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Source	<i>Proceedings of the 24th Global Chinese Conference on Computers in Education (GCCCE 2020)</i> (pp. 720-724)
Organised by	Global Chinese Society for Computers in Education (GCSCE)

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# Scripting peer-rating for collaborative knowledge improvement – A study on pre-service teachers’ collaborative lesson design

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**Abstract:** *This paper examines the effect of a scripted peer-rating procedure for collaborative knowledge improvement in a computer-supported collaborative learning (CSCL) environment. The context of the study was in pre-service teacher education. Participants underwent two rounds of computer-supported collaborative lesson design (CSCLD) guided by the five-phase Spiral Model of Collaborative Knowledge Improvement (SMCKI) script. The intergroup peer-rating phase (phase 3 of SMCKI) provided opportunities for participants to view and critique lesson ideas of other design groups. To ensure the quality of peer-rating, the rating procedure was micro-scripted so that the issues of social loafing, the bias in opinion, and avoiding criticism in the attempts to maintain harmony in the Asian culture norm can be averted. The findings show that the micro-scripted intergroup peer-rating bring forth quality feedback. Results also reveal that the feedback helped develop the pre-service teachers’ TPACK competencies in Technology-Enhanced Learning (TEL) design, indicating that micro-scripted peer-rating was effective in supporting collaborative knowledge improvement.*

**Keywords:** Peer-rating, Collaborative knowledge improvement, Micro script, Pre-service teacher education

## 1. Introduction

Peer-rating is a pedagogical method and a form of collaborative learning where students learn through assessing and rating each other’s work (Miao & Koper, 2007; Wadhwa, 2003). Past research has shown that this method helps develop critical thinking, improve communication skills (Miao & Koper, 2007), enhance a sense of judgment, objectivity, develop autonomous thinking and metacognition (Divaharan & Atputhasamy, 2009), and raise the confidence level and understanding of the subject matter involved (Akanmu, 2016). It also gives impetus to every member of the group to participate and prevents free riders (Divaharan & Atputhasamy, 2009). During the peer-rating process, quality feedback needs to be appropriate to the task’s specificity that subsequently improves learning (Gielen, Peeters, Dochy, Onghena et al., 2010). Such feedback includes justifications, suggestions for improvement and thought-provoking questions (Gielen et al., 2010) can bring about collaborative knowledge improvement (Ng, Looi, Chen, 2008; Chen, Wen, Looi, & Ooi, 2011; Wen, Looi & Chen, 2011). As a result, the tension to provide constructive feedback yet maintaining harmonious can be challenging.

Past research studies on computer-supported collaborative learning (CSCL) have claimed that CSCL scripts can mediate communications and resolve the above-mentioned tension (Bouyias & Demetriadis, 2012). Scripts aim to “structure the collaborative learning process by constraining interactions, defining a sequence of activities and specifying individual roles” (Dillenbourg & Jermann, 2007, p. 275). Leveraging on the five-phase Spiral Model of Collaborative Knowledge Improvement (SMCKI) (Chen, Zhang, Wen, Looi & Yeo, 2019) collaborative script, the SMCKI intergroup peer-rating phase 3 was micro-scripted to unleash the potential cognitive and metacognitive benefits of peer-rating had on collaborative knowledge improvement. The research questions of the study are: 1) How does the

script help with the intergroup peer-rating? 2) How does the scripted intergroup peer-rating help to promote social-metacognition? 3) How does the intergroup peer-rating enhance collaborative knowledge improvement in the collaborative lesson design?

## 2. Literature Review

In this study, the collaborative learning process was supported via the five-phase SMCKI (Chen et al., 2019). To overcome the challenges faced in the collaborative learning environment, scripts act as instructional prompts that help participants use the affordances offered in new learning spaces (Kollar et al., 2014). The five-phase SMCKI commenced with phase 1 individual ideation which encourages diverse ideas creation. Phase 2 intra-group synergy taps on this idea diversity to seek synergy of ideas. Phase 3 intergroup peer-rating brings collaborative knowledge improvement to the class level, where participants contribute to other groups’ idea by giving constructive feedback (Chen et al., 2019). SMCKI completes with a phase 4 intra-group idea refinement and a final individual achievement phase 5.

The focus of this study is on peer-rating phase 3. Frith (2012) claimed that students’ metacognition can be enhanced via social interactions. Past studies of social metacognition suggest that agreements, disagreements, and correct evaluations during interactions can influence subsequent discussions and increases correct new ideas (Chen, Chiu & Wang, 2012). Micro-scripting the peer-rating phase can enhance and develop individual and shared cognition critically (Järvelä, Kirschner, Hadwin, Järvenoja et al., 2016). Hence, the quality improvement of lesson ideas through the phase 3 feedback uptake which resulted with phase 4 lesson idea refinement would be examined to better understand collaborative knowledge improvement that arises from scripted peer-rating.

