

# Evaluation of an Empathic Robotic Tutor for Geography and Sustainability Learning

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**Abstract.** This paper discusses the evaluation of an empathic robotic tutor, developed in the EMOTE project. It also argues for the adoption of a new evaluation approach for educational robots, called situated evaluation.

## 1 Introduction

The EMOTE project<sup>1</sup> is developing and evaluating an empathic robotic tutor working in conjunction with an interactive touch table for use in the geography school curriculum with children between 11 and 15 years old. In order to create a technology that is useful to the classroom, two common domains in EU geography curricula were chosen: map reading and sustainability. In map reading the tasks usually have discrete right and wrong answers and we envisaged a single user working with an assisting tutor. Sustainability was selected to contrast with the first. An important question was how a robotic tutor can work in a context where there is no single right answer but where students are learning about trade-offs and dynamics within a complex model. For this purpose a serious game concerning sustainable energy called Enercities [1] was selected and adapted into a multi-player touch-table based game, in which the robot tutor could be one of the players. Both applications were developed with input from school teachers and students in the EU. The commercially available Nao robot was used, with the Emys expressive robot head as a comparator.

## 2 Evaluation Approach

Praslovas [2] evaluation model was chosen to determine the evaluation criteria in EMOTE. This model describes several important elements for the evaluation of an educational technology: Reaction criteria, Learning criteria, Behavior/transfer and Results criteria. Although we have mainly focused on the first two types of criteria, we are aware of the importance of the latter. For the evaluation of the reaction criteria we have adapted several questionnaires: Empathy [3], ALMERE [4], Godspeed [5], NARS [6], MemoLine [7], and Self-assessment of learning [8]. For the learning criteria in the map application we have used map

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<sup>1</sup> EMOTE project: <http://www.emote-project.eu/>

reading assignments that combine different map reading skills. For the learning criteria in the sustainability application we have used facts-based questionnaires, and open problem solving tasks in which children have to argue for a solution. We will also code the video-taped interaction to determine whether the robot encourages the discussion of personal values during the game play, as proposed by Antle et al. [9].

### 3 Discussion

The criteria proposed in [2] and used in EMOTE provide a comprehensive overview of aspects that are relevant when introducing new educational technologies in the classroom. However, the model also assumes that the innovation is a fixed object and that its benefits can be known in advance. Measuring the effects through questionnaires and tests ignores the fact that the use of these technologies is socially situated, meaning that each introduction of a technology leads to adaptations within a specific context. In EMOTE we have experienced this more than once. Bruce et al. [10] thus propose situated evaluation as an alternative approach to the evaluation of socio-technical systems. In this approach, first an idealization of a system is defined. Thereafter, the settings in which the technology is used are examined, and third the realization in different settings is analyzed to generate hypotheses about the how and why of these realizations. For the evaluation of educational robots, which can influence and are influenced by so many different aspects of the classroom practice, we would argue that a situated evaluation approach is a promising approach for future projects.

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