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# **Self-assessment and achievement in mathematics education: The influence of immediate feedback included in a computer-based learning environment.**

## **Concept of a research study**

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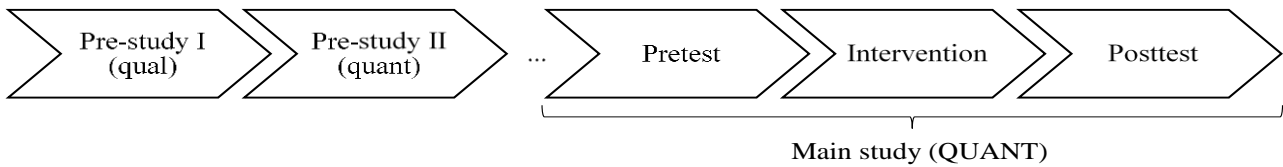
### **Theoretical background**

Roth (2015) defines computer-based learning environments based on mediawiki software as a structured pathway with a well-matched sequence of tasks. Central contents are interactive materials like for instance GeoGebra-applets. Roth adds that learners are encouraged to work self-regulated, self-reliant and activity-oriented within these pathways. In Germany suchlike learning environments are for example available on the website of ZUM-Wiki (<https://wiki.zum.de/wiki/Hauptseite>), a web page that is called on to yield a well-kept surrounding in which everybody is invited to add something (Vollrath & Roth 2012). In our study, we will focus on quadratic functions. The area of functional relationships is a central theme during secondary education in Germany in which commonly occur some learning difficulties as for example on figuring out the meaning of parameters (Nitsch 2015). A computer-based preparation is called to promote the understanding of the parameters due to the option to easily include dynamic and interactive visualizations (Vollrath & Roth 2012). Furthermore, the importance of feedback for learning is mentioned in several publications (e.g. Black & Wiliam 1998; Vollrath & Roth 2012; Hattie & Gan 2011). Hattie and Gan (2011) for example identified feedback as one of “the top 10 influences on achievement” (Hattie & Gan 2011, p. 249). Thereby the dimension of this influence would vary depending on different kinds of feedback. Apart from this, we are interested in the influence of feedback on self-assessment as a specific component of metacognition (cf. Ibabe & Jauregizar 2010). More specific we will look at students’ self-rating ability. In our study, we will focus on feedback, which is typically encountered in computer-based learning environments. Suchlike feedback concerns the right answer and, in some cases, comments on how to get to this conclusion. Beside it “help me”-buttons with hints about how to proceed are added. Both the right answer and the hints can be activated by mouse click.

### **Research questions**

1. Is students’ self-assessment better if they work with a computer-based learning environment, including immediate feedback, than it is when they get the feedback outside the learning environment (research based on quadratic functions)?
2. Does a computer-based learning environment, including immediate feedback, have greater benefit on students’ math achievement in comparison to their achievement when they get the feedback outside the learning environment (research based on quadratic functions)?

## Method



We are currently conducting some preliminary studies, including a qualitative (pre-study I) and a quantitative part (pre-study II). The quantitative pilot study includes testing the self-assessment scales and the achievement test. Within this study, self-assessment is used in a context of self-rating the expected performance in the upcoming achievement test. The achievement test includes items about functional thinking as anchor items and items about linear functions (pretest) alternatively quadratic functions (posttest). In the qualitative pre-study, we are proving the designed computer-based learning environment about quadratic functions. Our aim is to reveal problems and misunderstandings and thus to rework and improve the learning environment.

The main study will be a quantitative research study with a quasi-experimental between-subject design. Students will work with the computer-based learning environment. The experimental group receives the learning environment including immediate feedback and hints for the tasks. The control group gets the same learning environment with absent feedback. Instead, this group gets correct-answer-feedback in outlying paper-sheets. Students' self-assessment as well as math achievement will be measured in a pre- and posttest design. The achievement test will measure the students' prior knowledge about linear functions (pretest) and their concepts on functional thinking (pre- and posttest) as well as their increase of learning after the self-regulated learning with the different types of feedback (posttest). As further research interest, we are going to compare the self-assessment ability of both groups related to the passage of time.

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