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# On Measuring Engagement Level During Child-Robot Interaction in Education

Chris Lytridis, Christos Bazinas, George A. Papakostas, Vassilis Kaburlasos

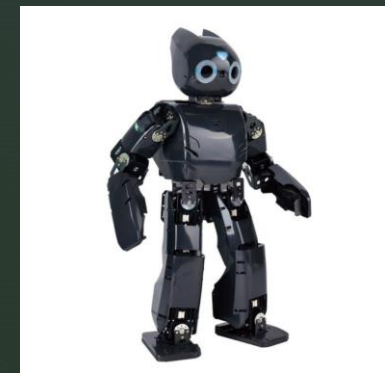


# Robots in education

- The objective is to improve the learning process by introducing
  - Motivation
  - Novelty
  - Repeatability
- Robot selection depends on educational objective
  - Humanoid (interaction)
  - Animal-like (social skills)
  - Mechanical (construction tasks, collaboration)

# Commonly used robots

- NAO
- Lego Mindstorms
- KASPAR
- Darwin



# Applications

- Typical education
  - Learning activities according to the curriculum
    - Arithmetic, physics etc.
  - Social skills
- Special education
  - Autism (ASD)
  - Severe intellectual disabilities
  - Dyslexia

# Measuring engagement levels

- Automatic measurement
  - Gaze
  - Body posture
  - Speech
  - Bio-markers (Electroencephalography–EEG, facial muscles)
- Human observations
  - Video analysis by experts, annotations
  - Questionnaires (parents, children)

# Typical education

<b>Educational activity</b>	<b>Measurement method</b>
Robot as a peer	Gaze and speech detection, device logs (duration, number of interactions)
Storytelling	Audio, visual, contextual analysis, electroencephalography (EEG)
Games	Gaze detection, video observation, motion detection, audio analysis
Arts (theater, dance, singing, drawing)	Video observation, questionnaire
Arithmetic - mathematical tasks	Questionnaire, teacher observation
Free interaction - application of curriculum	Interviews, video analysis (distance, posture, time per session, number of participants per session)
Math, language, problem solving sessions	Questionnaire, interaction time analysis, touch screen logs, measuring mobility, video observation, interviews



# Special education

<b>Educational activity</b>	<b>Measurement method</b>
Games	Video observation, smile and facing behaviors, intonation, bodily appearance
General interaction	Video observation, interaction duration, biomarkers to check stress levels, key behavioral traits
Imitation	Video observation, motion sensors, interaction initiations, eye gaze, gaze shifting, smiling/laughter, questionnaire, attention measurement
Dance	Questionnaire, social response time, video observation (gaze, distance, touch, imitation)
Attention exercises	Observation by clinicians, eye tracking
Conversation, questions	Video observation, annotating behavioral traits
Others	Video observation, rate of correct responses, speech recognition, motion analysis, vocal reaction sensing, interviews

# Shortcomings

- Complex behaviours can only be detected by humans
- Measurement accuracy requires external measuring devices
- Needed:
  - Intelligent algorithms for detection of complex actions and behaviours
    - Autonomy
    - Adaptation/personalisation



# Social Robots as Tools in Special Education

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# Objectives

- The engagement of social robots in specially designed intervention programs as innovative instruments in the Greek Special Treatment and Education (STE).
- The application of social robots in STE for autism and selected cases of Learning Disabilities
- The use of computational intelligence models to increase the autonomy of interaction of the social robots with the end-users

# Robots

NAO



Pepper



Amazon Lynx

