Enhancing Computer-supported Case-based Learning for Pre-service Teachers: Effects of Hyperlinks to Conceptual Knowledge and Multiple Perspectives

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Abstract: Effects of instructional support for pre-service teachers (n=100) learning with digital video cases were investigated in an empirical field study with a 2x2 factorial design during a four-day university course. Hyperlinks to conceptual knowledge and/or multiple perspectives were implemented into a computer-supported learning environment. Analyses of learning processes and outcomes provide evidence that both forms of instructional support could enhance the effectiveness of case-based learning by fostering specific components of the prospective teachers' analytical competency.

Objectives of the Study

The professional competency of teachers is strongly connected to their competency of being able to understand and analyse classroom situations (Schrader, Hohmann, & Hartz, 2010). 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 (especially those of teachers and learners, see Oser & Baeriswyl, 2000), and (3) the ability to apply conceptual knowledge to case information in order to better understand the situation at hand.

Methods of case-based learning are considered to have great potential for promoting analytical and problem-solving abilities in teacher education. This is particularly true for methods utilising 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 typically comprise complex and authentic situations that require analysis, problem-solving, and decision making. Recent empirical research, however, has demonstrated that learners do not get the most out of case-based learning without additional instructional support (e.g., Fitzgerald et al., 2009; Moreno & Valdez, 2007).

Cognitive Flexibility Theory (CFT) can be drawn upon as a basis for instructional support that seeks 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. As digital video technology allows for the visualisation of dynamic processes, approximating a fuller presentation of complexity to learners, it has been recommended for training in ill-structured domains (Goldman, Pea, Barron, & Derry, 2007) such as teacher education.

Research Questions

The empirical study presented here aimed to answer the following research question: how do hyperlinks to conceptual knowledge, hyperlinks to multiple perspectives, and a combination of them both facilitate the analytical competency among pre-service teachers in a computer-supported case-based learning environment? In addition, collaborative learning processes were investigated to find out if these instructions may help counteract some of the known deficits of case-based learning, i.e. learners tending to get sidetracked instead of analyzing the case in a goal-oriented way, or insufficient immersion of case-based learners who are often unable to adopt alternate perspectives (see Zottmann et al., in press).

We hypothesised for learning processes and outcomes that the availability of conceptual knowledge in the learning environment would have a positive effect on the application of conceptual knowledge, while the availability of multiple perspectives would have a positive effect on immersion.

Methodology

A total of 100 prospective foreign-language teachers (English as a second language) participated in this field study with a 2x2-factorial design, the factors being "conceptual knowledge" and "multiple perspectives". The case-material for the study was recorded in regular English lessons for intermediate learners. Authentic case sequences of up to 15 minutes were implemented in a computer-supported learning environment that was developed for this study based on the ideas of the CFT.

The study was realised as a four-day university course for pre-service teachers. On the first day, these teachers were introduced to case-based learning within the scope of a lecture, before control variables and demographic data were assessed. Subsequently, participants wrote a pre-test case analysis individually without instructional support. For the following four training cases on days two and three, the experimental conditions were realised: the factor "conceptual knowledge" was varied by providing / not prodiving hyperlinks to short descriptions of various pedagogical models and theories of learning and instruction (Cognitive Apprenticeship being one of them, for instance) that could be applied to the case. The factor "multiple perspectives" was varied by providing / not providing hyperlinks to authentic comments made by the teacher and learners from the video. These comments had been generated from interviews conducted a few weeks after the course took place. Regardless of the experimental condition, learners analysed 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. Learners had to write a post-test case analysis individually without instructional support on day four.

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. ANCOVAs were conducted to examine the effects of instructional support on learning processes and outcomes relating to the acquisition of analytical competency.

Results and Conclusions

Individual learning outcomes show that learners drew on conceptual knowledge more often in their post-test case analyses when hyperlinks to conceptual knowledge were available to them throughout the course, $F(1;95)=10.14$; $p<.01$; 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, $F(1;95)=8.38$; $p<.01$; partial $\eta^2=.08$.

With respect to the learning processes, particularly the hyperlinks to multiple perspectives affected the small group discussions of the cases as they led to an increase of immersion, $F(1;95)=6.05$; $p<.05$; partial $\eta^2=.06$. With respect to sidetracking, however, a significant interaction between the two factors was found, $F(1;95)=5.16$; $p<.05$; partial $\eta^2=.05$. Study participants in the combined condition made fewer case-related statements than learners in any other experimental condition.

In summary, results of this study provide evidence that additional instructional support in the shape of hyperlinks to conceptual knowledge and multiple perspectives embedded in a computer-supported environment can indeed enhance the effectiveness of case-based learning by fostering specific components of analytical competency - a competency that is considered crucial for teachers' professional performance.

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Acknowledgements

This research has been funded by the Deutsche Forschungsgemeinschaft (DFG).