

# Pedagogical Agents for Teacher Intervention in Educational Robotics Classes

Ilkka Jormanainen

Educational Technology Research Group  
Department of Computer Science and Statistics  
University of Joensuu, Finland

23.9.2006

# Motivation

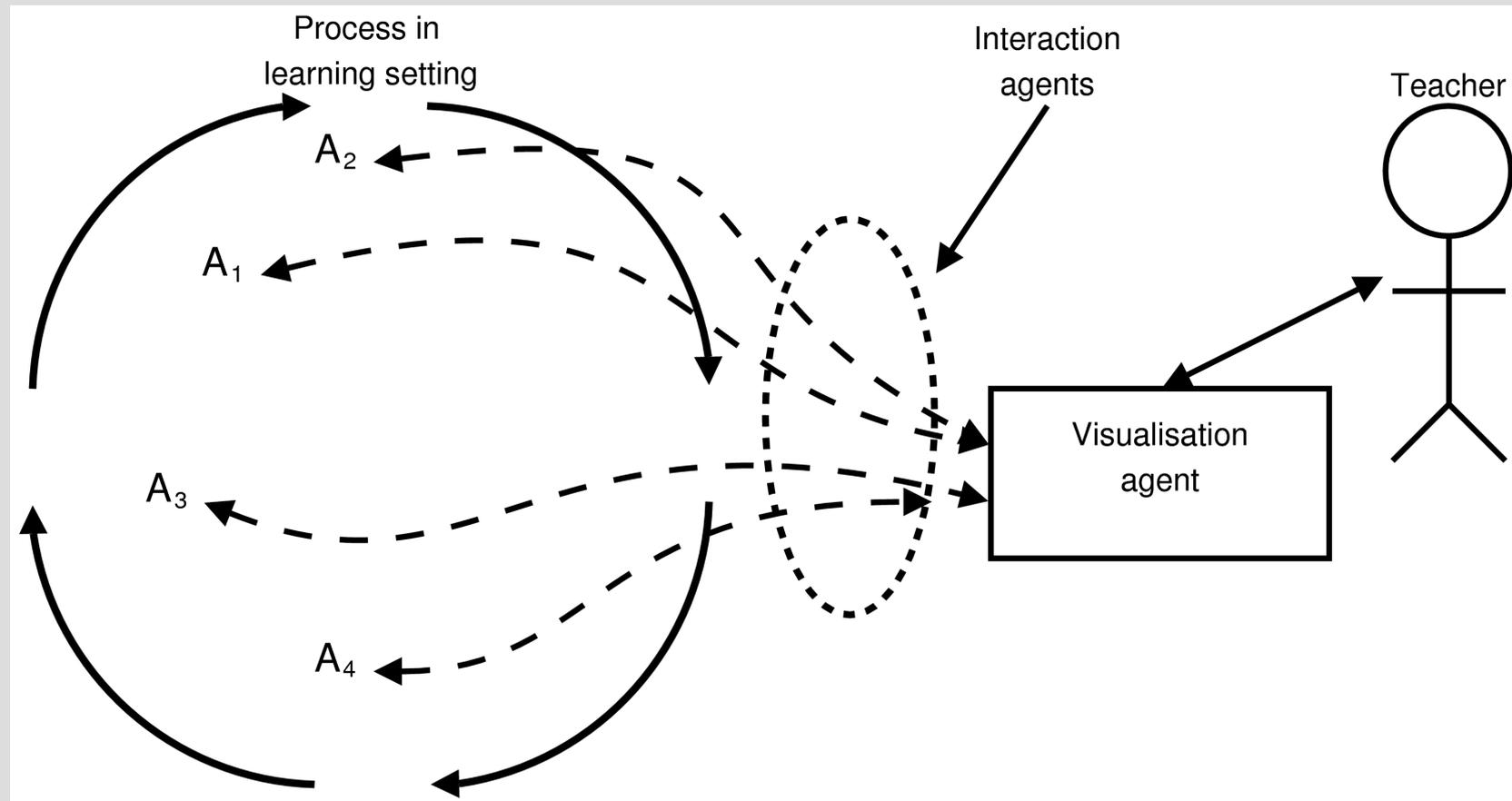
- Educational robotics is successfully used for teaching in several school contexts
  - Student's own creativity is crucial
  - Emphasizes an active learner as the center of the learning process
- Educational robotics have proven to be useful especially in difficult learning settings and contexts
  - For example special education and developing countries

# Problem definition

- Requires new kinds of classroom settings
  - Resources and teachers' knowledge
  - Group oriented working methods may cause difficulties for teacher to follow the learning process
  - For example: one teacher with a normal classroom divided to 10 small groups of 3-4 students
- *How could the robotics environment inform the teacher what students are doing and how they are progressing?*

