A Virtual Educational Robotics Coding Club Framework to Improve K-6 Students' Emotional Engagement in STEM

Alexandra Alcala
On behalf the ELI and collaborators on this research.

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Supporting parents, communities and schools
in the education of children

VII IEEE World Engineering Education Conference

EDU 2023

Education Society

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Final Paper # 779 and Author Registration

Paper Information

Title: A Virtual Educational Robotics Coding Club Framework to Improve K-6 Students Emotional Engagement in STEM (Paper #779)

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Abstract: Educational robots allow students deepen their knowledge of mathematics and scientific concepts. Educational Robotic coding clubs provide a learning environment for K-6 students that promotes coding through STEM digital literacy. Students in educationally disadvantaged families may not have the educational and financial capital to engage in STEM learning. Closures of schools and afterschool services during the COVID-19 pandemic increased this digital divide. This research proposes a framework for delivering a virtual robotic coding club in an educationally disadvantaged community. The framework develops young people's emotional engagement in STEM through robotic coding. Synchronous online classes were delivered into family homes using Zoom. Results demonstrate that children achieved emotional engagement as reported through high levels of enjoyment and increased interest after participating in the programme. The research shows promise in increasing children's STEM skills and knowledge, and in improving positive attitudes towards STEM for children and parents.

The FINAL PAPER #779 has been ACCEPTED by the Program Committee.
The paper accurately reflects the scope of coverage of the conference or closely related areas. The paper is written in English and is of sufficient quality that readers can easily follow the narrative. The format of the paper conforms to the requirements of the conference template.

STEM Programmes in ELI
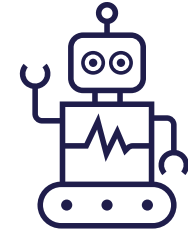
STEM programmes since 2008

- Robotic Coding Club (RCC)

- Students aged 10-12

- Introduction to robotics, programming and electronics

- Delivered in person for 8 weeks

Early Learning Initiative
National College of Ireland

Transition to e-Learning

- Transition STEM programmes to e-learning 2020

- Adapted the resources, curriculum, and methodology for the RCC

- Needed to take family context, interest, and skills into consideration

Early Learning Initiative
National College of Ireland
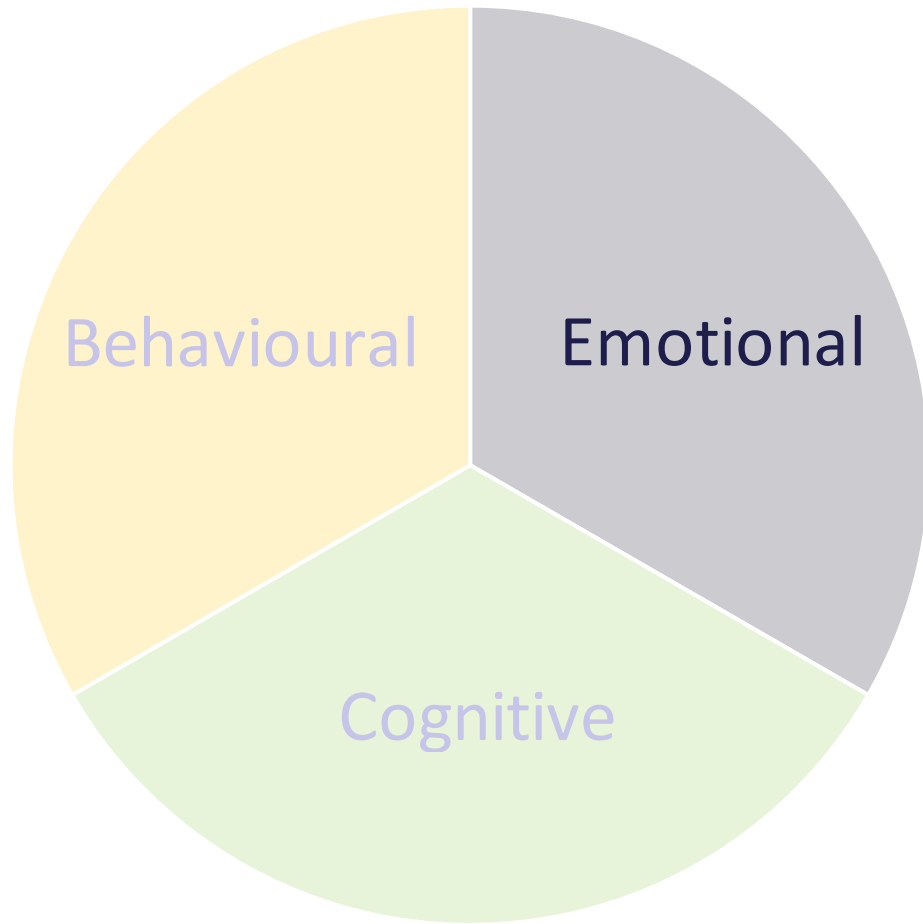
Student Engagement

