Piloting Diversity and Inclusion Workshops in Artificial Intelligence and Robotics for Children

1st AIR4Children
dept. name of organization (of Aff.)
air4children: Artificial Intelligence and Robotics
Xicohtzinco, México
air4children@gmail.com

***Abstract*—This document is a model and instructions for LaTeX. This and the IEEEtran.cls file define the components of your paper [title, text, heads, etc.]. *CRITICAL: Do Not Use Symbols, Special Characters, Footnotes, or Math in Paper Title or Abstract. Nam dui ligula, fringilla a, euismod sodales, sollicitudin vel, wisi. Morbi auctor lorem non justo. Nam lacus libero, pretium at, lobortis vitae, ultricies et, tellus. Donec aliquet, tortor sed accumsan bibendum, erat ligula aliquet magna, vitae ornare odio metus a mi. Morbi ac orci et nisl hendrerit mollis. Suspendisse ut massa. Cras nec ante. Pellentesque a nulla. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Aliquam tincidunt urna. Nulla ullamcorper vestibulum turpis. Pellentesque cursus luctus mauris.**

***Index Terms*—component, formatting, style, styling, insert**

I. Introduction

Guarantee security, accessibly and human dignity can be considered the pillar for inclusivity. However, the disparity of advances in education and technology is not creating environments to construct a fair society. Recently, Astobiza et al. reported the need of collaborations between industry and a multidisciplinary group of researchers to address concerns on the paradigm of inclusivity in robotics [1]. Similarly, Astobiza et al. suggested that inclusive robotics should be based on: "1) they should be easy to use and 2) they must contribute to making accessibility easier in distinct environments" [1]. Peixoto et al. in 2018 reported the use of robots as tool to promote diversity which lead to improve competences in communication, teamwork, leadership, problem solving, resilience and entrepreneurship [2], [3]. Pannier et al. pointed out the challenges of increasing the participation of women and underrepresented minorities in the areas of Mechatronics and Robotics Engineering as well as the creation of community of educators to promote diversity and inclusion [4]. Pannier et al. mentioned that the prevalence of free and open-source software and hardware made mechatronics more accessible to a diverse group of population [4]. Also, Pannier et al touched on the evidence and importance of offering workshops to different range of underrepresented students that lead to inspires other programs to create outreach activities for students, trainings, workshops, Recently, Montenegro et al. introduced air4children, Artificial Intelligence for Children, as a way (a) to address aspects for inclusion accessibility, equity and fairness and (b) to create affordable child-centred materials in AI and Robotics (AIR) [5]. That said, in this work we design and pilot workshops of air4children to test how children of different ages and genders and instructors engage to create an environment of diversity and inclusion.

This short paper presents our findings on the first pilot workshop to promote diversity and inclusion in Artificial Intelligence and Robotics for children. This paper is organised with the introduction of diversity and inclusivity in AI and Robotics for children. We explain how four workshops were designed, present results of the workshops and finalise it with conclusions and future work.

II. Diversity and Inclusion of air4children in alternative education programs

A. Alternative education programs

Alternative education programs such as Montessori, Waldorf and Regio Emilia considers children as active authors of their own development [6]. Such programs that in a way follow same philosophies have been adopted internationally. However the contributes changes of technologies have been started to evolve. For instance, Edwards pointed out the schools deriving from the same philosophy might also need to observe teacher-child interactions, its environments and interview to the past and present parents and children [6] Recently, Aljabreen pointed out the adoptions of new technologies and how early child education is re-conceptualised [7].

B. Montessori education

Elkin et al. in 2014 explored the how robots can be used in the Montessori curriculum [8]. Authors conclude that the confidence and experience in robotics is crucial to deliver and communicate the right experience to encourage students [8]. Similarly Elkin et al. posed the question on the revision of new curriculums of technology that do not deviate from the purpose of the Montessori classroom [8]. Drigas and Gkeka in 2016 reviewed the application of information and communication technologies in the Montessori Method [9]. Drigas and Gkeka mentioned the Manipulatives, as objects to develop motor skills or understand mathematical abstractions, are based on cultural areas, language, mathematics and sensoria but little to none on technological areas. Drigas and Gkeka reviewed Montessori materials of the 21st century where interactive

systems with sounds and lights, touch application to enhance visual literacy or the development of computational thinking and constructions of the physical world [9]. These indicate that the incorporation of such manipulatives with the use of robotics might led to reach scenarios to explore motor skill development, visualisation and computational thinking.

