Examining the influence of online reflection mode (Individual vs. Collaborative) on deep learning of pre-service female teachers about Technological and Pedagogical Knowledge

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Abstract

*E*xamining the influence of individual and collaborative online reflection on female pre-service teachers' knowledge about pedagogical and technological knowledge is promising. Deciding which mode of reflection is significant can lead to design effective online activities for female pre-service teachers. This research examined the influence of individual and collaborative online reflection on pre-service teachers' knowledge about pedagogical and technological knowledge. The experiment includedtwo groups with pre-post test to decide the effect of online reflection mode on deep learning about pedagogical and technological knowledge of pre-service teacher. Data were analyzed by using t-test since numbers of groups are two and number of variables is one. T-test can be used to complete the comparison process. Finally, results were reported and discussed in the light of the context of the research and the previous literature about online reflection.

Keywords: Pre-service teacher, Teacher education, TPACK development, Online reflection, Individual work, Group Work

1.Introduction

Preparing pre-service teacher to use instructional technology is vital for the effective integration in the learning process. Preparation may include the development of pre-service knowledge about technology, pedagogy or content. In the general program of pre-service teachers' preparation, it is required to focus on the pedagogy and technology knowledge since the backgrounds of the learners are different (science, art...etc). Technology and Pedagogy knowledge (TPK) model can be used in these general programs of pre-service teachers' preparation.

TPK is a sub domain of Technological, Pedagogical and Content Knowledge TPACK model (Mishra & Koehler, 2006). The main elements of this model are technological knowledge TK that can be defined as "the knowledge about standard technologies, such as books, chalk and blackboard, and more advanced technologies, such as the Internet and digital video" (Mishra & Koehler, 2006, p. 1027), pedagogical knowledge PK that can be defined as "the deep knowledge about the processes and practices or methods of teaching and learning and how it encompasses, among other things, overall educational purposes, values, and aims" (Mishra & Koehler, 2006, p. 1026), and content knowledge CK that can be defined as " the knowledge about the actual subject matter that is to be learned or taught". In this research, technological and pedagogical knowledge is including "the existence, components, and capabilities of various technologies as they are used in teaching and learning settings, and conversely, knowing how teaching might change as the result of using particular technologies" (Mishra & Koehler, 2006, p. 1028). Using such model is effective in general preparation programs for teachers.

Learning activities are the real transformer of knowledge to pre-service teacher. Types of learning activities may include reflection about the content being taught, practice of teaching and the daily experiences in schools(Shulman, 1987) .The efficacy of reflective practice in helping prepare highly qualified teacher candidates has long been recognized (Bullough Jr, 1989; Ertmer, 2003; Gore, 1991; Shulman, 1987; Yost, Sentner, & Forlenza-Bailey, 2000; Zeichner & Liston, 1987). Dewey (1993) defined reflection as an "active, persistent, and careful consideration of any belief or supposed form of knowledge in light of the grounds that support it and the further conclusions to which it tends" (p. 118). In pre-service teacher preparation, reflection is a critical part (Tochon, 1999).

Improving reflective writing of pre-service teachers is vital for deep learning. According to (Posner, 2005)Surface knowledge can mainly be achieved if experience has no reflection; Thus, it is

the experience combined with reflection, which leads to deep learning. Also, collaboration between learners has the potential to improve reflective writing (Dewey, 1993; Ramsden, 1992).

Transfer the activity of the reflection to be online can yield various benefit such as flexibility and shareability of reflection among pre-service teacher. When using such techniques, Students may ask to have the choice to decide either to work individually or in groups for online reflection activities (Personal experience). So far, a little is known about the influence of individual and collaborative online reflection on pre-service teachers' knowledge about instructional technology. Thus, deciding which mode of online reflection activities is more effective can increase the quality of instructional technology preparation programs.

Purpose and Research Objectives

The purpose of this research is to examine the influence of online reflection mode (individual vs. collaborative) on learners' deep learning about TPK. Thus, in the current research, two objectives are defined:

1. Designing a standardized test that measures deep learning of the instructional content.
2. Examining the influence of online reflection mode (individual or collaborative) on female pre-service teachers' deep learning about TPK.

