In-service Science Teachers' Readiness of Integrating Augmented Reality

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Abstract

This paper investigates the readiness degree among in-service science teachers in Ma'an Governorate for integrating augmented reality in teaching according to Technological, Pedagogical and Content Knowledge TPACK framework and its domains. The study sample consisted of (60) in-service science teachers enrolled voluntary in the study. The researcher used descriptive statistics, ANCOVA and T-test. The data analyses revealed significant differences among teachers' readiness in a high degree. Paired sample t-test showed female teachers' readiness higher than male teachers at all of the TPACK the domains. Results of ANCOVA revealed that experience of teachers' readiness do not differ significantly. The study recommended the focus on integrating augmented reality within learning environments.

Keywords: augmented reality, TPACK, in-service science teachers, readiness, skills, teachers training, Jordan

1. Introduction

Technologies has hugely impacted and invaded all fields of life including education. Nowadays there are many obstacles, barriers, and challenges facing teachers in understanding the way of integrating and incorporating those technologies effectively in educational settings. Still adopting new technologies in education is hugely affected by teachers acceptance, readiness, and their ICT involvement in pre-\in-service teacher training to evoke their competencies into a proper level (Jwaifell, M., Abu-Omar, A., & Al-Tarawneh, M. 2018). Teachers need to possess more competencies to integrate ICT in learning and teaching environments. To assure ICT competencies, integration should emphasize pedagogy and content as scholars suggested the technological pedagogical content knowledge (TPACK) framework (Mishra & Koehler, 2006) to have a clear picture of how ICT related to curricula components.

Augmented Reality is one of multiple media integrated learning application Which offers a new bright light into the learning process and forces learners' to represent information and knowledge in a new and innovative way where it can enhance both teachers and learners motivation to provide a rich learning and teaching environment.

1.1 Augmented Reality

Augmented Reality (AR) comprises of three fundamental criteria for its application: a combination of real and virtual world, interactivity in real time environment and has to be registered in three dimensions form (Azuma, 1997). By this definition, AR is a variation of environment designed in a virtual aspect, or as commonly called Virtual Reality which immerses a user inside a synthetic environment. But the most distinguish techniques used is allowing the students to enrolled in rich virtual environment and seeing the real world at the same time.

1.1.1 Augmented Reality and Its Role in Learning

This dynamic complex environment allow students to think more about using technologies (Leinhard & Greeno, 1986; Spiro, Fletovich, Jacobson & Coulson, 1991) while teachers need to have more competencies to practice and design learning\teaching environment and situations based on those technologies and this diverse of components that motivates students to be more interactive.

The AR integrate what is real within a virtual world where they achieve cognitive, affective, and psychomotor objectives by interacting with virtual objects to be performed through real world tasks while using the computer as a tool to make those tasks or problems to be solved much easier to perform without having risks of injury, limited time, or more costs especially in learning science such as physics or engineering.

It cannot be denied that AR has been used in all fields starting with military to marketing. The earliest applications of AR were in gaming, medical, and engineering, but the most interesting applications were in educational situations to bridge the gap between real and virtual worlds and at the same time the learner will become part of this combination. The previous applications in education were projects that encourage children to learn about scientific processes (Rogers, Price, Randell, Stanton Fraser, Weal, & Fitzpatrick, 2005) and exploration of physical environment (Klopfer & Squire, 2008).

Researchers have explored those uses within a variety of disciplines such as the medical applications which have been examined by Liu, Jenkins, Sanderson, Fabian, & Russell (2010), while other researchers have focused their work on AR applications on mathematics and geometry through creating an AR system for facilitating learning and teaching situations between students and their teachers (Kaufmann & Dünser, 2007; Kaufmann & Schmalstieg, 2003). AR can be used in education in different ways. Yuen, Yaoyuneyong, and Johnson (2011) pointed to five significant educational applications of AR technology: AR books, AR gaming, discovery-based learning, objects modeling, and skills training.