## 3. Methodology

A quasi-experimental time-series design was applied in this study. The participants were 20 female pre-service Chinese language teachers enlisted in a one-year Postgraduate Diploma in Education (PGDE) programme from the National Institute of Education, Nanyang Technological University Singapore (NIE, NTU). They were enrolled in a course titled “The use of ICT in Character and Citizenship Education and Chinese Language Learning”. The lecturer, who is the first author of the paper, has three years of experience in teaching pre-service teachers in designing TEL for teaching and learning the Chinese language. Time series analysis was used to analyze the lesson design artefacts.

### 3.1. Lesson Design and Implementation

The participants were grouped into 5 small groups of 4 members each. Group composites were decided by the students themselves as self-selected groups may simulate “real-world” workgroups more closely and yield better group dynamics and collaborative work results (Chapman, Meuter, Toy & Wright, 2006). The course was carried out from August to October 2019. Participants were tasked to collaboratively design TEL for Chinese language teaching and learning based on primary schools curriculum in Singapore. Before the course, participants were taught content knowledge of their subject mastery. Before the collaborative lesson design (CLD), each group selected one text within the primary school syllabus of the Singapore national curriculum for the Chinese language for their CLD task. Participants underwent two rounds of CLDs. SMCKI Phase 1 to 4 were conducted for both CLDs, which was a 1.5 hours face-to-face class session. After the second CLD, a Phase 5 individual achievement task of a lesson plan was completed out-of-class. Table 1 shows the scripted SMCKI Phase 3:

Table 1. Scripted SMCKI Phase 3 intergroup peer-rating.

Social Metacognitive Rules	Cognitive & Metacognitive Guide (Design Theory/principles)
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- No personal emotive appeal
  - Each member adopts 1 or 2 design theory/principle
  - Opinions include: Agree, disagree must be elaborated objectively with design theories/principles
  - Suggestions must be associated with TPACK
- TPACK
  - Self-Directed Learning
  - Assessment for Learning
  - Blooms Taxonomy
  - Student-centred learning environment principles
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#### 4. Data Analysis and Results

The generated artefacts during the two CLD sessions were coded by the first author using the two coding schemes. The first coding scheme, TPACK coding scheme (adapted from Oner, 2019; Zhang, Liu & Cai, 2019) was developed to analyze the quality of the lesson design artefacts from phase 2, 4 and 5. The second coding scheme, Peer-rating coding scheme was derived by adopting the explanatory variables of the statistical discourse analysis (SDA) suggested by Chiu (2013). Additionally, this peer-rating coding scheme incorporated the concept of cognition (opinions, anecdotes, elaborations) and social metacognition, in the form of questions and different opinions to analyze the cognitive and social metacognitive aspects of each rating comment given to each group during phase 3 peer-rating.

To answer the first two research questions, the total number of comments generated from phase 3 over the two rounds of CLDs were counted. There is an increase in the number of quality comments from CLD1 to CLD2 (CLD1  $M = 3.0$ ,  $SD = 3.8$ ; CLD2  $M = 3.6$ ,  $SD = 2.9$ ). This result suggests that participants were able to abide by the role distribution script to prevent social loafing. Figure 1 shows an increasing trend for cognitive and social metacognitive feedback over the two CLDs. Figures 2 and 3 show a further breakdown of the classification of comments into the cognitive and social metacognitive domains of the TPACK framework. There is an increasing trend for both domains from CLD1 to CLD2. This result suggests that participants engaged in the design theories/principles within the script to provide constructive feedback. The significant increase for the social metacognitive domain suggests that social metacognitive can be improved over time. Figure 4 shows the distribution of comments across the seven TPACK dimensions. There is a significant improvement of constructive feedback over the seven TPACK dimensions over time, except for technology. This trend demonstrates that the participants were able to consider a more balanced TPACK application during TEL design instead of just concentrating on technological tools as the means to TEL. The surge with the “Learning theory at the cognitive domain” for CLD2 suggests the participants’ competency improvement in this aspect, which subscribed to the design theories/principles within the script. Based on these results, the first and second research questions were answered.

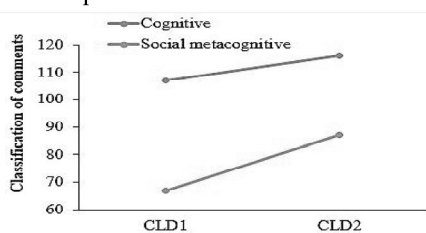


Figure 1. Cognitive and Social metacognitive feedback over the two CLD.

