Teaching AI and Robotics to Children in a Mexican town

Diversity, Equity, and Inclusion Workshop (DEI-HRI2023)

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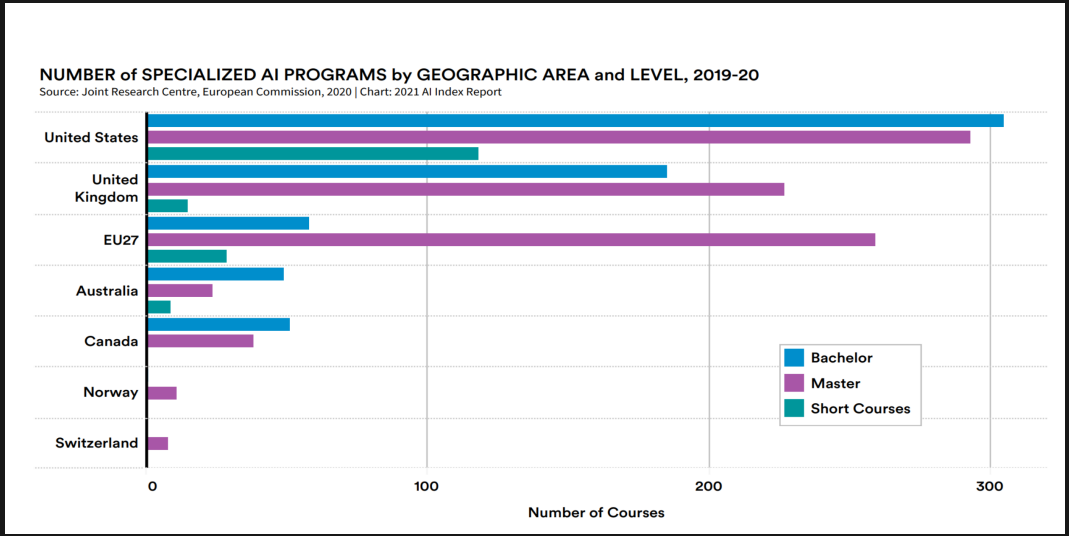
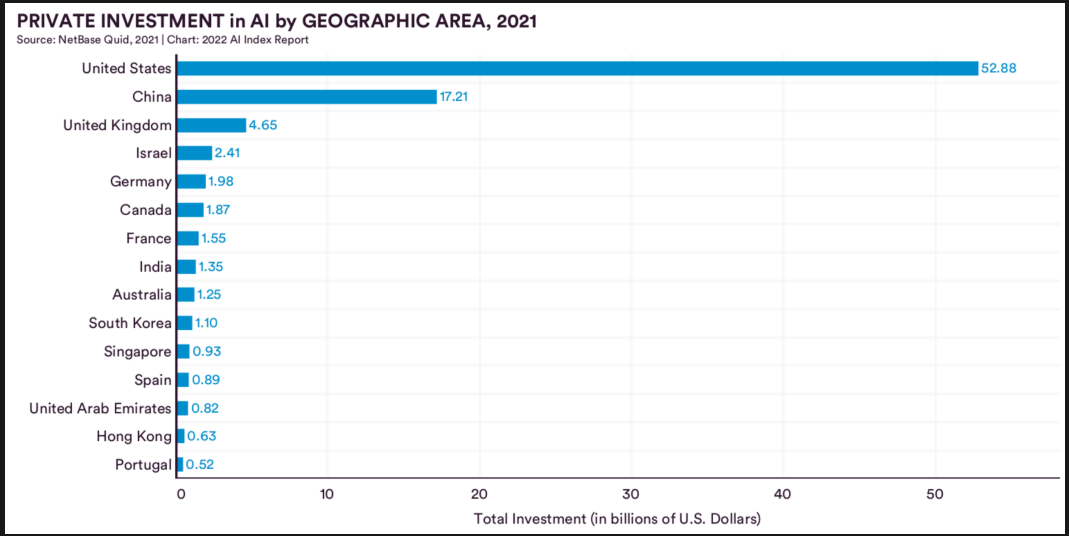
Specialised AI programs by Geographic Area and level



