Chapter 2

Addressing Special Educational Needs in Classroom With Cyber Physical Systems

Aneta Petrova Atanasova
Sofia University “St. Kliment Ohridski”, Bulgaria

Aleksandra Ivaylova Yosifova
New Bulgarian University, Bulgaria

ABSTRACT

The focus of the current chapter is on humanoid robots as part of inclusive education. The investigation of the perception of and attitude of children and teachers to the application of cyber physical systems in education is essential. The data of a survey of the perception and attitude to the application of cyber physical systems in education of teachers and students from several Bulgarian schools are currently being examined. The attitude of teachers in the current study towards robots is positive. The attitude of students is rather neutral, and the difference between the two populations is statistically significant. Both teachers and students think of the robot as of a humanoid, capable of expression emotions. There is no difference between the attitudes towards the role and appearance of the robot of boys and girls. However, older children demonstrate a more negative attitude than younger children.

INTRODUCTION

The focus of the current chapter is on humanoid robots as part of inclusive education. The field of CPS in the form of socially assistive robots in education is developing quickly. Although still practically non-existing, this seems to be the natural course of events, considering the fast development of technology and its application in education and therapy. Efforts in the fields of mainstream education and assistive therapy have already been made and the results are promising. Robots could support the learning of children (Kory Westlund et al. 2017), personalize it to their needs (Leyzberg et al. 2014) and reduce the teachers’ workload (Movellan et al. 2005). However, thorough research is necessary before the application of CPS with SEN children in schools.

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Children With Special Educational Needs (SEN)

The integration of children with special educational needs (SEN) and the creation of appropriate, accepting and supportive environment is one of the main challenges in the contemporary educational system.

The main groups of SEN include autistic spectrum disorder (ASD), dyslexia, physical disability, hearing and vision impairment, hyperactivity, and intellectual disability. The specific characteristics of each condition require modification of the learning environment and teaching methods in order to meet the needs of the child.

Autistic Spectrum Disorder (ASD)

ASD is a neurodevelopmental disorder which impairs the social communication skills of the children. The number of children with autism has increased significantly during the last few years. Respectively – so did the need to find appropriate ways for them to be included in the educational process. ASD is a condition, which continues throughout the whole lifespan of the person. It is characterised by the typical specifics and the necessity to apply the appropriate intervention at every age. The stage of school education represents a great challenge to children with autism due to the need to cope with a variety of demands. The typical difficulties experienced by children with ASD in school include discomfort from physical stimuli in the environment, such as noise, light, temperature. The understanding of the group norms and social rules of conduct could also be a challenge. In addition, children with autism do not follow/imitate others spontaneously; often fail to understand that the instructions of the teacher apply to them. Some peculiarities in eye contact (inability to maintain appropriate eye contact, the predominant use of peripheral sight, etc.) are typical for people with ASD. It is possible that some children with autism prefer to be left alone, while others insist to be part of the group but are unable to achieve that. In many cases it is difficult for them to control their emotions and behaviour. They could have ritualised behaviour, characterised by repetitive movement of parts of or the whole body and manipulation of objects. These challenges could be addressed by following a consistent, clearly structured visual program and regular reminding of the order of the daily responsibilities.

The structured behavioural programme, based on ABA (Applied Behavioural Analysis), is usually applied by therapists trained in the work with children with ASD. Its aim typically includes the training of certain capabilities, such as social skills (Reid, Lannen & Lannen, 2016). Some aspects of the behavioural programme, designed for concrete children with autism, could be applied with the assistance of a robot. The programme requires the representation of the target skills in small chunks. For example, the child needs to tell his/her name, age, address and receives a reinforcement for every right response. Common social situations and the accompanying conversations could also be trained with the help of a robot. Examples of such situations are borrowing books from the library, buying food for lunch or stationery from the bookshop.

Attention Deficit Hyperactivity Disorder (ADHD)

ADHD is a neurodevelopmental disorder associated with difficulties in concentration, attention, impulsivity and inhibition of undesirable behavior. Remaining immobile in their seat in the classroom for long periods of time could be challenging for children with ADHD. Their attention is easily captured by distractions or spontaneously diverted without any apparent external stimuli in the environment. They