Recently, Scippo and Ardolino reported a longitudinal study of the use of computational thinking in five years participants of primary school in a Montessori school [10] Scippo and Ardolino pointed out the importance of alignment of the Montessori material with the computational thinking activities.

III. Designing Diversity and Inclusion Workshops

Considering the challenges of low-to-middle-income countries faces, technologies such as robotics and artificial intelligence might not be available to towns. In that sense, we focus this work on a pilot experiment to promote diversity of and inclusion to children to teach AI and Robotics. Figure 1 presents four lessons of the workshops.

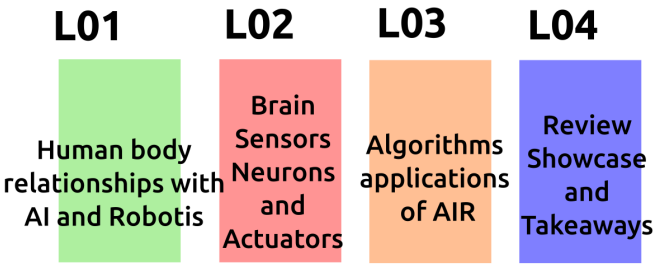

Fig. 1. Curriculum for four lessons (L01 to L04). Lesson 01 introduce the course, lesson 02 provides the basics of anatomy, lesson 03 covers algorihtms, and lesson 04 wraup and showcase the project of children.

a) Lesson 01: Braking the ice and motivations: Place figures and tables at the top and bottom of columns. Avoid placing them in the middle of columns. Large figures and tables may span across both columns. Figure captions should be below the figures; table heads should appear above the tables. Insert figures and tables after they are cited in the text. Use the abbreviation

b) Lesson 02: Human senses and coding my first robot: Place figures and tables at the top and bottom of columns. Avoid placing them in the middle of columns. Large figures and tables may span across both columns. Figure captions should be below the figures; table heads should appear above the tables. Insert figures and tables after they are cited in the text. Use the abbreviation

c) Lesson 03: Playing with reaction-action activities: Place figures and tables at the top and bottom of columns. Avoid placing them in the middle of columns. Large figures and tables may span across both columns. Figure captions should be below the figures; table heads should appear above the tables. Insert figures and tables after they are cited in the text. Use the abbreviation

d) Lesson 04: Develop your own AIR: The four lesson aimed to summarise what was covered in the previous lessons emphasising the relationship of the human body anatomy (brain, neurons and body parts) with humanoid robots (computer, sensors and actuators). This lesson covered real-word application of AI and Robotics including medicine, spacial robotics and smart cities. Three projects were prepared to be introduced to each team in which every participant have a role. Each team prepare a short speech of their application using AI and Robotics.

IV. Piloting Diversity and Inclusion Workshops

To pilot the workshop, we invited 14 (6 female and 8 male) participants with range of age from 6 to 11 years old (average age of 7.64). Similarly, three instructors with 3 years of experience in teaching and two coordinators with 10 years of teaching experience volunteered to deliver four lessons. Originally, each lessons was planned to be 90 minutes but we did not consider breaks or perhaps the hyperactivity of some of the participants to which in the second to four lesson a 15 minutes break was incorporated. We surveyed children with questions about their understanding and feelings towards different type of robots to find out that some of the children were not in the age to read, to which we support them. Although the survey contained only 10 questions, we decided to made use of 10 minutes at the start of each lesson to complement all the questions.

Figure 2 illustrates instructors and children during interactive activities.

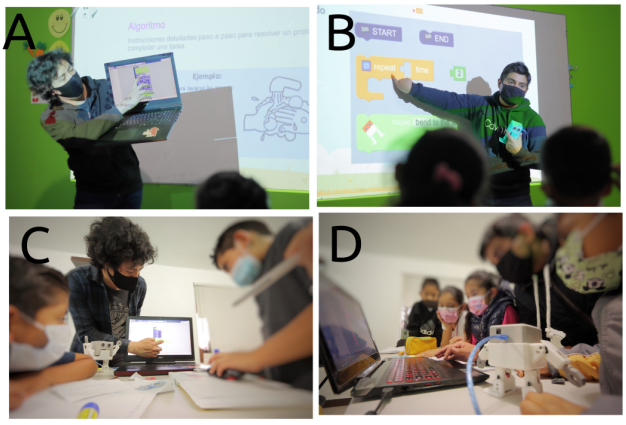

Fig. 2. Instructors demonstrating basics of AI and Robotics (A, and B). Children engaging with robots, classmates and instructors (B, and C).

