

## Chapter V

# The Didactical Agency of Information Communication Technologies for Enhanced Education and Learning

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### **ABSTRACT**

*This article presents substantial results from two projects that deal with teaching and learning with digital media in basic and higher education and offers a new perspective on the active role of technology in learning processes. The first case draws on the project “Roberta—girls conquer robotics,” which was launched by the Fraunhofer Institute (AIS) with the aim to help promote girls’ interest in sciences, mathematics and technology. It suggests a new pedagogical approach towards the use of robotics in education and discusses how didactics and technology (LegoMindstorms) interact and how the character of robotics itself plays an important role here, such as it already comes along as gendered material. The second case focuses on distance education teaching methods in childcare management. The space left for practitioners in Higher Education is either to embrace the new media or to watch its inevitable unfolding. We take a critical stance towards that perspective and suggest that the shape and learning effect of new media in higher education is contested and evolves in communities of practice. No technologies are neutral and it is more appropriate to speak of technological and societal features as interactively fostering e-learning processes through distributed actions (Rammert, 2002).*

## INTRODUCTION

Informed by a constructivist learning approach and the principles of gender mainstreaming, these two cases draw conclusions towards general educational concepts for digital media. If carefully used as a *didactical actor*, information communication technology not only suit learners' interest in technological messiness but enables them for a technologically mediated life instead of just feeling overwhelmed. Digital media can therefore serve as media for general education in the more comprehensive sense of developing personality, professional identity and agency.

### The Didactical Agency of Robotics for Education

“Roberta—girls conquer robotics,” a project funded by the German Federal Ministry of Education and Sciences (BMBF), was launched by the Fraunhofer Institute (AIS) with the aim to help promote girls' interest in sciences, mathematics and technology, and especially to encourage girls' curiosity for engineering and computer science (Müllerburg/Petersen/Theidig 2004)<sup>1</sup>. Scientifically escorted by the University of Bremen, Digitale Media in Education (DiMeB) and the Institute for Didactics of Natural Sciences (IDN). Roberta addressed 10-16 year old girls. The projects' basic assumption was that robot construction kits—offering possibilities to develop more self-confidence in one's skills—provide an attractive access to technology for girls. By offering substantial results from the qualitative evaluation of Roberta courses we suggest a new pedagogical approach towards the use of robotics in education.

The robot construction kits (Lego Mindstorm) consist of complementary mechanical, dynamic and electronic parts that allow the construction and programming of different types of robots. Basic models can be equipped with different engines and sensors (contact sensors and optical

sensors). The programming can be done in two programming languages (RIS and NQC), the first offering easy to combine graphical blocks, the second requiring more teaching and explanations. The programmes are transmitted on to the RCX module, a programmable Legobrick with 3 input sockets for sensors and 3 for engines. In order to learn about informatics, the teaching of basic programming skills marks an important aim of the Roberta courses.

While informatics is treated in Roberta as a constructivist science, the educational sciences provide the necessary orientation for both shaping and evaluating digital learning environments. Our evaluation thus focused on the following questions:

- How can the interest of girls and women in technology be triggered by the use of robotics?
- How is curiosity for technology generated?
- How should learning environments be designed in order to satisfy both girls and boys?
- Which didactical concept is appropriate in connection with robotics?
- Are robotics and didactics suitable to influence the self-concept of the students?

Results of the quantitative evaluation show that the course experience in longer Roberta courses are noticeably stronger influenced by the focus of the teacher (didactics, informatics, gender, technology) than in shorter ones (Rethfeld/Schecker 2005). The didactical focus stages as the most positive influence on the experiences of the participants—which is why the importance of the course-concept increases with the length of the courses. Although the self concept of informatics and occupational orientation are only sustainably affected in medium sized and longer courses, all Roberta courses help to develop a more positive attitude towards informatics with the

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