Prospects of Artificial Intelligence in Early Childhood Education: Can We Expect Humanoid Teachers?

Prof. Vatroslav Zovko

ABSTRACT

Artificial intelligence (AI) pervades our lives, extending its reach into the educational sector. This paper scrutinizes the potential introduction of humanoids as pre-school teachers, exploring their relevance within early childhood education processes and goals, along with the challenges they confront.

Keywords: artificial intelligence, early childhood education, humanoids, robotics.

INTRODUCTION

Early childhood education remains unexplored in terms of technology usage, particularly in pre-school settings. Dore and Dynia (2020) state "While the vast majority of the literature has focused solely on technology and media use in the home environment, less is known about either the prevalence or the nature (i.e., purposes and contexts) of technology and media use in pre-school classrooms". The same is true for artificial intelligence; we still cannot grasp the potential and negative impacts of artificial intelligence (AI) on the development of children. Looking at the rapid development of AI in general it is logical to ask if the potential of AI is to replace pre-school teachers.

Goals of Early Childhood Education

When referring to early childhood education we refer to programs that are performed in pre-school settings or classrooms. These programs have three major goals:

a) providing safe and nurturing care in a developmentally appropriate setting for children,

b) second is enrichment related to development of social and cognitive skills that cannot be developed in a home setting and

c) compensation to help the children successfully integrate into the mainstream of society (Essa & Burnham, 2019, pg. 9).

In that context it is important to stress the importance of quality elements, especially related to process quality elements such as social and emotional support through the development of relationships between pre-school teachers and children, organizational and management support related to classroom management skills of teacher, and instructional support related to teachers' strategies related to successful knowledge and skills development of children (Essa & Burnham, 2019, pg. 17). All these process quality elements are characterized by distinctive human characteristics of teachers and the general approach is that AI will not replace teachers anytime soon.

Artificial Intelligence - Perspectives

Artificial intelligence, according to Patel "seeks to forge intelligent entities that perform tasks otherwise reliant on human intellect"(Patel, 2023, pg. 3). In that manner AI can be categorized as follows (Boddington, 2023, pg. 3):

*   Weak AI programs that are not intelligent but have some abilities related to intelligence,

*   Strong AI that refers to programs with intelligence that demonstrates understanding and consciousness,

*   Artificial General Intelligence that demonstrates capabilities that are characteristics of human beings,

*   Superintelligence represents artificial intelligence that surpasses human abilities.

Now, AI is still in the first phase of development. Even the most popular AI program, ChatGPT, falls under the category of weak AI because it is based on datasets compiled by human beings. In other words, it solely relies on human directions to perform its task. That situation leads to the impression that some human jobs will be irreplaceable, and that computerization will impact low-skill low-wage occupations (Frey & Osborne, 2017). It is suggested that teaching jobs are among the least suspectable to be replaced by AI.

On the other hand, Ray Kurzweil stresses that human-level intelligence in a machine will be developed by 2029 (Hussein & Atiyah, 2022). That means, if Kurzweil's predictions are right, in less than a decade humans can expect to compete for previously exclusively human jobs with intelligent machines. The same is true for teaching professionals.

AI in Early Childhood Education

It can be said that the contemporary view on AI in education in general, and therefore in early childhood education, is that AI represents a tool for enhancing teaching practices. These teaching practices are enhanced through "computer-supported collaborative learning, teaching automation, and evaluation, detecting learners' emotions, and recommending useful materials for students" (Su, 2023). As such, the introduction of AI into the educational system represents disruption that by definition consequently must have a radically different approach to teaching, learning, and education making AI an equal partner to students and transforming schools from educational institutions to learning communities (Zovko & Gudlin).

Insofar, the potential for the exploitation of AI in early childhood education is still limited to the development of AI competencies and AI literacy. It is recommended that AI literacy should be achieved through the development of three competencies (Su & Zhong, 2022):
- AI knowledge - grasping the idea of what is the AI.
- AI skill – development of computational thinking.

- AI attitude - assessment of positive and negative effects of AI on society.