V. Conclusions and Future Work

A pilot workshop to promote diversity and inclusion to teach AI and Robotics to 14 children was successfully organised in Xicohtzinco Mexico last November 2021. In such workshop, activities were designing to encourage participants to engage with each other. Similarly, the workshops were free cost to

encourage participation of anyone. We realised that grouping children with four teaching assistances was challenging because of the space as well as having a more engaging interaction with the subjects of the group. That said, we are planing to organise another workshop in third or four quart of the 2022 where lessons will be better organised, material will combine more interactive activities and robots and material will be suited for three participants per group.

For curriculums of workshops, we will incorporate a similar approach of the synthesis program which is a new education program aiming to cultivate student voice, strategic thinking and collaborative problem solving [11].

ACKNOWLEDGMENT

To Rocio Montenegro for her contributions with the design of the Montessori curriculum for the workshops. To Marta Pérez, for their support in organising the pilot of the workshops. To Diego Donato Badillo-Peréz and Antonio Badillo-Peré for volunteering as instructors of the workshops. To Leticia Vázquez for her support with the logistics and feedback to improve the workshops. To Adriana Fortiz-Perez for her contributions and discussion to prepare draft surveys for the parents and children. To Elias Mendes for his support and feedback on the hardware design of the robot. To Dago Cruz for his feedback and discussions on the design of the workshops. To Angel Mandujano, Elva Corona and others who have contributed with feedback and support to keep iterating the project of AIR4children.

REFERENCES

[1] A. Monasterio Astobiza, M. Toboso, M. Aparicio, T. Ausín, D. López, R. Morte, and J. L. Pons, "Bringing inclusivity to robotics with inbots," *Nature Machine Intelligence*, vol. 1, no. 4, pp. 164–164, Apr 2019. [Online]. Available: https://doi.org/10.1038/s42256-019-0040-5

[2] A. Peixoto, M. Castro, M. Blazquez, S. Martin, E. Sancristobal, G. Carro, and P. Plaza, "Robotics tips and tricks for inclusion and integration of students," in *2018 IEEE Global Engineering Education Conference (EDUCON)*, 2018, pp. 2037–2041.

[3] A. Peixoto, C. S. G. González, R. Strachan, P. Plaza, M. de los Angeles Martinez, M. Blazquez, and M. Castro, "Diversity and inclusion in engineering education: Looking through the gender question," in *2018 IEEE Global Engineering Education Conference (EDUCON)*, 2018, pp. 2071–2075.

[4] C. Pannier, C. Berry, M. Morris, and X. Zhao, "Diversity and inclusion in mechatronics and robotics engineering education," *ASEE annual conference exposition proceedings*, 2020. [Online]. Available: https://par.nsf.gov/biblio/10184534

[5] R. Montenegro, E. Corona, D. Badillo-Perez, A. Mandujano, L. Vazquez, D. Cruz, and M. Xochicale, "Air4children: Artificial intelligence and robotics for children," 2021. [Online]. Available: https://github.com/air4children/hri2021

[6] C. Edwards, "Three approaches from europe: Waldorf, montessori, and reggio emilia," *Early Childhood Research and Practice*, vol. 4, 03 2002.

[7] H. Aljabreen, "Montessori, waldorf, and reggio emilia: A comparative analysis of alternative models of early childhood education," *International Journal of Early Childhood*, vol. 52, no. 3, pp. 337–353, Dec 2020. [Online]. Available: https://doi.org/10.1007/s13158-020-00277-1

[8] M. Elkin, A. Sullivan, and M. Bers, "Implementing a robotics curriculum in an early childhood montessori classroom," *Journal of Information Technology Education: Innovations in Practice*, vol. 13, pp. 153–169, 01 2014.

[9] A. Drigas and E. Gkeka, "Montessori method and icts," *International Journal of Recent Contributions from Engineering, Science; IT (iJES)*, vol. 4, no. 1, p. pp. 25–30, Mar. 2016. [Online]. Available: https://online-journals.org/index.php/i-jes/article/view/5481

[10] S. Scippo and F. Ardolino, "Computational thinking in montessori primary school," *Ricerche di Pedagogia e Didattica. Journal of Theories and Research in Education*, vol. 16, no. 2, p. 59–76, Jan. 2021. [Online]. Available: https://rpd.unibo.it/article/view/12163

[11] "Synthesis: where kids learn how to think." https://www.synthesis.is/ , accessed: 16 Jan 2022.