

APPROACHES TO INCLUSION OF MODERN AND INNOVATIVE TECHNOLOGIES IN THE PROGRAM OF BOTANY SCIENCE

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Abstract. This paper involves the increase in students' learning motivation because of using technology-based media in a botany class. The differences between the academic results of the students who used computer technology in botany and the students who studied according to the traditional teaching method are analyzed.

Key words: digital age, technology, simulation, web 2.0 tools, 3-D printers, virtual laboratories, reality, virtual reality, digital hologram.

Introduction. In this era, which we call the digital age, technology is considered an integral part of our lives. In addition, many national and international reports expect the next generation of students to be IT literate during their education and employable in their future life, which is an important quality for them (Hills et al., 2019). Accordingly, it is important to know and use technology [1].

Technology is also seen as a tool that can be used in various fields and plays an important role in easing the work of individuals (Saettler, 1968). The integration of technology into education, which can be used in almost every field, is also on the agenda, and in this regard, efforts are being made in the education policy of countries [2].

Modern and innovative technologies should be included in the curriculum, and students should be offered the opportunity to interact closely with technology. The introduction of innovative and effective approaches to the education and training processes of the new generation, which is born and growing up in the digital age, is of great importance in increasing the effectiveness of education. In this sense, technology is used as a teaching tool and can play a supporting role in teaching, especially in areas such as science where technology is readily adaptable (Commission on Educational Technology, 1970).

Discussion. Science education has used various technologies from past to present, including computer, projection, simulation, web 2.0 tools, 3-D printers, virtual laboratories, reality, virtual reality and digital hologram. These technologies are

included in educational programs as teaching tools in order to increase the effectiveness of education. In particular, reality, virtual reality and digital hologram technologies, which are often mentioned recently and used in various fields, are considered important from the point of view of the relevance of education and are the main component of this.

In 2008, the International Society for Educational Technology (ISTE) published a set of visionary standards for supporting student learning and creative thinking, designing digital youth activities and assessments, and modeling, modeling, and modeling digital studies (Trust, 2018). The ISTE Standards for Teachers are standards that describe teachers' competencies in using technology. These standards include subcategories such as learner, leader, citizen, partner, designer, facilitator, and analyst. The aforementioned standards encourage peer collaboration, deepen practice, and guide student learning by rethinking traditional approaches (ISTE, 2020). In addition, these standards cover areas of competency such as designing learning environments for the digital age and being role models for working and learning in the digital age.

The teaching quality framework (TQF - The Teaching Quality Framework) has identified eight key competence areas: “communicating in the mother tongue, communicating in foreign languages, mathematical competence and key competences in science/technology, digital competence, inquiry learning, social and civic competences, sense of initiative and entrepreneurship, cultural awareness and self-expression” (MOV, 2018).

Thus, teaching includes seven key components of science education: conceptualization in terms of goals, content, and alignment; preparation for teaching; teaching methods and practices; presentation and student interaction; student outcomes; mentoring and advising; reflection, development and training service / scholarship [3].

In particular, key competencies in mathematical competence, science/technology and digital competence cover the use of information and communication technologies in everyday life. On the other hand, 21 st century skills are considered in three categories and include learning and innovation skills, life and career awareness, and media and technology skills. Information, media and technology skills also feature in 21st century skills (Partnership for 21st Century Skills, 2013). The skills of effective use of information and communication technologies are noted as one of the main skills of the 21st century.

Science education is one of the areas that can easily adapt to technology, and science education often has reflections of technology. Recently, in our country, special attention has been paid to digitization and technological competencies in the science curriculum, and the infrastructure of using innovative technologies in the classrooms has been observed and paid attention to.

A study that examined the updated current science curriculum in Turkey from the perspective of innovative technology revealed that the following units are suitable for using innovative technology applications. So: Grade 5 - Sun, Earth and Moon, Life, Humans and Environmental World; Grade 6 - Solar system and eclipses, matter and heat, systems in our body and our health; Class 7 - Solar system and beyond, cells and divisions; and 8th grade - DNA and genetic code, pressure.

Azuma (1997) highlights three characteristics of augmented reality; combines reality and virtuality to allow simultaneous interaction and includes 3-D objects.

A digital hologram is defined as a tool that can transfer 3D images of selected objects to different locations and provides continuity of images even in the absence of these objects (Katsioloudis & Jones, 2018). Thus, thanks to holograms, it is possible to access 3-D images of objects that do not exist in the environment and need to be examined. Holograms, which are used in fields such as architecture, tourism and entertainment, medicine, and industry, have recently started to be used in the field of education as well (Rahim, Abdullasim, Saifudin & Omar, 2018; Turk, 2020).

It is especially used in science education to teach difficult-to-understand topics and concepts, and is also preferred as a teaching tool for materializing abstract concepts and topics. Digital holograms can be made as videos in programs such as Powerpoint or Camtasia, and images can be created using hologram pyramids. In science education, holograms are preferred for subjects that require microscopic observation, such as cells, genes, and chromosomes.

Orcos and Magrenan (2018) used hologram technology to teach cells and divisions in science education and concluded that digital holograms should be used as a teaching tool to increase student motivation and increase student satisfaction with holograms (Figure 1) [4].



Fig.1. A digital hologram of a young plant growing out of an open book

In recent years, lifelong learners will be needed. These individuals are expected to learn how to learn under any circumstances and to take responsibility for their own learning. In addition, technological competence, which is one of the requirements of our time, can be acquired through educational programs adopted by countries with the necessary technological equipment. Thus, in the future, individuals who have no problems with technology, who have the ability to use technology, and who know technology well will be educated.

It is also seen as an indicator of the level of development of countries. Developed countries produce well-equipped individuals, tech-savvy individuals have easy access to job opportunities, and technologically skilled individuals are employed in almost every industry due to the active use of technology that supports this idea.

Conclusion. The use of technology-based media in a botany class affects students' learning motivation. There was a difference in student achievement between students who was exposed to computer technology in botany and students who were exposed to traditional teaching methods. The use of multimedia to enhance the understanding of abstract concepts can be supported by the use of both formal academic language and the informal discourse of teachers and students. Therefore, it is recommended that the integration of computer technology into the teaching of Botany will increase the academic performance of students.

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