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# Inclusion and participation of disadvantaged learners through robotics

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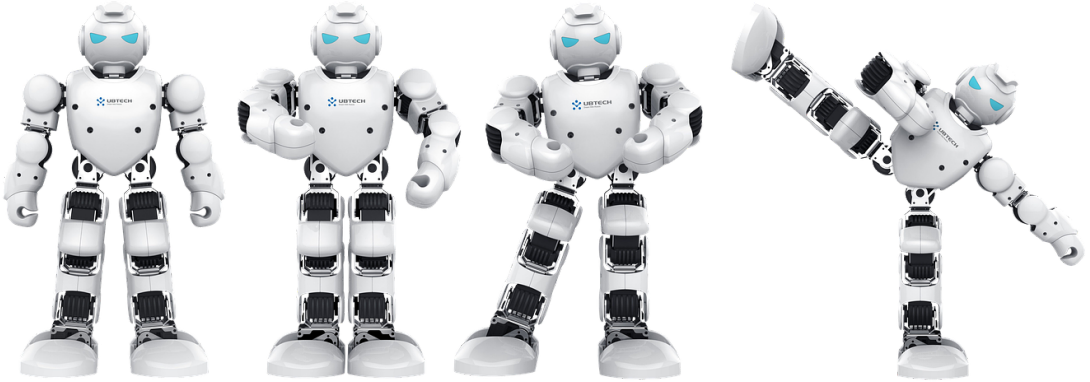

Abstract

*There is, thus far, a fair amount of researchers and academics who have dedicated part of their work to demonstrating how robots can be conceived and put to use to the benefits of certain categories of population and furthermore the specific ways in which these robots can support and be a positive factor in terms of inclusion and participation of disadvantaged categories in various learning and acquisition processes. This paper attempts to further bring arguments and showcase how robotics can be a useful approach to a more inclusive education.*

## Terminology and argumentation

By disadvantaged learners this article understands young adults and students which either underperform, have poor school results because either they cannot keep up with the curricula pace or are dramatically demotivated It is not a new concept for education, although educational robotics is mostly associated with Science, Technology, Engineering, and Mathematics (STEM) in developing mathematical concepts and principles of physics, engineering and other branches of STEM, as well as in developing knowledge in different stages of education, from preschool to higher education. Lately, new research directions have been developed which

proved that robotics has such positive effects as increased learning motivation and improved interest in the learning process itself.

Furthermore, robotics can help overcoming various factors that can lead to risks of: severe de-motivation of students that feel they can no longer cope with the learning challenges; social marginalization; risks of early school leaving.

## The case of inclusive education in robotics

As this paper is focused on inclusive education in robotics, it becomes also extremely useful to detail what exactly it is meant by this. Inclusive education is a worldwide phenomenon[1] which has emerged from a commitment to enact the values of basic human rights. It involves the creation of situations destined to equalise opportunities for all learners. Inclusive education has evolved as a movement which challenges exclusionary policies and practices. It has gained in dimension worldwide over the past decade and has become, to a certain extent an approach to when it comes to addressing the learning needs of all students. International initiatives are meant to prove that all children have the right to be educated on equal terms regardless of their physical, intellectual, emotional, social, linguistic or any other condition, and that such inclusion makes good educational and social sense (as stated by UNESCO).

Following a case study conducted in the UK[2], educational robotics has some advantages which could make it very supportive of inclusive education. The study claims that the way in which Lego Mindstorms robots are built using diagrammatic plans and programming icons allows teachers to remove some of the barriers which children with learning difficulties might experience. Educational robotics in this context also demonstrates a range of transformational properties. The robotics curriculum is a synthesis of many subject areas which are taught in new ways.This way, robotics is seen a distinct educational method. As stated by the same authors,

[1] Sheehy, K. and Ferguson, R. (2008). Educational inclusion and new technologies. In: Scott, Thomas B. and Livingston, James I. eds. Leading-Edge Educational Technology. New York: Nova Science Publishers, pp. 159–176.

[2] idem

there is also evidence, from robotics groups, that robotics can accommodate a diverse range of learners and has many advantages for children with special educational needs.

The case of SIR (socially interactive robotics)

An emerging and peculiar trend within the technological field is represented by SIR, with research so far showing it holds great promises for groups of socially disadvantaged learners[3].

It is also argued that today and for the future, robots applied in teaching is a field which will continue to become more and more acknowledged as a positive means of inclusion.

Today many learners have become accustomed to mediated learning via digital technologies in terms of personal development (e.g. new language acquisition) but also for formal learning settings. The added value of robots in this context is that these can be designed from the beginning as attractive and with a humanoid interface, which has particularly positive effect in education but also in healthcare, as in the case of NAO[4] robot. NAO is a small humanoid robot designed to interact with people. Packed with sensors, it can walk, dance, speak, and recognize faces and objects. It is a well-known example in this field and used in research, education, and healthcare all over the world.

Several studies show these same positive outcomes for adolescents. In a research conducted by Howell, Stanger and Marz[5], the results mainly indicated that both students and teachers saw benefits through the use of the robot as a science tool. The implications of the research are discussed in terms of increasing interactions between disabled and non-disabled students and the functionality of the robotic device as an assistive tool, in various contexts either for learning acquisition or for healthcare purposes.

[3] "Interactivity, Game Creation, Design, Learning and Innovation"; Brooks, A. et al, 5th ed, Springer 2018

[4] "NAO robot" retrieved from https://robots.ieee.org/robots/nao/

[5] "Classroom applications of educational robots for inclusive teams of students with and without disabilities"; Howell, Marz et Stanger in Technology and Disability 5(2), issue 5 vol.2, retrieved from www.researchgate.net

Similarly, Khanlari[6] reinstates that the use of hands-on robotics with students facilitates an active learning environment. Robotics due to its multidisciplinary nature, provides constructive learning environments that are suitable for a better understanding of both scientific and non-scientific subjects and it has a significant role on learning STEM subjects.

## Conclusion

That robotics and other new technologies will increasingly become rooted in our everyday lives is becoming more and more evident. This said, this paper brings arguments which favour the idea that robotics field has insofar a great potential today and in the future, to help educators into creating a favourable learning environment for students in general, as well as for disadvantaged learners. This is valid also in the sense robots are suitable for a better understanding, a more active participation from learners and it has a significant role on learning STEM subjects. From a participatory perspective, robotics groups of learners, both in an informal and formal educational contexts, help creating more inclusive environments, as all participants are encouraged to bring their input and to actively interact with robots. In this respect, this paper re-emphasizes that robotics can help overcoming factors that can lead to risks of: severe de-motivation of students that feel they can no longer cope with the learning challenges, and might feel excluded by not keeping up the pace, as well as creating fairer educational and socially environments.

[6] "Effects of Educational Robots on Learning STEM and on Students' Attitude Toward STEM"; Khanlari, A.; 2013, IEEE 5th Conference on Engineering Education (ICEED), retrieved from www.researchgate.net

## References

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