The Effects of Online Peer Feedback Supported by Argumentation Instruction With Worked Example and Argumentative Scripts on Students' Learning Outcomes

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Abstract: This study investigates the effects of online peer feedback supported by argumentation instruction with worked example and Argumentative scripts on students' argumentative essay writing, argumentative feedback quality and domain-specific knowledge acquisition in the field of educational sciences. Participants were 52 students who were randomly divided over 26 dyads and randomly assigned to three conditions (unscripted peer feedback, Instruction with worked example, scripted peer feedback). To do so, an online peer feedback system was designed and developed. They were then asked to write and argumentative essay (individually), to engage in argumentative peer feedback with their learning partner (collaboratively), and finally to revise their essays based on feedback which received (individually). The findings indicate that the online peer feedback supported by argumentative scripts outperformed other two conditions in terms of argumentative essay writing, argumentative feedback quality and students' learning. Implications, limitations and suggestions for future research are discussed.

Introduction

Online peer feedback is one of the promising educational strategies to improve student's learning outcomes. For example, researchers have shown that peer feedback can improve students' writing quality (Huisman et al., 2018; Gielen & De Wever, 2012, 2015; Noroozi & Hatami, 2018; Noroozi et al., 2016; Valero Haro et al., 2018), students' feedback quality (Gielen & De Wever, 2015; Noroozi et al., 2016), domain-specific knowledge gain (Noroozi & Mulder, 2017; Valero Haro et al., 2018), and students' attitudes toward the subject at hand (Noroozi & Mulder, 2017). Although, these studies have confirmed the effectiveness of online peer feedback, there are some main criticisms on the way in which the peer feedback is implemented. For example, there are concerns about the quality of peer feedback because of students' limited knowledge, experience and language ability (Saito & Fujita, 2004). Also, there are emotional and psychological issues with giving and receiving critical feedback (Andriessen, 2006), such as perceiving critiques and counterarguments as personal attacks (Rourke & Kanuka, 2007). Therefore, peer feedback should be supported in the online environments to fully guarantee its effectiveness (Noroozi et al., 2016). Different instructional approaches have been proposed to support online peer feedback. These approaches include sentence starters, open text-boxes, assigning and rotating roles, peer interactions, input text fields and question prompts including procedural, elaboration and reflection prompts (Noroozi et al., 2012). All of these approaches fall under the name "scripting". Although, studies have shown the effectiveness of scripting approaches on improving students' academic writing, some researchers point out that this approach can be challenging. For example, overly detailed scripts or "over-scripting" can impose cognitive load (Dillenbourg, 2002) and impede learning (see Noroozi et al., 2013). To cope with this challenge, researchers have proposed to use instructional strategies to reduce cognitive load such as instruction with worked example (see Clark & Mayer, 2016). Valero Haro et al. (2018) showed the effectiveness of worked example on improving students' argumentative essay writing quality. This study therefore compares the impacts of online peer feedback supported by argumentation instruction with worked examples and argumentative scripts on students' learning outcomes such as students' argumentative essay writing, argumentative feedback quality and domain-specific knowledge acquisition in the field of educational sciences. This overall research focus was divided into three research questions:

1. What are the effects of an online peer feedback supported by argumentation instruction with worked example and argumentative scripts on students' argumentative essays quality?
2. What are the effects of an online peer feedback supported by argumentation instruction with worked example and argumentative scripts on students' argumentative feedback quality?
3. What are the effects of an online peer feedback supported by argumentation instruction with worked example and argumentative scripts on students' domain-specific knowledge acquisition?

Methods

The study took place at Kharazmi University, Tehran, Iran. The participants were 52 BSc students who enrolled for the course "Applying Computer in Educational Sciences", and were randomly divided over 26 dyads and were assigned to unscripted (9 dyads), instruction with worked example (9 dyads) and scripted (8 dyads) conditions. Students in the unscripted condition were regarded as a control group without any support during the online peer feedback. Students in the instruction with worked condition received instruction on "how to provide an argumentative peer feedback". Then, they were provided with a worked example. Students in the scripted condition were supported by argumentative scripts in the form of a question prompts during their online peer feedback. The mean age of the students were 20.21 (SD = 1.51) years. All participants were female. The topic for discussion was Mobile Learning. Students were asked to write an argumentative essay on the following statement: "The use of mobile phones and tablets in the classroom should be banned". They were provided with the description of the case, summary of the theoretical text regarding the topic and sets of links to article and webpages. They were provided with some additional links to websites to further study the concept of the "M-Learning". The students were asked to take into account the various perspectives on the use – or lack thereof – of using "Mobile Learning (such as, Tablets and Smartphones) in classroom". Then, the students engaged in argumentative peer feedback, and finally they revised their essays based on feedback which received. A self-made online learning environment (EduTech) was designed and used in this study. This online learning environment had a series of steps (see Figure 1).