2.Research hypothesis and Variables

The independent variables are online reflection and task type (Individual, collaborative) while the dependent variables are learners' technological and pedagogical deep learning. The hypothesis of this research is none directional as follows:

1. **Null hypothesis**: no significance difference between group 1 (G1) that used individual reflection and group 2 (G2) that used collaborative reflection at 0.5 level
2. **Alternative hypothesis**: there is a significance difference between G1 that used individual reflection and (G2) that used collaborative reflection at 0.5 level

3.Literature Review

Reflection is the process by which learners can examine their thought in the light of the given information in order to get better understanding for the information being taught. Boud, Keogh, & Walker (1985) defines reflection as 'those intellectual and affective activities in which individuals engage to explore their experiences in order to lead to new understandings and appreciations.'(p. 19). Shulman's Model of Pedagogical Reasoning and Action (1987) considered reflection as a critical aspects in his model. Reviewing, reconstructing, re-enacting and critically analyzing one's own and the class's performance, and grounding explanations in evidence are a reflection process that should happen by teachers.

Learners reflections can be categorized into nine different types in relation to the activity, time and style of writing as summarized in table 1.

Table 1: Types of Reflection

(Schön, 1983)	**Reflection on action**
	Reflection in action
	Reflection for action
(Von Wright, 1992)	**Retrospective Reflection**
	Contemporaneous Reflection
	Anticipatory Reflection
(Hatton & Smith, 1995)	**Descriptive Reflection**
	Dialogic Reflection
	Critical Reflection

During the preparation for pre-service teachers to integrate technology effectively, critical reflection is required to deepen learners' knowledge about learning (Moon, 2004). In deep learning, the process of reflection can take place collaboratively or individually. For collaborative reflection, a group of students exchange and interact with each other to achieve better understanding by working together (Kemmis, 1985; Knights, 1985; Von Wright, 1992). On another hand, individual reflection is a self-reflection process with the given content to get better interaction during the learning process (Black, Sileo, & Prater, 2000; Costa & Kallick, 2000). Limited researches have studied which mode (collaborative or individual) is more effective. Thus,

in this research we are trying examine the influence of reflection's mode on pre-service teachers' TPK deep learning.

4.Research Procedure

This research was conducted at Taif University in Saudi Arabia. In order for the graduates to be assigned as teachers, they are required to complete a high diploma in education. This diploma lasts for two semesters including both theoretical learning and practical training for the students. Two courses are offered related to the use of computer in education: Educational Technology course and Educational Application of Computer course. The name of the course at which this research was conducted is Educational Technology. At the beginning of the semester, the researcher provides students with a syllabus describing objectives of the course, content, tasks required, deadlines and the course references.

This course is one of many other courses that are required to be completed by Pre-service teacher during their preparation program. The main objective of this course is the exposure of the students to the process by which technology can be integrated effectively into the learning process. The content of the course consists of one main textbook and other references for further reading. The main textbook is named Educational Technology authored by Mandor Abd Alsalam and consists of six chapters. These chapters covers the following topics: The educational communication process, Concept of instructional technology, The process of selectingappropriate instructional technology, The concept of educational technology, Recent development in educational technology tools and Applications of Educational technology in the teaching process. These topics should be covered during 12 weeks and the pedagogy used during the course teachingis lecturing using PowerPoint slides and discussion.

Students were required to write three online reflection papers about the books chapters. After studying two chapters, they were required to submit a reflection paper in Learning

Management System LMS BlackBoard (BB). After the deadline, they were required to post their papers to the forum in BB.

Since students are not familiar to this type of papers, the researcher provides scaffolding supportto achieve better reflective writing (Lai & Calandra, 2007). Types of scaffolding may include soft scaffolding or hard scaffolding (Saye & Brush, 2002). These soft and hard scaffolding can be in a form of conceptual, metacognitive, procedural or strategic scaffold (Hannifin, Land, & Oliver, 1999). In this research hard and conceptual scaffolding were used to support learners' reflection process.