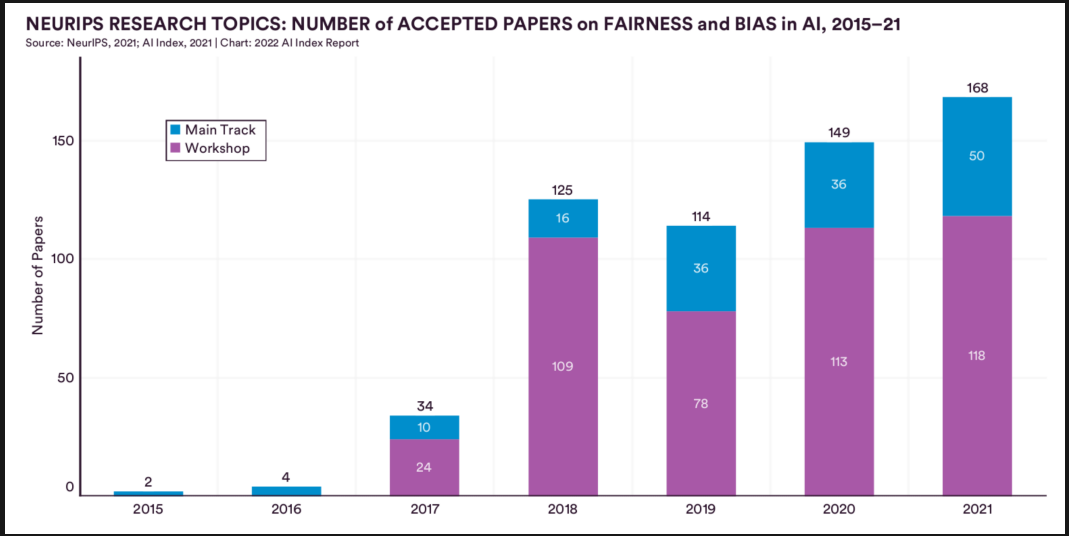
[Zhang D. et al 2021 in AI 2021 Index Report, Fig 4.3.3 https://aiindex.stanford.edu/report/]

Private investment in AI by Geographic area



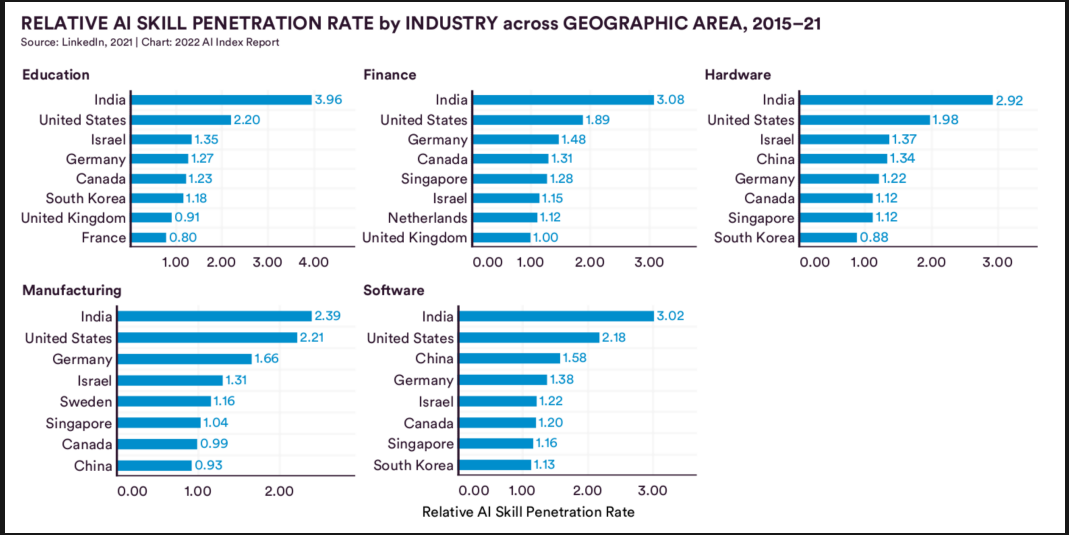
[AI Index Report 2022, Fig 4.2.4 https://aiindex.stanford.edu/report/]

