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Facilitating the Analytical Competency of Pre-Service Teachers with Digital Video Cases: Effects of Hyperlinks to Conceptual Knowledge and Multiple Perspectives

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Abstract. Analytical competency in classroom situations can be seen as a crucial aspect of teachers' professional competency. While case-based learning is considered to have great potential for the promotion of analytical skills of teachers, there have been few attempts to investigate the effects of corresponding instructional support. The empirical study presented here investigates the effects of instructional support in the form of hyperlinks to conceptual knowledge or multiple perspectives in a computer-supported case-based learning environment based on the principles of cognitive flexibility theory. 97 prospective foreign-language teachers participated in a field study with a 2x2-factorial design. The pre-post comparison of the individual participants reveals that specific components of analytical competency could be fostered by the different treatments. Process analyses show that particularly the multiple perspectives affected the small group discussions of the cases. These results underline the importance of adequate instructional support for effective case-based learning in teacher education.

Keywords: Case-Based Learning; Cognitive Flexibility; Media in Education; Multiple Perspectives; Skills Acquisition; Teacher Education

Research background

The professional competency of teachers is strongly connected to their competency of being able to understand and analyze classroom situations (Schrader & Hartz, 2003). Analytical competency can be structured into (1) the ability to portray pedagogical situations in a differentiated way, (2) the ability to become immersed in multiple perspectives (for example, to adopt teacher and learner perspectives), and (3) the ability to apply conceptual knowledge to case information in order to better understand the situation at hand (see Schrader & Hartz, 2003). Methods of case-based learning are considered to have great potential for promoting analytical and problem-solving abilities in teacher education (Lundeberg, 1999). This is especially true for methods that utilize authentic cases with the purpose of enabling learners "to explore the complex and messy problems of practice" (Merseth, 1996, p. 725). Cases

implemented to educate learners in analytical skills usually comprise complex and authentic situations that require analysis, problem-solving, and decision making.

Recent empirical studies have demonstrated that learners do not get the most out of case-based learning without additional instruction (e.g., Fitzgerald et al., 2009). In order to foster the analytical competency of teachers effectively, instructional support needs to be designed that supports learners to apply their conceptual knowledge to a case and immerse in multiple perspectives. Cognitive flexibility theory (CFT) can be drawn upon as a basis for such instructional support as it aims to further flexible knowledge application in different real situations, increase awareness of one's own perspective, and allow for the construction of connections to alternative perspectives (Spiro, Collins, Thota, & Feltovich, 2003). The CFT further recommends the use of hypermedia environments to realize a non-linear, multi-dimensional presentation of contents. Since digital video allows dynamic processes to be visualized, presenting learners with a fuller picture of complexity, the use of this technology has been recommended for training in ill-structured domains (Goldman, Pea, Barron, & Derry, 2007).

Against this backdrop, the research question of this study was: how do hyperlinks to conceptual knowledge, hyperlinks to multiple perspectives, and a combination of both influence the acquisition of analytical competency among pre-service teachers in a computer-supported case-based learning environment? Moreover, learning processes were investigated to find out if these instructions could help counteract some of the known deficits of case-based learning, which include learners tending to get sidetracked instead of analyzing the case in a goal-oriented way, or insufficient immersion of the case-based learners, who are often having difficulties to identify the relevant perspectives for the case. We hypothesized for learning process and outcomes alike that the availability of conceptual knowledge would have a positive effect on the application of conceptual knowledge, and that the availability of multiple perspectives would have a positive effect on the immersion of the learners.

Methodology

A total of 97 prospective foreign language teachers participated in this field study with a 2x2-factorial design, the factors being "conceptual knowledge" (with / without) and "multiple perspectives" (with / without). The case-material for the study was recorded in regular English lessons for intermediate learners. Authentic case sequences of 10 to 15 minutes were implemented in the computer-supported learning environment "Case Viewer" that was developed for this study based on the ideas of the CFT. Functions offered by the learning environment included video replay with standard video-player functions (e.g., stop, start, rewind, forward), but also the option to annotate the video cases.

The study was realized as a four-day university course for prospective foreign language teachers. The person conducting the courses was a full-time professional trainer for pre-service school teachers. He was trained on the basis of a facilitator script prior to the study to ensure standardized proceedings for all experimental groups. All participants were given two readers for their preparation two weeks before the training started: one reader introduced them to pedagogical models and theories of learning and instruction relevant to the cases, while the other reader explicated the importance of multiple perspectives for the understanding of learning and instruction processes. On day one, the participants were introduced to case-based learning within the scope of a lecture, before control variables and demographic data were assessed. After that, learners wrote the first case analysis without instructional support (pre-test). For the subsequent four training cases on days two and three, the experimental conditions were realized: the factor "conceptual knowledge" was varied by providing / not providing hyperlinks to pedagogical models and theories of learning and instruction, while the factor "multiple

perspectives“ was varied by providing / not providing hyperlinks to authentic statements of the teacher and learners from the video. For quantifying the dependent variable analytical competency, a complex coding scheme for the measurement of analytical competency was developed that incorporated its aforementioned three components. Regardless of the condition, learners analyzed each training case individually (40 min.) and in groups of three (65 min.). The small group interactions were recorded on video to investigate the learning processes. On day four, learners had to write another case analysis individually without instructional support (post-test).

Results and Conclusions

In the pre-post comparison (cf. Goeze, Zottmann, Schrader, & Fischer, 2010), individual learners drew on conceptual knowledge more often in the post-test case analyses when hyperlinks to conceptual knowledge were available to them, $F(1;92)=9.97$; $p<.01$; partial $\eta^2=.10$. Learners supported with hyperlinks to multiple perspectives adopted teacher and learner perspectives more often in the post-test than participants who did not have this support, $F(1;92)=6.04$; $p<.05$; partial $\eta^2=.06$. With respect to the learning processes observed in the small groups, particularly the multiple perspectives had an impact as they led to an increase of immersion, $F(1;92)=4.90$; $p<.05$; partial $\eta^2=.05$, but likewise to (marginally significant) sidetracking, $F(1;92)=3.01$; $p<.10$; partial $\eta^2=.03$. In summary, these results show that additional instructional support in the shape of hyperlinks to conceptual knowledge and multiple perspectives embedded in a computer-supported learning environment can increase the effectiveness of case-based learning by fostering specific components of analytical competency.

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