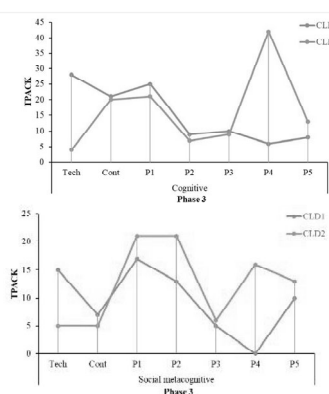


Figure 3. Phase 3 TPACK (Cognitive)

Figure 2. Phase 3 TPACK (Social Metacognitive)

Note: T=Technology; C=Content; P1=Teaching strategies; P2=Assessment; P3=Learning Outcomes; P4=Learning Theory; P5:Learners

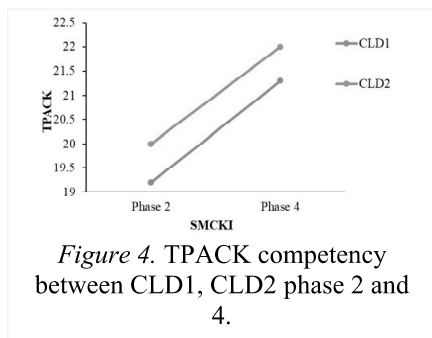


Figure 4. TPACK competency between CLD1, CLD2 phase 2 and 4.

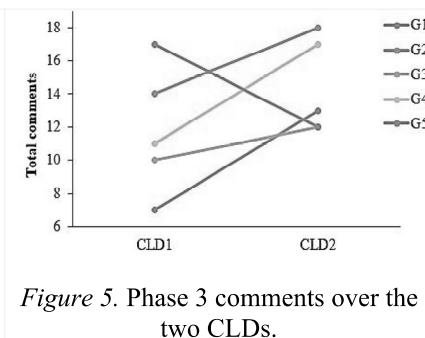


Figure 5. Phase 3 comments over the two CLDs.

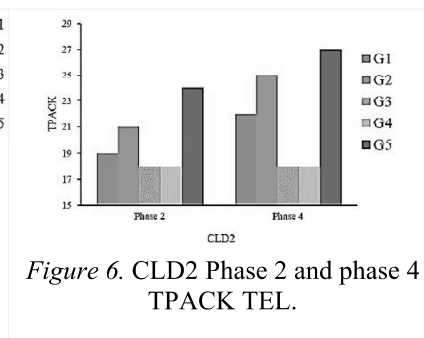


Figure 6. CLD2 Phase 2 and phase 4 TPACK TEL.

To answer the third research question, we examine the quality of lesson design between phase 2 and 4 for both CLDs. Figure 4 and 6 report a significant improvement with the TEL design across phase 2 and 4 for both CLDs. The improvement in the TPACK scale further suggests that intergroup peer-rating did enhance collaborative knowledge improvement in the collaborative lesson design. Figure 5 shows two different trends, with the highest increment of 46% for G1 and a decline in comments for G5. Further analysis was conducted to examine how peer feedback affects lesson design quality. Of the number of comments for G1 in CLD2, 54% were coded within the social-metacognitive domain. 50% of the feedback was taken up. Table 2 shows the feedback given by G3, G4, and G5 and their uptake by G1.

Table 2. Improvement of lesson design in response to peer feedback (G1).

Social Metacognitive comments (Translated Chinese to English)	Improvement to lesson design at Phase 4 (G1)
How to achieve authentic learning? (G5 → G1) Bloom’s taxonomy: Did not achieve high cognition. Maybe let them create own scenario, describe an unforgettable day. (G3 → G1)	Students to relate to their daily activities, e.g., what time do what activity
How to ensure or support weaker students so that they can complete the different parts of the writing task? (G4 → G1)	Include differentiated instructions. Teacher to facilitate and guide weaker students.

The above findings concur with past studies which suggested that disagreements and correct evaluations can influence the direction of subsequent discussion and increases the likelihood of correct new ideas (Chen, Chiu & Wang, 2012). This result suggests that the intergroup peer-rating did enhance collaborative knowledge improvement in the collaborative lesson design.

## 5. Discussion and conclusion

The results from this study corroborate with past findings that peer-rating affects collaborative learning and collaborative knowledge improvement (Chen et al., 2019; Kollar & Fischer, 2010; Strijbos & Sluijsmans, 2010). The benefits of peer-ratings should be considered from the perspective of a rater and a receiver. From the viewpoint of a rater, he/she has to deep process the artefacts when he/she rate others’ artefacts. This increases the opportunities to be stimulated by the other party’s artefacts (Kohn, Paulus, & Choi, 2011). From the receiver’s viewpoint, he/she would recognizes areas for improvement when he/she receives the ratings from others (Chen et al., 2019). Taken together, peer-rating could widen students’ perspectives and facilitate their learning in collaborative settings.

To the best of our knowledge, scripting the process of peer-rating is an area less studied even though the challenges faced were well reported (Briñol & DeMarree, 2012; Divaharan & Atputhasamy, 2009). Prior research has attested that when pre-service teachers engage in peer-rating, they develop metacognitive skills to critique and evaluate their practice, as well as that of their peers (Lynch, McNamara & Seery, 2012). Therefore, scripting the peer-rating process in the context of collaborative lesson design in pre-service teacher education is a focus area worthy for future research (Van Zundert et al., 2010). We propose future studies to be conducted with a control group with unscripted intergroup peer-rating to compare the experimental and control groups to find out the impact of scripting. Future research with a larger sample size can also help to generalize the findings to a wider context.

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