During the scaffolding process, learners were instructed to write reflective paper about each chapter of the textbook. The main steps of writing reflection were explained to them that include description, interpretation and outcome (Cleland & Ross, 2012). In order to increase learners understanding about reflective writing, a sample of reflection writing was provided by the lecturer as a model work.

5.Participants

The sample of this research is female pre-service teachers in two sections of high diploma in Education. They were auto randomly assigned by the university system into the sections. For the selection process, it was convenient sampling since the researcher teaches both sections. One of the sections was selected randomly to complete the task of online reflection individually while the other section would complete the online reflection collaboratively (G1 n=48, G2 n=48).

6.Data collection and Analysis

An instrument consists of 36 objective questions was designed to assess learners deep knowledge about TPK. The six chapters of the textbook were analyzed to identify the instructional objectives of each course. After that, six objective questions were designed related to deep learning in Bloom's taxonomy. Evaluation and knowledge level were not included in the elements designed since knowledge level is mostly related to

lower learning and evaluation elements was challenging since most of the textbook chapters were theoretical rather than practical.

Table 2: elements of the instrument

		No of questions	Evaluation	Deeper learning
		6	Synthesis	
		6	Analysis	
		12	Application	
		12	Understanding	
		0	Knowledge	Lower Learning
Total		36		

Validity test_for the instrument was conducted with two experts. Minor comments were given and considered during the final version of the instrument. The alpha Cronbach reliability test of pre-test is 0.76. According to George &Mallery (2001), when the results of reliability test range from .75 to .92, it is considered satisfactory to outstanding.

The data of the research was analyzed by using inferential statistics (T-test). Pre-test and post-test were used to examine the influence of online reflection mode on Pre-service teachers' knowledge of technology and pedagogy as shown in figure 1.

Figure(1) Research Design

Pre-test	Reliability & Homogeneity Test	G1: Individual Reflection	Post Test
		G2: Collaborative Reflection	
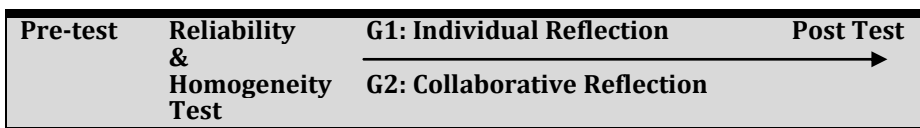
Results were analyzed by using Excel software to examine the influence of modes of reflection on participants' deep knowledge about TPK.

6.Findings and Discussions

6.1 Within Groups' Comparison

The results within groups who performed the task of refection individually and collaboratively show a potential impact of such activities on learners' deep learning. Table(3) shows in details a significance difference within G1 on learners' deep knowledge about TPK. Also, results of pre-post test for G2

show a potential significance difference in learners' deep learning about TPK as shows in table 3.

Table 3: G1 and G2 Pre-Post Test

Pre-post test within same group: Section (G1)			Pre-post test within same group: Section (G2)		
Sample Range (1 to 48):	Pre G1	Post G1	Sample Range (1 to 48):	Pre G2	post G2
Sample Mean:	16.7	21.5	Sample Mean:	16.0	18.7
Sample Std Dev:	3.0	7.1	Sample Std Dev:	2.7	7.7
Mean of Differences:	-4.7		Mean of Differences:	-2.6	
Std Dev of Differences:	7.0		Std Dev of Differences:	8.5	
t-Statistic (d.f. = 38):	-4.1		t-Statistic (d.f. = 47):	-2.1	
Critical Value(s):	± 2.0		Critical Value(s):	± 2.0	
Alpha:	0.05		Alpha:	0.05	
p-Value:	0.0002		p-Value:	0.0335	
Decision Rule: Reject the Null Hypothesis if |t-Statistic| > 2.0244 or p-Value < 0.05			Decision Rule: Reject the Null Hypothesis if |t-Statistic| > 2.0117 or p-Value < 0.05		
Conclusion: Reject the Null Hypothesis			Conclusion: Reject the Null Hypothesis		
95% CI for the Mean of differences: 4.72- ± 2.28 [7.00- to 2.43-]			95% CI for the Mean of Differences: 2.69- ± 2.47 [5.16- to 0.22-]		