Accepted papers on FAIRNESS and BIAS in AI at Neurips, 2015–21



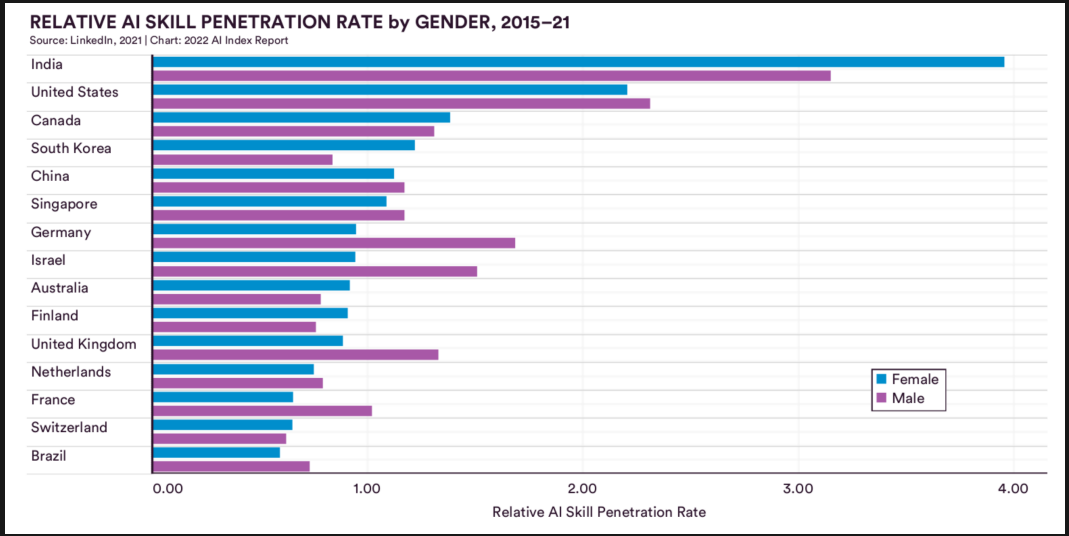
[AI Index Report 2022, Fig 3.3.7 https://aiindex.stanford.edu/report/]

Relative AI skill penetration rate by industry across geographic Area, 2015-2021



[AI Index Report 2022, Fig 4.1.9 https://aiindex.stanford.edu/report/]

Relative AI skill penetration rate by gender, 2015-2021



[AI Index Report 2022, Fig 4.1.10 https://aiindex.stanford.edu/report/]

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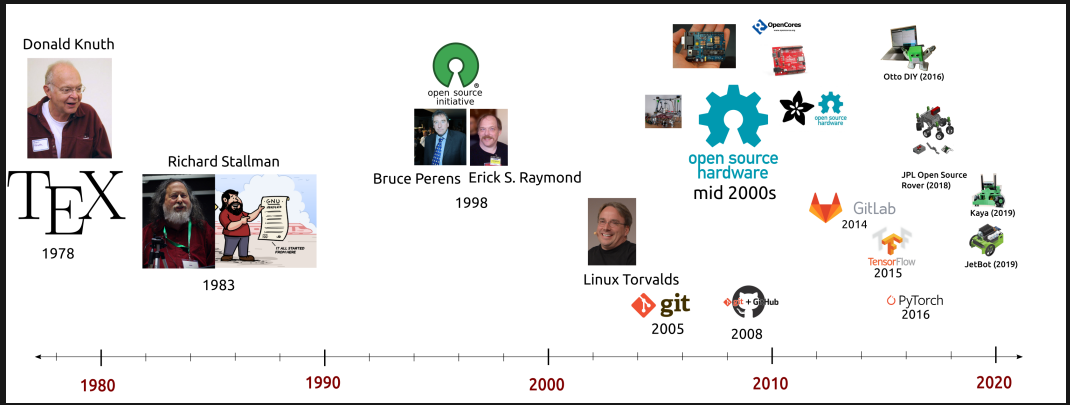
Open source software and hardware in AI and Robotics

