Chapter 11
Integration of Educational Robotics to STEM Education

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ABSTRACT

Science, technology, engineering, and mathematics (STEM) education is integrated into education programs in many countries because it benefits the national economy and raises qualified manpower. During STEM-based activities, students increase their problem-solving and research skills by using technology and engineering knowledge together with science and mathematics knowledge. When the studies in the literature are examined, although it is seen that STEM education has positive contributions, it is encountered that the current resources for teachers are limited. The lack of up-to-date resources for teachers causes them to be insufficient in their field knowledge. Apart from this, teachers need to follow current technologies to be able to correctly apply the technology and engineering steps in STEM education and to have a high level of technological literacy. This study will provide information about the integration of educational robots in the researches to be done in the field of STEM education and give an idea to the studies to be done on the subject.

INTRODUCTION

This section will examine the paradigm shift in education and its effects in detail. In addition, the readers will be informed about the reason for the emergence of STEM education.

Technological developments cause changes in every aspect of social life. These changes also affect the structure and functions of educational institutions. Many social systems such as industry, economy, and communication expect academic institutions to train individuals using technology (Deb, 2014). This expectation includes teaching the use of technology and using them in teaching activities. Today, where technology triggers changes in every field, education is one of the areas where changes are experienced. Societies are working to ensure that individuals raised through education become individuals who command technology, access, and use information. These studies, which are carried out to ensure that every individual has the right to access information and communication technologies, to provide individuals with information and technology literacy, and to enable individuals to use these competencies throughout their lives, are considered among the essential goals in the education policies of countries (Asunda, 2012). This process, called a new paradigm in teaching, aims to use these technologies and a more effective learning process by including current technologies in teaching environments and education programs (Williams, 2009).

The technology of our age presents us with industrial and economic needs. At every level of education, studies are carried out to meet the needs of today and the future. Contrary to previous years, these different conditions, which we have encountered frequently recently, have also changed the demands in the world (Baygin, Yetis, Karakose & Akin, 2016). Policies, employers, educators, students interact with the needs of the real world. This period, which is stated as the 21st century, brings several knowledge and skills that individuals should have. Technology, which we interact with from early childhood to adulthood, presents many innovations in our daily lives.

In the 21st century world, where innovation gains importance, changes are observed in both the nature and methods of science. This change affects teaching in school and out-of-school settings. Countries need to increase their workforce in STEM fields to be included in the global economic race and reach the capacity to compete in the 21st-century world. In the current century, the desire of individuals to pursue a career in STEM fields is changing. in the same way, a significant change was observed in their ability to adapt to the conditions of the age. With these skills, individuals are expected to gain various problem-solving abilities and meet the needs of society (Johnson, 2012; Lynch, Peters-Burton & Ford, 2015).

Introducing innovations with the integration process of technology in education is highly compatible with the nature of STEM education. In recent years, STEM education has been one of the accepted approaches regarding gaining 21st-century skills to students and how to measure them. In this context, it is possible to equip the generations with the necessary competencies to keep the countries alive in the world of the 21st century with STEM education. STEM education provides opportunities for students to develop 21st-century skills. 21st-century skills are defined within the framework of STEM literacy and are associated with the social, economic, cultural, and political problems of today's competitive world. Accordingly, the requirements of individuals to develop these skills and use them in daily life make STEM literacy even more critical (Barcelona, 2014; Rifandi & Rahmi, 2019).

Furthermore, creativity, critical thinking, collaboration, and communication are accepted as 21st-century skills essential in future professions. For this reason, these skills will allow students to be successful in occupations that will require STEM knowledge in the future. Therefore, based on the information mentioned above, STEM education is essential to educate individuals who will form the workforce of the future world with 21st-century skills.

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