

Chapter 9

Integrating Assistive Robotics in STEM Education to Empower People With Disabilities

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ABSTRACT

Science, technology, engineering, and math (STEM) education plays a vital role in order to prepare students for the twenty-first century economy. Unfortunately, people with disabilities in countries throughout the world are vastly underrepresented in scientific and technological fields. Closing the gap in the STEM is vital for improving fairness and opportunities for the people with disabilities. The STEM industry is critical in a world where there are various environmental, health, and development issues. It is essential not only for increasing productivity and competitiveness, but also for ensuring individual and societal well-being. The STEM workforce is expected to rise exponentially in the future year in today's burgeoning knowledge-intensive economy. This chapter explores a current state-of-the-art literature review on the use of assistive robots in STEM education people with disabilities.

INTRODUCTION

Today's individuals are the workforce of tomorrow. The jobs that will be available to our students when they graduate will require a higher understanding of technology, a greater confidence in problem-solving, and more collaboration with professionals around the world. STEM in education plays a critical role in preparing students for careers as adults. Almost 80% of future careers will require some STEM skills. Therefore, connecting STEM with real data in real problems might require educational institutions to be equipped with labs and highly qualified and effective teachers, updated curricula, and connections to

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higher education institutions and enterprises. Similarly, students with special needs should be prepared for the workforce of the future. Therefore, integrating STEM into the special education curriculum is essential to integrating them into life and developing the basic skills for workforce readiness in the 21st century (Moeller, 2012). The process of integrating STEM into authentic special education contexts is not an easy task. Special education teachers struggle to make connections across the STEM disciplines (Kutlu, Schreglmann & Cinisli, 2018). Global challenges such as migration, climate change, overpopulation, health, agriculture, and declining water resource and energy requires to rethink current approaches to STEM education in both general education and special education. Therefore, the STEM industry is critical in a world where there are various environmental, health, and development issues. Not only it is critical for enhancing productivity and competitiveness, but it also helps to ensure the continued well-being of individuals and societies. In today's burgeoning knowledge-intensive economy, the STEM workforce is projected to grow exponentially in the coming years.

Unfortunately, however, individuals with special needs are vastly underrepresented in scientific and technological fields in countries throughout the world. When it comes to pursuing successful and long-lasting STEM careers, they often face multiple barriers including a lack of access to STEM tools, STEM curriculum, and methodologies to teach STEM to special needs (Kutlu, Schreglmann & Cinisli, 2018). Closing the gap in STEM is critical to improving fairness and opportunity for people with disabilities. Education should aim at the full development of human potential and personality, talents and creativity to enable people with disabilities to participate effectively in society. Robotics can be a tool for individuals with special needs to integrate them in society. Therefore, educational robotics can be used in the classroom as a tool for cooperative learning to enhance the relational skills of all students, including those with physical and cognitive disabilities, and to create an emotionally proximal learning environment. A robot designed to help to improve certain ability of a person with special needs can be called assistive robot. Assistive robots have the potential to serve as surrogates and helpers for the people with special needs (Chen et al., 2013). For instance, children with autism are more interested in communication therapy when assistive robots involve the therapy (Papakostas et al., 2021; Robins et al., 2006).

The United Nations (UN) Convention on the Rights of Persons with Disabilities in Article 24 (UN, 2021) enshrines their right to education without discrimination and on an equal opportunity basis. Education must aim at the full development of human potential and personality, talents and creativity, enabling people with disabilities to participate effectively in society. In modern society, teachers need to update and increase their digital skills with increasing frequency. The tools that can be available to an educator are numerous and he must therefore develop the skills necessary to select these products and create effective educational activities.

Disability can be explained as physical impairment or a health condition that prevents an individual from taking full advantage of life's opportunities such as activities of daily living, recreation, vocation, and education. An individual with disabilities can experience problems arising from health condition (WHO Report, 2011).

A robot is called assistive when the device is able to acquire information from the context, process it and carry out actions that can bring benefits to people with disabilities and in old age during daily activities (Stranger & Cawley, 1996; Uluer et al., 2015). An assistive robot is therefore a tool able to compensate for the difficulties of the disabled user, commonly understood as physical ones. Educational robotics can be used in the classroom as a tool for cooperative work aimed at learning and at the same time to enhance the individual abilities of all students, including those with difficulties. Assist therefore

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