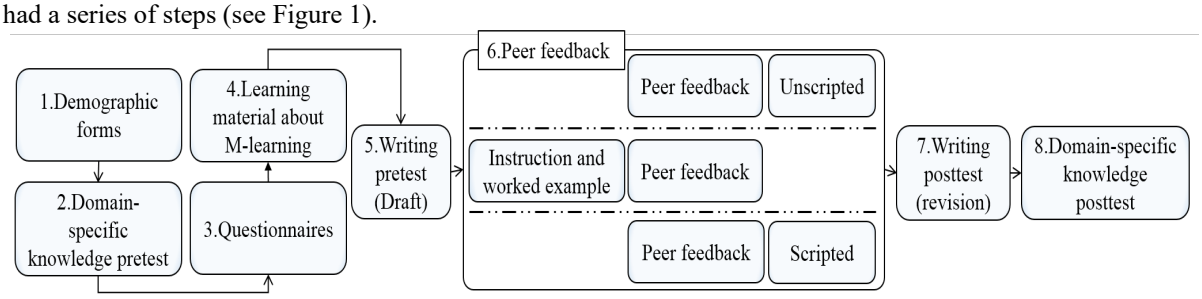

Figure 1. The steps that students should take in EduTech

All these steps had to be completed individually except for the peer feedback step (all steps were completed by student in double anonymous format). EduTech not only helped with regard to managing and monitoring students' learning activities, but also it provided us with data gathering. EduTech provided students with various forms of information presentation, such as texts, exercises, graphs, diagrams, and pictures with the feedback features to stimulate interactions between members of a group in an active learning environment by getting them thinking together about topics, media or material that is relevant to them. The feedback features in EduTech (for scripted condition) was designed in such a way as to guide the interaction style for both synchronous and asynchronous interactions – promoting reasoning, critical discussion, and justified arguments. The structure of the guided peer feedback (i.e., argumentative peer feedback scripts) was designed on the basis of argumentation literature (Toulmin, 1958; Andrews, 2010; Noroozi et al., 2016; Wingate, 2012; Schneer, 2014) and a high-quality argumentative essay in the field of Educational Sciences; because, various disciplines have different features of structure, discipline's value, epistemology, and argumentation (Andrews, 2010; Wingate, 2012). Therefore, specific requirements of the essay and presentation of the arguments in the essays should be taught to students in a given discipline by disciplinary experts (Wingate, 2012). To do so, a series of meetings were held with the experts of the field (three professors in the field of Educational Sciences and first author of this article) to define the elements of a high-quality argumentative essay for students in the field of Educational Sciences. These meetings resulted in a list of items that should be included in argumentative essays of students. The panel of experts concluded that a high-quality argumentative essay in the field of Educational Sciences should include: the expression of a clear position on the topic at hand, expressing the context of topic (introduction), the arguments and evidences (examples, facts, Expert opinion etc.) for and against the topic, integration of various pros and cons, and the final conclusion on the first position. We then designed our argumentative peer feedback script as well as Instruction with worked example on the basis of these items and embedded them in EduTech.

Overall, implementation of the study took about 5:30 hours and consisted of five main phases (each phase in one session in five consecutive weeks). 1) During the introduction and pretest phase, students received introductory textual and verbal explanations in the online learning environment and completed several questionnaires on demographic variables, and their domain-specific knowledge (about 30 minutes). 2) In the study and draft phase, students were asked to read theoretical text and articles on the topic at hand (M-learning), to search the Internet based on keywords that were bolded in the theoretical text (40 minutes), and to write an

argumentative essay on the following statement: "The use of mobile phones and tablets (Mobile Devices) in the classroom should be banned" (80 minutes). 3) In the peer feedback phase, each student were asked to read the draft argumentative essay of her learning partner and provide feedback on them (50 minutes). 4) During the revision phase, students were asked to read the comments of their learning partners and then revise their draft argumentative essay (60 minutes). 5) Finally, in the posttest phase, students were asked to fill out several questionnaires to assess their domain-specific knowledge on the topic at hand (15 minutes).

Measurements

The quality of student's written argumentative essays (in the draft and the revision phases), was measured using the coding scheme developed by the authors. The scheme considers the features of a high-quality argumentative essay in the field of Educational Sciences and was developed in conformity with the literature (Toulmin, 1958; Andrews, 2010; Noroozi et al., 2016; Wingate, 2012; Schneer, 2014). The scheme included eight components. A single score was assigned for each of these component. Each student was given no point for each level 1 assessment (e.g. not mentioned), one point for each level 2 assessment (e.g. non-elaborated), and two points for each level 3 assessment (e.g. elaborated). Thus, for each component, students could get a score of between zero and two. Subsequently, all points assigned to each student were added together and served as the final score for students' written argumentative essay quality. Two trained coders coded 10% of the data to evaluate reliability index of inter-rater agreement. This resulted in identical scores in 80% of draft and 82% of the revision phases. The same coding scheme was adjusted to assess the quality of students' feedback quality. Two trained coders coded 10% of the data resulted in identical scores in 83% of the data. The pre- and post-test questionnaire, which was completed by students before draft phase and after revision phase consisted out of 10 multiple-choice questions to measure students' domain-specific knowledge. For these questionnaire, students needed to choose one answer out of four options. Each correct answer was given one point and as a result each student could receive 10 points at maximum for both pre- and post-test.

