

Understanding Teachers' Collaboration for Designing Technology-Enhanced Learning

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Abstract: This study examined the effectiveness of teacher collaboration in promoting teachers' attitudes and perceived competence toward design. Team design talk was analyzed. Additional data included teachers' attitude and perceived competence questionnaire. Results showed that teachers' perceived competence toward design improved after collaboration, yet their attitude toward design did not change significantly. Qualitative analysis showed that challenging ideas was found positively correlated to the formation of team shared mental model.

Introduction

Encouraging collaboration among teachers is essential for effective professional development programs. As teacher design talk is the main resource for understanding teachers' collaborative design, this study attempts to analyze how teachers go through the collaboration. One promising line of research that may shed light on teachers' collaborative design process is shared mental model (SMM). SMMs are "knowledge structures held by members of a team that enable them to form accurate explanations and expectations for the task, and in turn, to coordinate their actions and adapt their behavior to demands of the task and other team members" (Cannon-Bowers, Salas, & Converse, 1993, p. 228). Johnson, Lee, Lee, O'Connor, Kahlil, and Huang (2007) identified five key dimensions of shared mental models: (1) team knowledge, (2) team skills, (3) team attitudes, (4) team dynamics, and (5) team environments. Research suggested that if members had very different response to questionnaire assessing the SMMs, team members were likely to have large gap towards completing tasks (Razzouk & Johnson, 2013). In this study, we focus on what kind of collaborative action helps the formation of SMM.

Method

Research questions

There are three main research questions in this study: (1) Whether the collaborative design helped to improve teachers' attitudes toward and perceived competence in designing technology-enhanced learning; (2) How teams went through the collaborative process; (3) How is the relationship between the collaborative process and SMM similarity within a team.

Context and participants

This study was carried out in a summer graduate course about design technology-enhanced learning. Students who joined this graduate program were young teachers who were in first few years as a K-12 teacher. Each team were required to work in groups to create a technology-enhanced learning lesson. A total of 36 teachers with an average age of 25.5 participated in the study, with 28 females and 8 males. All of them held a bachelor's degree and had an average of 3.4 years of teaching experience.

Instruments

Background information questionnaire. This questionnaire was composed to collect demographic information, including their gender, age, years in the profession, and subject taught.

Teacher attitudes and perceived competence questionnaire. There were 14 questions that measured teachers' attitudes toward designing, which was adapted from the Science Attitude Scale developed by Sumrall's (2008). The second part of the questionnaire contained 6 questions measuring teachers' perceived competence in designing, which was adapted from Voet and De Wever's (2017) questionnaire.

Shared mental model questionnaire. This questionnaire was adapted from team assessment and diagnostic instrument by Johnson et al. (2007). All the items were 5-point Likert-scale questions, ranging from "highly disagree" to "highly agree". It consisted of 15 items in five dimensions.

Procedure

The design project module underwent three successive days. In the first day, all teachers took the attitudes and perceived competence questionnaire. Then they received lecture about design, practiced related cases, and discussed issues about designing. In the second day, teachers were randomly assigned to 12 teams. Teams were

engaged into an authentic collaborative design task for creating inquiry activities on WISE (Web-based Inquiry Science Environment) platform, with the purpose of enhancing their design competence by teamwork. The design task was divided into three phases: 1) topic identification, 2) needs analysis, and 3) project development. The three phases were made by consulting with other 2 teacher educators. The teachers' design talk was recorded as important evidence for understanding their collaboration. Finally, participants completed the teacher attitudes and competence questionnaire as posttest and SMM similarity questionnaire.

Results

Effects of collaborative design on teacher attitudes and perceived competence

The results showed that there was a significant increase in teacher perceived competence [$t(35) = 2.49, p = .02$] from the pre-test to the post-test, but no significant difference was found in teacher attitudes [$t(35) = .75, p = .46$].

Teachers' use of collaborative actions during different phases

In phase 1, there was a significant difference in the percentages of the three types of collaborative actions [$F(1.38, 48.30) = 8.73, p < .001$]. Post hoc test revealed that the percentage of developing ideas was significantly lower than those of the other two skills. In phase 2, there was also a significant difference in the percentages of the three types of collaborative actions [$F(1.57, 54.85) = 44.08, p < .001$]. Post hoc test revealed that the percentage of developing ideas was significantly lower than those of the other two skills, and the percentage of presenting ideas was also lower than that of challenging ideas. In phase 3, there was no significant.

The relationship between collaborative actions and SMM similarity

It was revealed that SMM similarity differed significantly across the five dimensions [$F(2.11, 23.16) = 5.32, p = .012$]. The value of SMM similarity of dimension 2 was significantly higher than that of dimension 4, suggesting that teams reached greater consensus in the dimension of team dynamics than in the dimension of team skills. Correlation test suggested that the more frequently the team members with different expertise challenged each other's ideas, the more consistent understandings the team members formed. In contrast, the more frequently the team members developed ideas, the less likely the team members to form common perception in dimension 5.

Discussion

The findings of this study have several implications. First, attitude change for teachers is not an easy process. They may need more opportunities to examine the effectiveness of their design for improving the attitude. Second, promoting teachers' collaborative actions of challenging ideas may lead to a greater team consensus. Therefore, researchers or teacher instructors could encourage teachers in design teams to question or challenge team members' ideas to facilitate the process of forming consensus. Finally, developing ideas was found to be negatively correlated with team consensus, which suggest that more guidance is needed to help improve the idea development and negotiation process among teachers with different expertise.

As this study is limited for its duration, it is suggested that future research conduct multiple assessments of SMM at different phases of collaborative process. It's also necessary to examine how the development of SMM are influenced by teachers' collaborative actions.

References

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