# Our approach

- Educational agents to help the teacher to focus his/her attention in potential problems



# Research outline

- The research problem:
  - To develop a concept and appropriate tools with agent-based Empirical Modelling environment to support teacher intervention in educational robotics classes.
- The Integrative Learning Design (ILD) framework to support design-based research
- The ILD framework guides the research process from initial definitions to evaluation of the implemented system

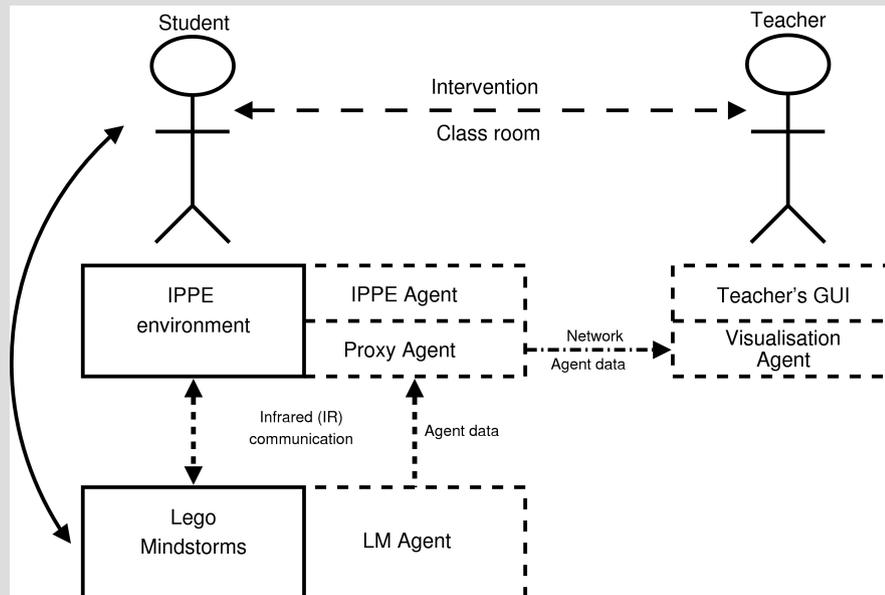
# Research questions

- Descriptive (D), evaluative (E), and constructive (C) research methods
- Several research questions:
  - What is pedagogical modelling? (D)
  - What is technical modelling? (D)
  - What kind of agency architecture could support the modelling? (D/C)
  - How we could implement such a system? (D/C)
  - How this system works? (E)

# Implementation platform

- **Lego Mindstorms**
  - A cheap and widely-used educational robotics platform
- **The IPPE programming environment**
  - The programming environment for Lego Mindstorms robots
- **Empirical Modelling tools**
  - Modelling approach with the emphasis on user's own experience and observations
  - Supports well modelling of a cycle-like process
  - Visualization agent and teacher's interface
- **Several Java-based tools (LeJOS, JATLite, etc.)**

# Architecture



- *LM Agent*: Agency in the robotics environment
- *IPPE Agent*: Agency in the IPPE programming environment
- *Proxy Agent*: Data delivering
- *Visualization Agent*: Implements visualization and teacher's interface

# Current state

- The research has been started at the end of 2005
- Two peer-reviewed publications
- Prototype implementation under the progress
  - JATLite as a framework for the application (?)
  - The first prototype should be ready as soon as possible
  - Conference paper about the implementation (perhaps DIGITEL 2007)
- Prototype testing in Finland at Kids' Club Joensuu

# Publications related to the topic

Jormanainen, I., Moroni, C., Zhang, Y., Kinshuk, & Sutinen, E. To appear (2006, November). Implementation of Intelligent Agents with Mobility in Educational Robotics Settings. In *The 4th IEEE International Workshop on Wireless, Mobile and Ubiquitous Technologies in Education (WMUTE 2006)*.

Jormanainen, I., Zhang, Y., Sutinen, E., & Kinshuk. (2006, July). Agency Architecture for Teacher Intervention in Robotics Classes. In Kinshuk, R. Koper, P. Kommers, P. Kirschner, D. G. Sampson, & W. Didderen (Ed.), *The 6th IEEE International Conference on Advanced Learning Technologies (ICALT 2006)* (pp. 142-143). Los Alamitos, CA: IEEE Computer Society.

---

Jormanainen, I., Kannusmäki, O., & Sutinen, E. (2002). IPPE - How to Visualize Programming with Robots. In M. Ben-Ari (Ed.), *Second Program Visualization Workshop* (pp. 69-73). University of Aarhus, Department of Computer Science.