- Research highlights the importance of STEM for everyday life and success in modern technological workplace (Hinjosa, Rapaport, Jaciw, LiCalsi and Zacamy 2016).

- Student engagement in STEM has been found to be lower in schools in disadvantaged communities (Bray, Banks, Devitt, and Ni Chorcora 2021).

- These children are at a greater risk of suffering 'learning loss' due to the restrictions imposed on schools throughout the pandemic (Darmody, Smyth and Russell 2020).
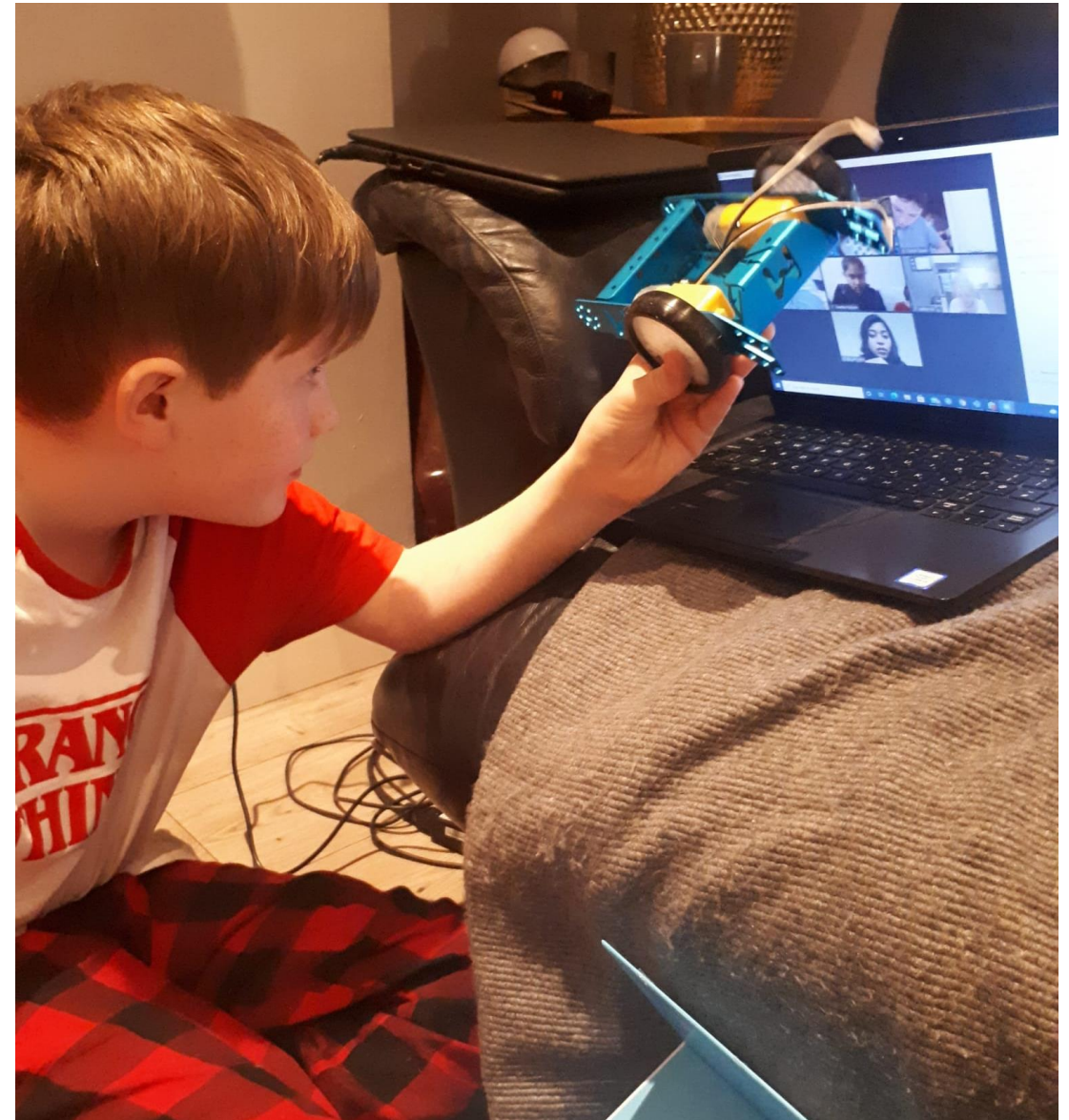
Student Engagement
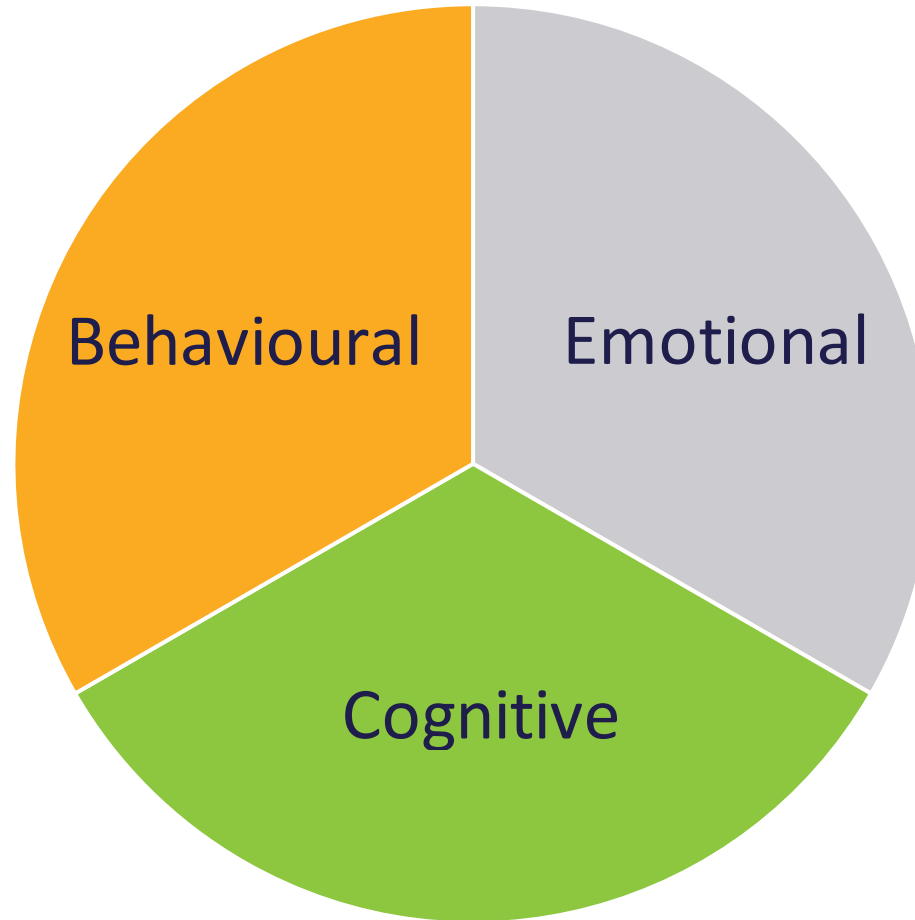
Emotional Engagement

- ➢ Students' reactions to their subjects or activities

- ➢ Interest

- ➢ Attitudes

- ➢ Motivator for behavioural and cognitive engagement

Research Aim

Investigate to what extent a Virtual Robotic Coding Club (VRCC) improves K-6 students' emotional engagement in STEM in disadvantaged communities.