6.2 Between Groups Comparison

The homogeneity between groups was verified as shown in Table4. This result between G1 and G2 of pre-test are reasonable since both groups are fresh graduate and mainly have not studied courses related to instructional technology. Similar homogeneity between the two groups is critical to make an accurate comparison when examining the effect of reflection mode on learners' knowledge. Also, Result of Pre-test between G1 and G2 shows no difference as shown in table 4.

Table 4: G1and G2 Homogeneity and Pre-Test comparison

Homogeneity Test		Pre test between groups: Section (G1,G2)		
			Pre G1	Pre G2
Null Hypothesis:	Var(Pre G1) = Var(Pre G2)	-	16.7	16.0
Alternative Hypothesis:	Var(Pre G1) ≠ Var(Pre G2)	Sample Mean:	16.7	16.0
Sample Variance (Pre 48):	9.01	Sample Std Dev:	3.0	2.7
Sample Variance (Pre 51):	7.55	Difference in Sample Means:	0.7	
F(38,47) Statistic:	1.19	t-Statistic (d.f. = 78):	1.1	
Lower Critical Value:	0.53	Critical Value(s):	± 1.9	
Upper Critical Value:	1.82	Alpha:	0.05	
Alpha:	0.05	p-Value:	0.2434	
Decision Rule: Reject the Null Hypothesis if F-Statistic < 0.5363 or F-Statistic > 1.8276		**Decision Rule: Reject the Null Hypothesis if |t-Statistic| > 1.9908 or p-Value < 0.05**		
Conclusion: Do Not Reject the Null Hypothesis		**Conclusion: Do Not Reject the Null Hypothesis**		
		95% CI for the Difference in Means: 0.73 ± 1.24 [0.51- to 1.97]		

Although G1 - individual online reflection- and G2 - collaborative online reflection- used different mode of reflections, results of Post-test between G1 and G2 show no difference as shown in table5. Both modes of reflection

(individual and collaborative) are effective for TPK development as shown in table 5. It seems inner reflection (individual) and outer reflection (collaborative) can yield similar knowledge about TPK. This result can be related to the nature of the adult learners who prefer to be independent and supported by others too (Knowles, 1973; Merriam, Caffarella, Wlodkowski, & Cranton, 2001). Thus, using a blend of both techniques for every instructional activity related to TPK development is advisable to fulfill the preference of every student in the classroom.

Table 5: G1 and G2 Post- Test comparison

Post test between groups: Section (G1, G2)		
Hypothesis Test :	Difference in Population Means	
-	post G1	post G2
Sample Mean:	21.5	18.7
Sample Std Dev:	7.1	7.7
Difference in Sample Means:	2.7	
t-Statistic (d.f. = 83):	1.7	
Critical Value(s):	± 1.9	
Alpha:	0.05	
p-Value:	0.0877	
Decision Rule: Reject the Null Hypothesis if |t-Statistic| > 1.9890 or p-Value < 0.05		
Conclusion: Do Not Reject the Null Hypothesis		
95% CI for the Difference in Means: 2.76 ± 3.18 [0.42- to 5.94]		

7.Limitation and Conclusion

Since the context of this research is limited and one sub-model of TPACK is studied, there are some limitations should be considered about this research:

1. Participants in this research are female pre-service teachers. Results cannot be generalized to the population of all pre-service males and female teachers.
2. Both in-service male and females teachers are not related to the population of this research because the sample in this research is pre-service female teachers.

3. Knowledge that examined is technological and pedagogical knowledge, other sub models of TPACK models are required to be studied before generalizing the results of this research to other models of TPACK.

Teachers' preparation programs can provide more freedom to learners to decide which type of reflection they practice during the preparation of technology integration program. This type of freedom may increase learners' satisfaction about the course since individuals can decide according to their interest which type of reflection is more suitable for them.

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