As early childhood education is focused on physical, cognitive, social, and emotional development (Paris J. et al., 2019), it is evident that the above-mentioned approach of AI solutions is focused only on the cognitive development of children. That is also confirmed by the study of Su and Yang which analysed 17 eligible studies that focused on the usage of AI in early childhood education. All the analysed studies focused on AI-supported teaching and learning. As cognition as a concept is focused on information retrieval, processing, integration, and usage (De Houwer, J., Barnes-Holmes, P. M. D., & Barnes-Holmes, Y., 2017), teaching and learning are primarily focused on the cognitive development of children.

On the other hand, UNICEF recognizes that AI technologies have the potential to assist in the physical and emotional development of children (UNICEF, 2018). In that manner, AI "should be viewed as a tool to maximize the teacher's potential, not as a replacement for the teacher" (Orhani, 2023). Therefore, with the current state of technology, we can expect that AI will become more useful in assisting pre-school teachers in developing pre-school children's social, physical, and emotional skills. This is true especially because in today's digital world virtual content cannot be separated from social, physical, and emotional aspects of early childhood education. With the intense use of social media, individuals are developing many different skills; communication skills, sharing ideas, cooperation, collaboration, emotional support, self-expression, and good manners. (Bhowmick & Madhu, 2020).

Social media represents a wonderful opportunity for more intensified exploitation of AI in early childhood education. A recent study on media use of children 3-17 years of age identified media habits of children and stratified pre-school children into two groups: supervised explorers represent children aged 3 – 4 years and increasingly independent children aged 5 – 7 years (Ofcom, 2023). The result of the study is that 87% of children aged 3-4 years went online with video viewing as a primary activity (87%)

followed by making voice calls and sending messages (48%). Children aged 5 – 7 years did not change their habits, 93% viewed videos while 59% made voice calls and sent messages. 39% of them created their own YouTube profile. That kind of exposure blurs the difference between the real world and the virtual one creating a new reality that children live in. And AI is an integral part of that world and the foundation of how today's social media functions (Sadiku et al., 2021). Consequently, children and even adults can no longer make the difference between what is real and what is fake. The most renowned example is that of Deepfake technology which is often aimed at creating false content online (Mahmud, B.U., & Sharmin, 2021). It must be stressed again that all these examples refer to the application of weak AI.

Humanoid Pre-school Teachers – Fiction or Reality

To successfully introduce humanoid pre-school teachers, humanoids should mimic the behavior of actual humans and have a human appearance. Human appearance includes not just physical appearance but also physical abilities, such as running, jumping, holding hands, etc. These abilities are necessary for the development of physical skills in children. The Mimic of human behavior does not pertain just to the communication skills of the robot but also to expressing emotions, otherwise, robots cannot participate in the development of social and emotional skills in children. These issues led to the development of humanoid science that combines robotics and cognitive science which was first proposed by Hiroshi. Furthermore, Hiroshi states that "If a human unconsciously recognizes the humanoid as a human, he/she will deal with it as a social partner even if he/she consciously recognizes it as a robot. At that time, the mechanical difference is not significant; and the humanoid can naturally interact and attend to human society." (Ishiguro, 2016).

From that perspective, today's humanoid teachers can be beneficial and can make sufficient human teacher substitutes especially for students who suffer from anxiety and embarrassment or children with an autistic spectrum disorder as the robots can be programmed to be minimally expressive and to gradually introduce more expressive behavior into interaction with children (Newton & Newton, 2019) enabling them to develop basic social skills. But at the current level of technology, human teachers should be present when a humanoid teacher is in use. So, from that perspective immediate introduction of independent humanoid teachers is fiction.

But in the next 15 years, it is realistic to expect efforts to introduce independent humanoid teachers, firstly in K-12 education and then gradually in early childhood education. It must be stressed that "robotics is not only an issue regarding science, technology and innovation policy but also a social and health issue" (Kaivo-oja & Roth, 2015). In other words, the dynamics of the introduction of independent humanoid teachers will be dependent upon how we face the ethical, legal, and social impacts of robotics on society. The social impacts of robotics on society will be the consequence of the development of a ubiquitous world where communication will be characterized not only by communication between different people but also between people and machines and between different machines (Kaivo-oja & Roth, 2015). This is closely related to ethical issues that will emerge. One of the most challenging engineering issues in the development of autonomous humanoids is that of how to develop artificial intelligence that safeguards basic human values like openness to change, self-enhancement, conservation, and self-transcendence, and how to make moral judgments (Heller, 2012). Today, widely accepted laws that are supposed to govern the actions of humanoids are three fundamental Rules of Robotics, proposed by Isaac Asimov (1950, pg. 41):

- Rule One: a robot may not injure a human being, or, through inaction, allow a human being to come to harm.