A Virtual Educational Robotics Framework
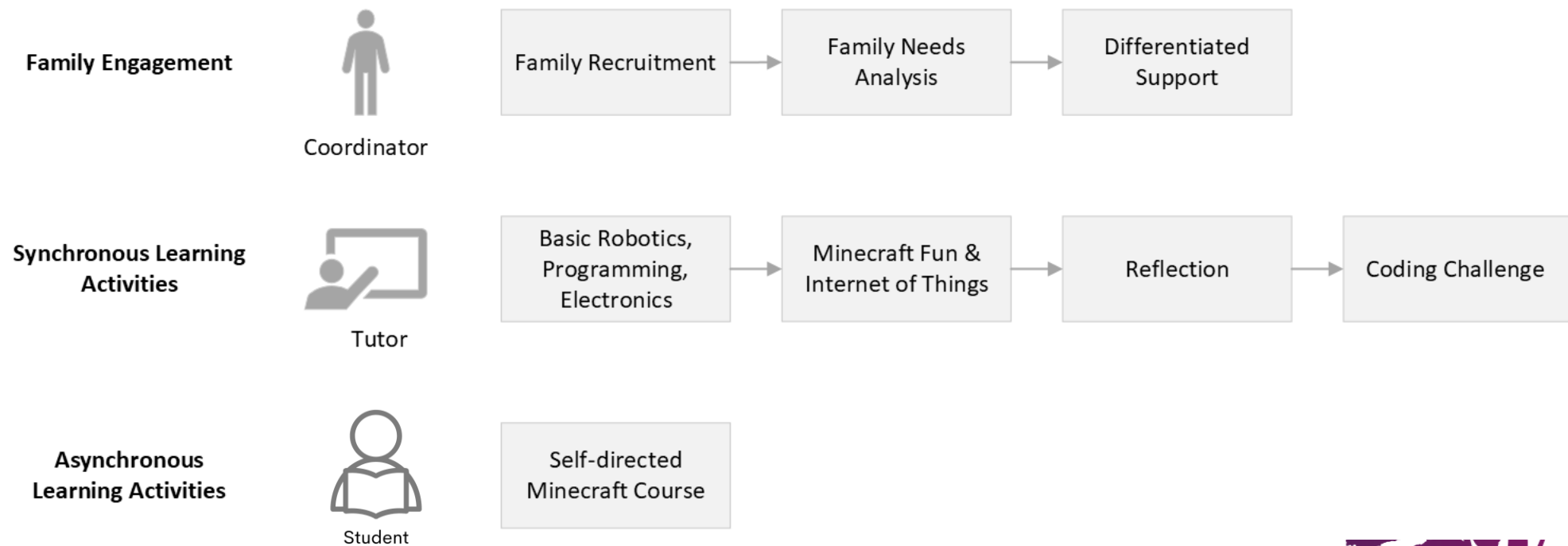
Methodology

- The development of the activities, framework and their evaluation follow a community action research approach (Senge & Scharmer 2001; Bleach 2016).

- Approved by NCI Ethics and informed consent sought.

- 60 children participated virtually.

- Data collected from pre- and post-programme surveys.

- 44 children completed pre-programme surveys (34% female), and 18 completed a post-programme survey (33% female).

- 19 parents completed a post-programme survey.

Enjoyment

94.44% (n=17) of children reported enjoying the VRCC.

"Child enjoyed it so much and had a great time learning in a fun environment."

Interest

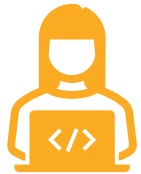| Interest in Science and Technology		
Level	*Pre (N=44)*	*Post (N=18)*
Not at all	2.27%	0%
A little	20.45%	0%
Quite	18.18%	50%
Really	59.09%	50%

Limitations

Prior relationships

Response bias

Response rate

Conclusion

High levels of enjoyment and interest.

Future work investigating behavioural and cognitive engagement.

Mainstreaming and extension of STEM eLearning.

Acknowledgements

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Dr Paul Stynes

Dr Pramod Pathak

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Thank you

Any questions?

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