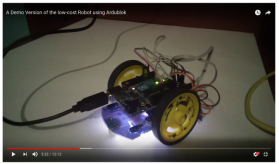


air4children, Artificial Intelligence and Robotics for Children

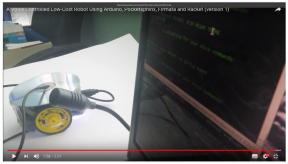
- create a more inclusive, affordable and fair participation of children in AI and Robotics,
- create child-centred AI and Robotics curriculums based on Montessori Education, and
- build Open source robots to be affordable and fun.

Prototyping Open Source Robots (2013 – 2017)

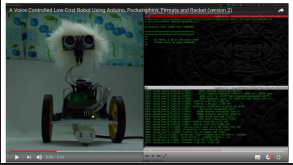
V00-MAY2014



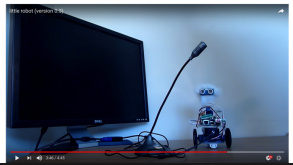
V01-JUNE2014



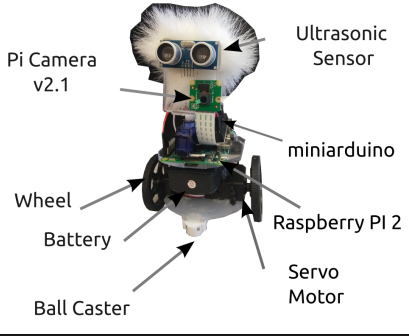
V02-JULY2014



V03-APRIL2016

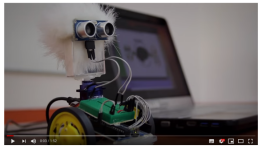


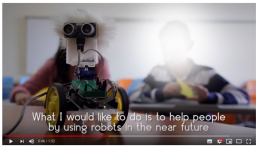
V04-DEC2017

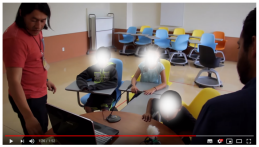


[Xochicale M. June 2014, Proposal of Libre Robotics. Libre Robotics: https://github.com/air4children/documents/blob/main/latex-librerobotics/LibrERobotics.pdf; Voice Controlled Low-Cost Robot: https://www.youtube.com/watch?v=f2mCCzVIxe0 Robot learning: https://www.youtube.com/watch?v=BKWucKcgsP0; little robot: https://www.youtube.com/watch?v=DexhVz_B8U0]

Piloting robot prototypes (2015 – 2019)





