IXME: Informatics by Maker Education

A Teacher Training Course on Maker Education in Informatics

Mirek Hančl[1], and Bernadette Spieler[2]

[1] University of Göttingen, Germany
[2] Zurich University of Teacher Education, Zürich, Switzerland

Abstract

Starting in the school year 2023/2024, informatics became a compulsory subject in grade 10 in Lower Saxony, a federal state in Germany. The core curriculum advises a project and product oriented work, following a constructivistic approach as offered by making acitivities. Since maker education implies a different form of teaching in schools, the question arises how teachers can be supported in integrating maker education into their informatics lessons and which changes can occur as a result of this support. Therefore, the teacher training course "IXME" (abbr. for "Informatics by Maker Education") was developed und conducted. Qualitative and quantitative data were collected, and are under ongoing analysis following a mixed methods research design.

Keywords and Phrases: Maker Education, Informatics, Teacher Training Course

1. Introduction

More and more federal states in Germany are introducing informatics as a compulsory subject in middle school, and so did Lower Saxony at the start of the 2023/2024 school year for grade 10. The core curriculum for informatics in Lower Saxony makes it clear that

> "informatics lessons [...] offer project and product oriented work, which [...] also has phases of self-organized knowledge and skills acquisition and takes place against the background of a specific problem. The result of the work can be a physical product [...], the students go through a creative and individual process that leads to a sense of competence and strengthens their self-efficacy. [...]" (Niedersachsen, 2014, p. 7)

1.1 Literature and Research Question

Creating a physical or virtual artifact to solve a problem in a creative process implies a maker mindset, which can offer students access to learning content in a more individual way compared to frontal teaching. "Knowledge, to a constructivist, is not a commodity to be transmitted [...] but an experience to be actively built, both individually and collectively" (Ackermann, 2004, p. 2), a viewpoint that is significantly

Hančl, M., & Spieler, B. (2025). IXME: Informatics by Maker Education. A Teacher Training Course on Maker Education in Informatics. *Constructionism Conference Proceedings, 8/2025*, 527–529. https://doi.org/10.21240/constr/2025/97.X

supported by making activities. A student's individual access to learning content with the help of making activities can be described as "maker learning capability" (Bower, 2018), whereby learning capability in educational psychology refers to the "individual responsiveness of a student to the learning content offered" (Klix, 2020). Maker education is implicitly concerned with the maker learning capability of students. Taking into account the recently introduced compulsory subject of informatics in Lower Saxony and the clear recommendation of the above mentioned core curriculum for informatics with regard to project and product orientation and the resulting three-step: maker mindset -> maker learning capability -> maker education, the following research question arises: "How should teacher training in maker education for informatics lessons be designed and implemented to enable educators to effectively apply maker education as a teaching method, and what resources are required to support this process?"

1.2 Methodology

The training course "IXME" (abbr. for "Informatics by Maker Education"), was designed and carried out for teachers from Lower Saxony as part of the research project. It took place in three phases: In the initial phase, an introductory event (duration: 1.5 days; $n_{(participants)}$=42), various aspects of making were presented in a learning circle. During the trial phase (duration: 6 months) the participants were able to try out making tools and consumables in their own classrooms. In the final phase, a follow-up event (duration: 1.5 days; $n_{(participants)}$=15) took place on a voluntary basis.

In order to investigate the effectiveness (output) of the training course, i.e. the change in perception and attitude towards maker education that the training course led to among the participants, quantitative data collection was carried out in the two parallel introductory events of the initial phase using pre/post tests (pre: n=40, post: n=39). To investigate the sustainability (outcome) of the training, the participants were asked about their planning and implementation of informatics lessons after the trial and final phases with the help of guided interviews (n=7) as part of a qualitative data collection. The interviews are analyzed with the help of content-structuring qualitative content analysis (Kuckartz & Rädiker, 2022). The qualitative and quantitative data analysis will be combined in a mixed method research design.

1.3 Results and Limitations

At time of submission the collected data is under ongoing scrutiny. The first partial results show that a more open approach to informatics lessons through maker education requires an individual but significant change in resource planning (e.g. time and space) by the teacher. Participants give a particularly positive feedback on making the learning process visible through students producing their own artifact and working together in teams.

A limitation oft the study is that the training course was offered to teachers on a voluntary basis. As a result, neither qualitative nor quantitative data collection exists from teachers who did not want to or could not take part in the training course.

References

Ackermann, E. K. (2004) *Constructing Knowledge and Transforming the World*. In *A Learning Zone of One's Own: Sharing Representations and Flow in Collaborative Learning Environments,* edited by M. Tokoro and L. Steels, p. 15–37. IOS Press, Washington, D.C..

Bower, M., Stevenson, M., Falloon, G., Forbes, A., Hatzigianni, M. (2018) *Makerspaces in Primary School Settings – Advancing 21st Century and STEM capabilities using 3D Design and 3D Printin*. Sydney, Australia: Macquarie University. https://primarymakers.com.

Klix, F. (2020) *Lexikon der Psychologie*. Spektrum Akademischer Verlag. Retrieved 01.02.2025 from https://www.spektrum.de/lexikon/psychologie/lernfaehigkeit/8794

Kuckartz, U., and Rädiker, S. (2022) *Qualitative Inhaltsanalyse: Methoden, Praxis, Computerunterstützung*. Beltz Juventa, Weinheim.

Niedersachsen, MK. (2014) *Kerncurriculum für die Schulformen des Sekundarbereichs I Schuljahrgänge 5 - 10*. Hannover