- Rule Two: a robot must obey the orders given to it by human beings except where such orders would conflict with the First Law

- Rule Three: a robot must protect its existence if such protection does not conflict with the First or Second Laws

In the context of early childhood education, these laws perfectly support the first goal of early childhood programs - to provide safe and nurturing care. It is important to stress that later Asimov introduced the fourth law that he titled a "Zeroth Law": "A robot may not injure humanity or, through inaction, allow humanity to come to harm." In that context, Asimov further completed the First Law by adding "… unless this would violate the Zeroth Law of Robotics" (Asimov, 1985, pg. 409).

Another ethical issue that emerges with the introduction of autonomous humanoid teachers is the emotional aspect of robotics that is in human beings manifested not just by body language and verbal communication but also by caress. Galvan (2003) argues that caress can be repeated by robots but that doesn't make it ethically correct. On the other hand, there is an ongoing debate about whether robots will become a new species with autonomy and consciousness, emotions and free will, and whether it is right for robots to have personality and express emotions (Veruggio & Operto, 2008). If that is so, then the emerging issue of ethical conduct of humans towards humanoids should also be addressed. In early childhood education that would pertain to situations of children's attitude and manners aimed at humanoid pre-school teachers.

CONCLUSION

No one can predict the exact dynamics of development and change that would lead to the introduction of humanoid pre-school teachers. Many skeptics think that humanoid teachers are a matter of fiction. But we have many historical examples that the emerging technologies of that time were viewed as just hype and something that will never get into everyday use, such as the telephone, the automobile, planes, personal computers, etc. (Clive-Matthews, 2023). Especially because, at least in the short and medium term, the above-mentioned hype led to overestimated benefits and underestimated costs and obstacles for widespread implementation of emerging technologies (Korotkova et al., 2023). The reality proved technology skeptics to be wrong. All technologies that are now in everyday use were once viewed as hyped technologies with use limited to technology enthusiasts. The same can be expected of the integration of humanoids into the educational system. So, the long-term question is not whether we will use humanoid teachers but what is needed to prepare the educational system and the whole society for their integration into everyday life. At present, the most challenging issue is to remove the emerging stigma of AI being "scary and worrying." This is especially related to the societal and ethical implications of AI use in everyday life (Većkalov et al., 2023). In other words, emerging technologies, especially AI-based entities are inevitable. Historically speaking, they should be embraced as they can be expected to improve early childhood education and human well-being.

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W	I	S	E	R
WHO	**INSTRUCTION**	**SUBTASK**	**EXAMPLES**	**REVIEW**
Identify the kind of writer you want the AI to be.	Give clear instructions - include things like how long you want the activity to take and how many children are involved, or how many lessons to generate.	Break down the steps so it knows the direction of the task it needs to create.	Give an example to the AI so it has something to follow and knows better what to output.	This is the real magic. You can refine the answer or change the ENTIRE scope of what you've created with a follow-up.
"You are an early educator with a diverse population of 4 year olds…"	"…Create a song to celebrate the rain in Seattle!…"	"…When creating the song, first tell me what other song the tune is from, then give directions on how to teach the song to students…"	"…For example, make it the kind of song different groups of kids can sing along to, like 'row, row, row your boat'."	"I like that song, but now make it to the tune of Old McDonald had a farm!"

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ABOUT THE AUTHOR

Prof. Vatroslav Zovko is a professor and the chair of Information and communication sciences department at the Faculty of Teacher Education, University of Zagreb, Croatia. A PhD in Education, Dr. Vatroslov has contributed extensively to academic journals, educational magazines, and conference proceedings. His articles delve into topics such as play-based learning, the role of technology in early education, and the impact of socio-economic factors on childhood development. With a keen interest in fostering inclusive education, he advocates for approaches that cater to the diverse needs of children, ensuring every child has an equitable start in their educational journey.

Prof. Vatroslav Zovko
University of Zagreb
Faculty of Teacher Education
Vatroslav.zovko@ufzg.hr