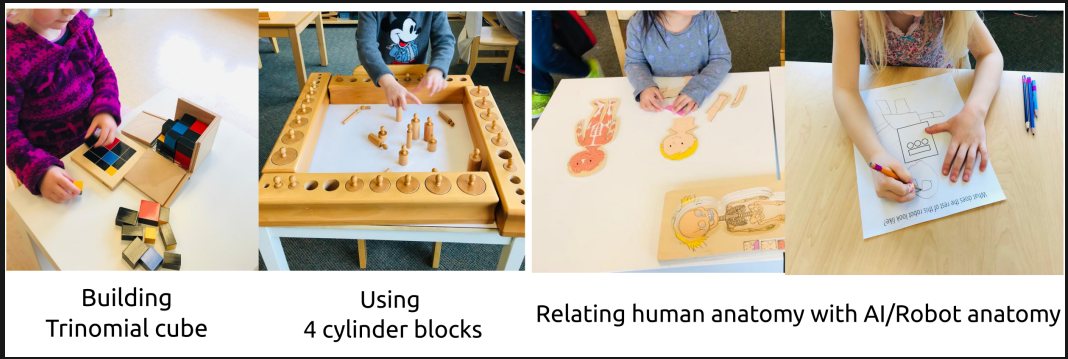


June 2015

October to December 2020

Montessori Education

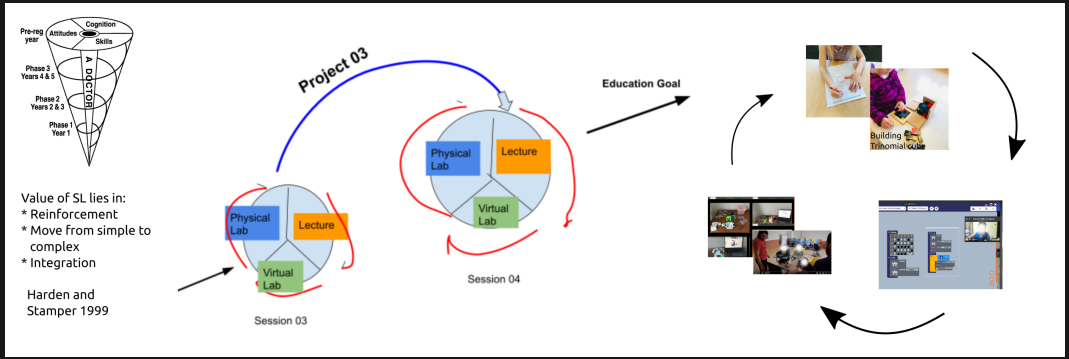
"The hand is the instrument of the mind." Dr. Maria Montessori (1970-1952).



Children are participating in creative explorations to develop fine motor skills and to engage in collaborative and teamwork activities.

[Elkin, M., Sullivan, A. and Bers, M.U. (2014). Implementing a Robotics Curriculum in an Early Childhood Montessori Classroom. Journal of Information Technology Education: Innovations in Practice, 13(1), 153-169. Informing Science Institute. https://www.learntechlib.org/p/174845.]

Spiral Learning Method



[Mohammad Tarik, M., M. Zena Tarik, M. Zahraa Tarek, and M. Farah Tareq. "A Hybrid Spiral Project Based Learning Model for Microprocessor Course Teaching." DOI: http://doi.org/10.24017/kjar; Harden R.M. (1999) What is a spiral curriculum?, Medical Teacher, 21:2, 141-143, DOI: https://doi.org/10.1080/01421599979752]

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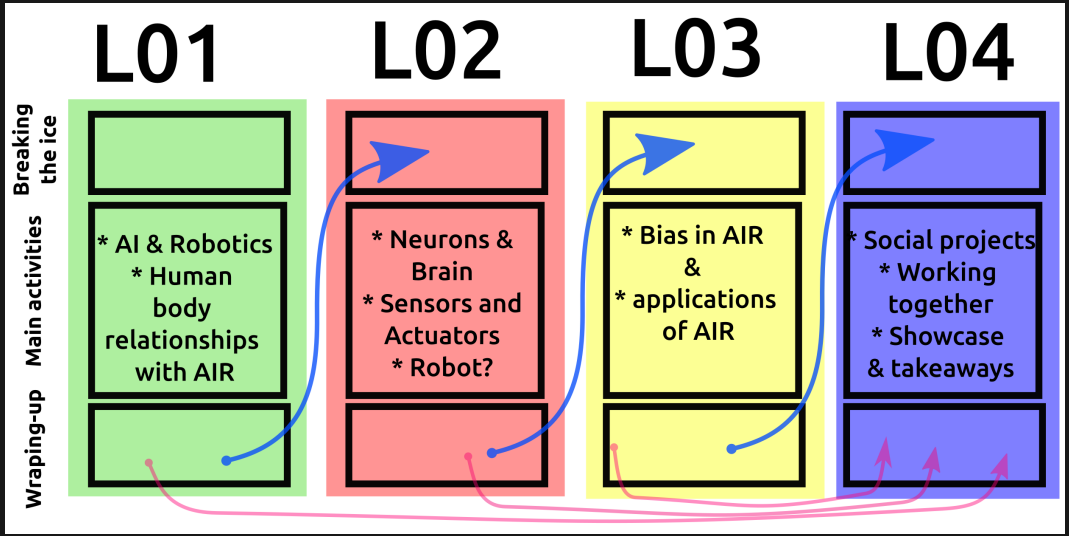
Curriculum