Findings and discussions

Repeated measures ANOVA test showed that the written argumentative essays quality of students in all conditions improved significantly from the draft phase to the revision phase, $F(1, 49) = 70.28$, $p < .001$, $\eta 2 = .58$. Also, there was a significant difference between the conditions in terms of argumentative essay quality, $F(1, 49) = 40.82$, $p < .001$, $\eta 2 = .62$. The post hoc Tukey HSD test showed that the mean score for the scripted condition was significantly higher than unscripted condition, $p < .001$. In addition, this test showed that the mean score for the instruction with worked example condition was significantly higher than unscripted condition, $p < .001$. Also, students in the scripted condition scored higher than students in the instruction with worked example condition in terms of argumentative essays quality, $p < .001$. This is in line with previous studies that emphasize the positive effects of scripts on quality of students' written argumentative essays (Huisman et al., 2018; Gielen & De Wever, 2012, 2015; Noroozi et al., 2016). Giving and receiving a high-quality feedback allow students to consider these features during the revision phase. Students in the scripted condition outperformed students in the Instruction with worked example condition in terms of argumentative essay quality. The reason may be that, although students in Instruction with worked example learned how to write argumentative essay, they were not prompted in the feedback phase to provide a high-quality feedback. This matter should be considered in future research on the use of scripts; i.e. when scripts and Instruction with worked example are used in combination.

One-way ANOVA showed a significant difference between various conditions in terms of argumentative feedback quality, $F = 31.77$, $p < .001$. The post hoc Tukey HSD test revealed that the mean score for the scripted condition was significantly higher than unscripted condition, $p < .001$. In addition, the mean score for the instruction with worked example condition was significantly higher than unscripted condition, $p < .001$. Also, students in the scripted condition scored higher than students in the instruction with worked example condition in terms of argumentative feedback quality, $p < .001$. This is in line with previous studies that emphasize the positive effects of scripts on quality of students' argumentative feedback (Gielen & De Wever, 2015; Noroozi et al., 2016). Peer feedback scripts provided students with criteria that help them to assess partners' essays clearly. Therefore, using these scripts, students assess their peers' essays based on predesigned criteria, not on their personal perspective. Also, EduTech was designed in such a way that the assessee and assessor were double anonymous. Bostock (2000) proposed two ways for increasing the validity and reliability of peer feedback: the use of clear criteria for assessment, and double anonymity of assessors and assessees.

Repeated measures ANOVA test showed that the domain-specific knowledge of students in all conditions improved significantly from the pretest to the posttest, $F(1, 49) = 87.70$, $p < .001$, $\eta 2 = .64$. Also, there was a significant difference between the conditions in terms of the domain-specific knowledge, $F(1, 49) = 4.43$, $p < .001$, $\eta 2 = .15$. The post hoc Tukey HSD test revealed that the mean score for the scripted condition was

significantly higher than unscripted condition, $p < .001$. In addition, the mean score for the instruction with worked example condition was significantly higher than unscripted condition. However, there was no significant difference between the scripted and the instruction with worked example condition, $p < .62$. This is in line with previous studies that emphasize the positive effects of scripts on quality of students' domain-specific knowledge (Noroozi & Mulder, 2017; Valero Haro et al., 2018). The peer feedback scripts in this study allow students to engage in higher cognitive processing (such as, argumentation, evaluation, criticism, justification, clarification, elaboration and analysing); as a result, students process learning material in deep manner.

Conclusions and implications

This study investigated the effects of online peer feedback supported by argumentation instruction with worked examples and argumentative scripts on students' learning outcomes such as students' argumentative essay writing, argumentative feedback quality and domain-specific knowledge acquisition in the field of educational sciences. The online learning environment designed for this study led students to improve their domain specific knowledge about the subject at hand. Also, peer feedback script allowed students to elaborate learning material included in EduTech and process them in a higher level. The peer feedback script provided students with high-quality feedback on partners' essays by clarifying criteria of assessment and features of a high-quality feedback. Students in the instruction with worked example condition outperformed students in the unscripted condition in terms of quality of feedback and argumentative essay writing. However, they were not as successful as the scripted condition. Therefore, this matter should be considered in future research on the use of scripts; i.e. when scripts and instruction with worked example are used together in combination.

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