

ADVANCING ROBOTICS EDUCATION DIRECTIONS FOR SCHOOL AND TERTIARY CONTEXTS

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The University of Canberra acknowledges the Ngunnawal people, traditional custodians of the lands where Bruce Campus is situated. We wish to acknowledge and respect their continuing culture and the contribution they make to the life of Canberra and the region. We also acknowledge all other First Nations Peoples on whose lands we gather.

Contents of the presentation

- ☐ Introductions
- ☐ Foundations of robotics and definitions of the robotics field
- ☐ Curriculum, pedagogical and instructional principles for designing robotics courses
- ☐ Applications of instructional practices
- ☐ Future directions and recommendations for educational contexts
- ☐ Reflections/Questions

Eleni's background

- Language Teaching, Linguistics and Teacher Education
- Language as Interaction
- Applying Interaction analysis in Curriculum Design and human-AI collaboration
- Acknowledgement of interdisciplinarity in STEM, Robotics , AI and teacher education

Damith's background

- Role of pop culture and art
- Early forays into entrepreneurship
- Robotic art and transdisciplinary context

Robotics in human settings

A physical system acts through a body in an environment

Embodied: form, movement and physical action

Embedded: people, setting and constraints

ROBOTS, AI AND SOFTWARE AGENTS

A robot has physical form and action

AI can inform a robot's perception or decisions

A software agent can act digitally without being a robot

Robotics educational principles

- Shift away from traditional modes of teaching due to the developments and applications of robotics in different fields
- Constructivist approaches integrate collaboration, inquiry based learning and engagement in problem solving around design and application of robotics
- A situated/co-design approach involving students in decision making and design of robotics applications promotes authenticity and drives innovation
- Videogames, competitions, project based learning allow for flexibility, engagement and contextual authentic learning

Designing assessment in Robotics education

- Project based learning tasks comprising collaborative work that enhance problem solving peer learning, learner autonomy and authentic learning
- Simple to complex design-based activities build prerequisite skills and enable a stable progression
- Reflective skills and critical learning attributes are an integral aspect of the co-design process
- **Papert (1980) argues: knowledge is created through reflection and engagement with people and artefacts.**
- Co-designing elements needs to be embedded as they promote collaboration, industry engagement, and a sense of ownership and student autonomy development.

Example of inquiry-project-based and codesigned assessment

- Begin with a human situation and real-life application and learning outcome
- Build and observe an interaction
- Use feedback to revise the design
- Reflect, iterate and re-apply
- **At school level,** the focus can be engagement, interaction and storytelling around movement
- **At higher education level,** the emphasis should be on prototype building, based on an authentic scenario encouraging students to design, evaluate, reflect, iterate and redesign, building multidisciplinary skills.

RAPP Lab as a teaching example

Robot responds to human behaviour

Theatre practitioner explores movement and emotion

Engineering students apply insights to robot interaction

Future directions for educational settings

- Co-design with learners to enable human-robot collaboration
- Give students an embodied encounter to observe, reflect, interact
- Bring arts and social perspectives into technical decisions
- Develop an interdisciplinary understanding: focus on STEAM skills rather than STEM

Questions for group discussion

- ☐ Have you interacted with a physical robot? What did the setting and its behaviour lead you to expect?
- ☐ What are your reflections on the integration of robotics and art? Do you have any experience in robotic art or theatrical robot performance?
- ☐ What kind of skills are appropriate for developing school children's skills in the robotics field and STEM in general?
- ☐ What role could robots usefully play in education at your level, and what would learners actually do?
- ☐ Which expertise beyond engineering would improve the design of that learning activity?
- ☐ What evidence would tell you whether students learned about both technical function and human interaction?

Key reading

Herath, D., & St-Onge, D. (2022). *Foundations of robotics: A multidisciplinary approach with Python and ROS*. Springer. <https://doi.org/10.1007/978-981-19-1983-1>

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<https://researchprofiles.canberra.edu.au/en/persons/eleni-petraki/>

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YOU





PLEASE CONTACT US!

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