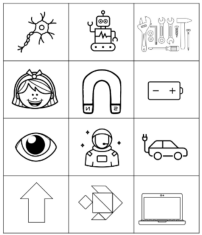
[Badillo-Perez A, Badillo-Perez D, Barco A, Montenegro R, Xochicale M. 2013, Teaching AI and Robotics to Children in a Mexican town, DEI-HRI2023, https://arxiv.org/abs/2303.03956]

Participants

- 14 participants of which 10 were able to attend, 6 male and 4 female of (age in years: mean=8 and std=$\pm$1.61)
- Four instructors of different teaching experience levels to young audiences.

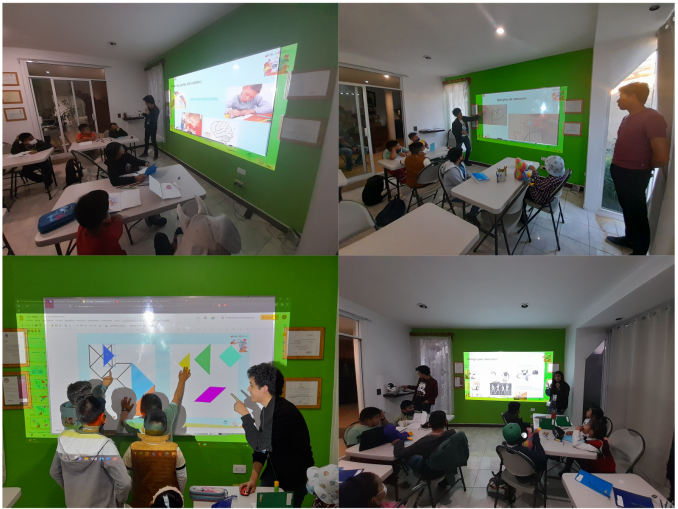
Piloting workshop: Coding and bingo activities

BINGO



[Badillo-Perez A, Badillo-Perez D, Barco A, Montenegro R, **Xochicale M. 2023**, Teaching AI and Robotics to Children in a Mexican town, DEI-HRI2023, https://arxiv.org/abs/2303.03956]

