Current research has clearly indicated the pivotal role of teachers in the successful integration of digital technologies into the university Mathematics curriculum. While teachers need support to develop the necessary technological and pedagogical content knowledge that is uniquely associated with the effective use of digital technology, adequate support has frequently not been provided, so that unrealistic expectations have been made of math teachers [6].

The teachers who participated in our research represented a wide range of opinions and thoughts about the integration of modern digital technologies in teaching mathematics. Most expressed an interest in learning more about technologies, others reported that they had altogether abandoned using some technologies due to the lack of resources and time constraints for learning new technologies, and some were skeptical about the benefits of using technologies [7].

As a rule, in higher education, a math teacher should instruct students in the broad field of mathematics. They have to create lesson plans to instruct their students in general or specialized subjects within mathematics. They should prepare math assignments, homework, and tests to impart knowledge and understanding to their students. They also assess students' progress and abilities throughout the academic year. To achieve success in educational process teachers should possess strong math skills and knowledge and be able to communicate math principles effectively to their students. Math teachers should need patience and understanding in order to promote students' critical thinking skills and ability to utilize math in everyday life. Math teachers' jobs can be very rewarding as they play a vital role in encouraging intellectual development.

There is already a wide range of existing 'mathematical' digital technologies which could readily be used by universities such as:

– Dynamic graphing tools;
– Dynamic geometry tools;
– Algorithmic programming languages;
– Spreadsheets;
– Data handling software and dynamic statistical tool;
– Computer algebra systems;
– Data loggers, such as motion detectors and GPS;
– Simulation software.

The findings reported here highlight areas that require further attention to enable teachers use digital technologies in mathematics teaching. For math teachers to integrate 'mathematical' digital technologies into their practice, they need an ever-evolving understanding of which technologies exist and their functionalities

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Recommendation 1: For math teachers. University mathematics should acknowledge the significant use of digital technologies for expressive and analytic purposes both in mathematical practice outside the university and in the everyday lives of young people.

Recommendation 2: For universities management. Curriculum and assessment in university mathematics should explicitly require that all young people become proficient in using digital technologies for mathematical purposes.

Recommendation 3: For universities management. High-stakes assessment needs to change in order to encourage the creative use of digital technologies in mathematics classes in universities.

Recommendation 4: For universities management and universities leaders. As the development of a technologically enriched student learning experience occurs at the level of the classroom, such change has to be supported by universities leaders and accompanied by sustained professional development opportunities for teachers [3].

New kinds of jobs are now open to people with mathematical qualifications, especially those with skills in the use of digital technologies. It is often argued that the number of mathematical tool users will outweigh many times the number of tool producers, with the implication that only a few experts need to really understand how to produce a mathematical tool. Such dichotomies are unhelpful as the workforce of the future will need to include a large number of mathematical tool modifiers. For the tool modifier, the central issue becomes the articulation of what the digital technologies should do; designing a system to do it and verifying that it will perform as specified.

In addition, the vast majority of young people are involved in creative production with digital technologies in their everyday lives, from uploading and editing photos to building and maintaining websites. They acquire many skills which will be relevant in their careers, but which are not drawn on during their time in university. They acquire new skills rapidly and share their knowledge with their peers – but rarely in an educational context. Whereas digital technologies are the ‘tools of the trade’ of the modern scientists, technologists, engineers and mathematicians, young people are not likely to use digital technologies for the creative production of science, technology and mathematics in their everyday lives.

Unless we can improve mathematics education in a more stimulating way, which takes into account the modern world and students’ needs we are in danger of turning mathematics into an increasingly ‘dead language’ and alienating groups of students whose mathematical potential will remain undeveloped. Rote learning of the current mathematics curriculum will not be sufficient to produce the problem solvers, independent thinkers and designers that the country needs [4].

Thus, the trends of development discussed in this article highlighted some important issues in the intersection of digital technologies and mathematics education that might serve as contexts for investigating “what might be”:

–Learners’ access to digital technologies creates a learner-mathematics correlation that is not yet widely covered by mathematics educators, that destroys the traditional flow of mathematics knowledge from teacher to student, and that is not well understood from a research perspective.

–The availability of online mathematics learning resources as the digital libraries means that many students now turn to these resources before they consult a teacher or a textbook, and this raises questions about how the resources are organized to in order to facilitate access and how they are designed pedagogically to foster conceptual understanding.

–The collaborative and social networking affordances of digital technologies raise questions about the design and use of learning management systems as well as personal learning environments and networks.

–Teacher use of blended learning to extend and supplement classroom learning with digital technologies and to make the classroom a place for extension of modern digital technologies in educational process.

Research reveals positive effects on teaching and learning mathematics when digital technologies are used to its fullest potential. It is therefore important that modern math teachers have to find creative and effective ways to integrate digital technologies into their classrooms. The study described in this article investigated the effects of integration of modern digital technologies in teaching mathematics. Findings revealed that the usage of modern digital technologies promote the students' awareness on mathematics.

In mathematics education, content-specific technologies include computer algebra systems; dynamic geometry environments; interactive applets; handheld computation, data collection, and analysis devices; and computer-based applications. These technologies support students in exploring and identifying mathematical concepts and relationships. Content-neutral technologies include communication and collaboration tools and Web-based digital media, and these technologies increase students' access to information, ideas, and interactions that can support and enhance sense making, which is central to the process of taking ownership of knowledge [6].

In conclusion, disconnect appears to exist between beliefs and practice, as teachers believe technology is important, but do not implement it in practice to effectively meet the needs educators wish to address, such as developing 21st-century learning skills and motivating students to continue pursuing science as an area of study. Many teachers are already using modern digital technologies effectively to enhance students' understanding and enjoyment of mathematics. In their hands lies the task of enacting a truly futures-oriented curriculum that will prepare students for intelligent, adaptive and critical citizenship in a technology-rich world.

Finally, integration of modern digital technologies in teaching and learning mathematics can transform the dynamics in math classes, making the lectures integrated to practice and providing resources that help in securing content and approach of theory with everyday life. As a result, digital technologies have the potential to help students learn mathematics and to boost teachers' opportunities to improve their own subject knowledge and teaching.

To close off this discussion, we would like to express our strong belief that digital technologies can give teachers and students remarkable resources. They have access to new opportunities for learning approaches to work together and to set aside additional cash. Digital technology is not just a powerful thing for education — it is a superpower.

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