USING INTERACTIVE H5P-VIDEOS TO REDUCE STUDENTS' ERRORS CAUSED BY MISCONCEPTIONS

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This poster describes a research project that aims to explore the impact and effectiveness of interactive videos that are designed to induce cognitive conflicts and promote a conceptional change in the context of differential calculus. Therefore, an instructional ECRR-sequence (elicit-confront-resolve-reflect) is implemented within an interactive H5P-video. We use this kind of automated, time- and location-independent instrument to reduce students' errors that are caused by misconceptions.

Keywords: interactive H5P-videos, misconceptions, conceptual change, ECRR

INTRODUCTION

Typical errors of pupils in mathematics are well investigated (Malle 1993; Kieran 1992) and systematic errors of secondary school students are often caused by a lack of understanding the concepts of school algebra (Tietze 1988). Moreover, these errors can be established (Kersten 2015) and then hinder students to succeed in university math courses (Altieri 2016). Errors can be indications for underlying misconceptions, so that it becomes important to consider students' prerequisites and aid students to change concepts that are not adequate.

Possible approaches to foster a change of existing concepts are instructional strategies that cause students to experience a cognitive conflict of their existing knowledge in contrast to new concepts. Several studies have investigated the impact of such strategies within traditional classroom intervention designs (for an overview, see: Chow and Treagust 2013), but there are only few studies that use digital tools. Therefore, this poster presents a digital intervention design based on videos that include different types of interactions provided by the software H5P.

THEORETICAL BACKGROUND

According to a constructivist view, a learner develops knowledge through interactions with its environment by building or reorganizing cognitive structures (Piaget 1976). Within this process, it is natural that an existing cognitive structure may not be adequate or in line with a specific perception. In such cases of inconsistency, a cognitive conflict can arise and at its best – if necessary – induce a conceptual change.

In the context of mathematics, the absence of questioning the applicability of concepts can cause a lack of cognitive conflicts, which can therefore result in overgeneralizations. An example of an overgeneralization is the improper use of linear reasoning, often referred to as "illusion of linearity" (De Bock et al. 2002). Coming from everyday life experience, this concept is intuitive, students tend to rely on it without reflecting its limitations and expand the domain of applicability inconsiderately (Verschaffel and Vosniadou 2004).

An established cognitive conflict strategy in physics education is the ECR (*elicit-confront-resolve*) sequence that has been shown to be effective in face-to-face interventions (McDermott 2001). Engelman (2016) added a reflection phase (R) and has proven its effectiveness when it was integrated in a computer-based learning environment.

CONFLICT-INDUCING INTERACTIVE H5P-VIDEOS

We transfer the cognitive conflict instructional ECRR-sequence to mathematics and implement it partly into interactive videos in order to reduce typical students' errors in differential calculus that are based on the illusion of linearity. In a first step (*elicit*), the error is detected via a diagnostic E-Assessment. In a second step (*confront*), the inconsistency of two alternative ways to calculate the derivative is uncovered in a video sequence. We use interactive exercises to cause students to become aware of the conflict. The *resolve*-phase consists of another video sequence in which the correct concept is justified by further explanations. The *reflect*-phase contains a set of initial exercises.

PILOT STUDY

We conducted a qualitative pilot experiment in order to get insights, how students experience the conflict-inducing part of the video. In videotaped sessions first-year students worked on the interactive video and were interviewed afterwards. First results have shown that the design of the confront-phase needs to be improved in order to present the inconsistency more explicit. This seems important to foster a rejection of the misconception and to evoke the desired conceptual change.

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