Piloting workshop: Teaching activities

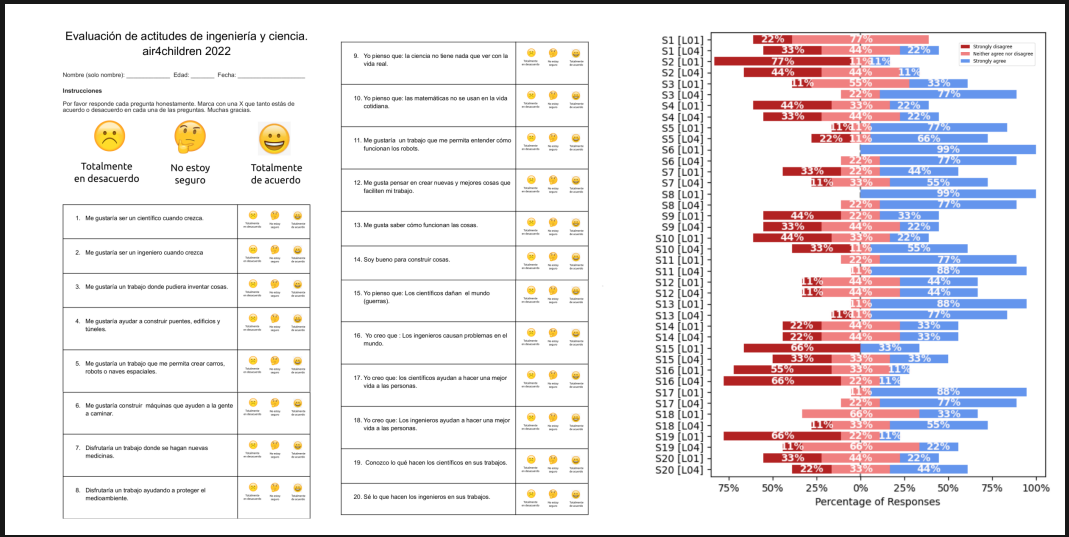


[Badillo-Perez A, Badillo-Perez D, Barco A, Montenegro R, **Xochicale M. 2023**, Teaching AI and Robotics to Children in a Mexican town, DEI-HRI2023, https://arxiv.org/abs/2303.03956]

Piloting workshop: Group activities

[Badillo-Perez A, Badillo-Perez D, Barco A, Montenegro R, **Xochicale M. 2023**, Teaching AI and Robotics to Children in a Mexican town, DEI-HRI2023, https://arxiv.org/abs/2303.03956]

Survey results



Evaluación de actitudes de ingeniería y ciencia.
air4children 2022

Nombre (solo nombre): _____ Edad: _____ Fecha: _____

Instrucciones

Por favor responde cada pregunta honestamente. Marca con una X que tanto estás de acuerdo o desacuerdo en cada una de las preguntas. Muchas gracias.

Totalmente en desacuerdo | No estoy seguro | Totalmente de acuerdo

1. Me gustaría ser un científico cuando crezca.
2. Me gustaría ser un ingeniero cuando crezca
3. Me gustaría un trabajo donde pudiera inventar cosas.
4. Me gustaría ayudar a construir puentes, edificios y túneles.
5. Me gustaría un trabajo que me permita crear carros, robots o naves espaciales.
6. Me gustaría construir máquinas que ayuden a la gente a caminar.
7. Disfrutaría un trabajo donde se hagan nuevas medicinas.
8. Disfrutaría un trabajo ayudando a proteger el medioambiente.
9. Yo pienso que: la ciencia no tiene nada que ver con la vida real.
10. Yo pienso que: las matemáticas no se usan en la vida cotidiana.
11. Me gustaría un trabajo que me permita entender cómo funcionan los robots.
12. Me gusta pensar en crear nuevas y mejores cosas que faciliten mi trabajo.
13. Me gusta saber cómo funcionan las cosas.
14. Soy bueno para construir cosas.
15. Yo pienso que: Los científicos dañan el mundo (guerras).
16. Yo creo que : Los ingenieros causan problemas en el mundo.
17. Yo creo que: los científicos ayudan a hacer una mejor vida a las personas.
18. Yo creo que: Los ingenieros ayudan a hacer una mejor vida a las personas.
19. Conozco lo qué hacen los científicos en sus trabajos.
20. Sé lo que hacen los ingenieros en sus trabajos.

Statistical analysis

- A Wilcoxon T test was used to analyze the results of the survey before and after the survey to see if the engineering attitudes had a significant effect on pre and post survey of the workshop.
- The average survey before the test was lower ($\mu = 2.194500 \pm\sigma\ 0.558367$) compared to the posttest results ($\mu = 2.239500 \pm\sigma = 0.396796$).
- There was no statistically significant in the increase of attitudes towards engineering (t=53.5, p= 0.45).

See Appendix section for reproducible Jupyter notebooks of statistical analysis and plots.

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Conclusions and future work

Conclusions

- Applied Montessory Education and spiral education to design child-based curriculumns in AI and Robotics
- Piloted a workshop with 14 participants of 4 lessons surveying attitudes with liker chart

Future work

- Improve surveys and statistical analysis
- Piloting AIR4Children with a major number of participants
- Applying for funding
- Engage with policy makers to increase the impact of air4children

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