Exploring students and teachers perceptions, using, or impact of AR on learners achievements are still in need beside the necessarily more research about the behavior of AR in teaching situations (Cabero & Barroso, 2016). For example Agbo-Egwa, Abah, and Abakpa (2018) examined the students' perceptions of tech-augmented learning in basic mathematics through a questionnaire to measure their perceptions, the results showed a high positive perceptions and the students expressed that they liked the tech-augmented activities. While Luckin & Fraser explored (300) participants for evaluating AR in schools and homes, their findings supported the claim that AR has the potential to promote learning and motivate children to engage with learning activities. Gopalan et al (2015) evaluated the (E-star application) to enhance science textbook using AR among secondary students, where they found that e-star application can be one of the potential solutions to motivate learners and to be a source for Malaysian students. Beside the work of Goplan, Zulkifli and Abu Baker (2016) in determining whether the intervention of the enhanced science textbook using AR contributes to the learning process of the students in science, the result they reached supported the relationship between engaging, enjoyment and fun. Presently, there is a study of using the mobile AR for physics experiments (Abubakar et al., 2018). Delello (2014) investigated pre-service teachers using science-based AR, where he concluded the potential of AR to positively impact classroom learning experiences.

1.1.2 Elements of Technological, Pedagogical, and Content Knowledge

Based on Shulman's construct of Technological, Pedagogical, and Content Knowledge (TPACK), which is a triad construct representing teacher knowledge for technology integration, or the knowledge intersections technology, pedagogy, and content as a core components (Mishra & Koehler, 2006), scholars investigated (TPACK) framework and analysed teachers' knowledge, readiness and perceptions in educational sciences (Cox & Graham, 2009; Niess et. al, 2009; Groth, Spickler, Bargner & Bardzell, 2009; Chi, Koh, Tsai, & Tan, 2011; White & Geer, 2013). TPACK consists of seven elements:

Content Knowledge (CK): Teachers' knowledge of the subject matter they teach to their students involving knowledge of epistemology levels (facts, concepts, roles, theories); Pedagogical Knowledge (PK): Teachers' knowledge of methodologies of teaching and learning; Technology Knowledge (TK): Knowledge of thinking about, and working with technology tools and resources; Pedagogical Content Knowledge (PCK): Transformation of the subject matter for teaching; Technological Content Knowledge (TCK): It is about how teachers' understanding of technology and their understanding of content influence one another; Technological Pedagogical Knowledge (TPK): The change of teaching and learning when particular technologies are used in particular ways, Technological Pedagogical Content Knowledge (TPCK): The meaningful and deeply skilled teaching with technology (Koehler & Mishra, 2009).

Researchers used TPACK to examine teachers' perceptions in science classrooms through questionnaire (Jang, 2010; Jang & Chen, 2010; Trautmann & MaKinster, 2010; khan, 2011; Hechter, 2012; Jang & Tsai, 2012; Lin et al., 2013) and the results indicated that teachers' perceptions are correlated positively with TPACKS domains.

The researchers examined a variety of technological tool to be integrated in teaching such as: whiteboards, mind-mapping tills, geospatial technology, and other using simulations programs. The concentration in this study is on AR as one of the e-learning tool, which are as the researcher knowledge there is a paucity in the literature that examined integrating AR in teaching science and understanding teachers' readiness for integrating AR in teaching in the Arab countries.

1.1.3 Rational of the Study and Research Questions

In this study, based on researchers' experiences in teaching hundreds of in-service teachers, graduated students (diploma, master and PhD), Science teachers still lack competencies to use technologies in their practice especially in the southern part of Jordan. The force of policy makers and technologies itself, reveal the need of such readiness to use technologies. There still is a shortage of research of science teachers readiness of using new technologies such as Augmented Realty, therefore this study was conducted under the claim that in-service science teachers in Ma'an Directorate have no prior knowledge about augmented reality thus their readiness in the use of this technology limited. Therefore, this study is aimed at determining Ma'an Directorate science teachers' readiness for integrating augmented reality, by answering the following questions:

1) What are the changes of readiness degree of in-service science teachers in Ma'an Directorate for integrating augmented reality in teaching according to TPACK framework and its domains?
2) Do male and female in-service science teachers in Ma'an Directorate differ in their readiness for integrating augmented reality in teaching according to TPACK framework and its domains?
3) Do years of experience of in-service science teachers in Ma'an Directorate have an effect on their readiness for integrating augmented reality in teaching according to TPACK framework and its domains?

2. Method

The study adopted a descriptive research design. The researcher conducted a survey using a measurement tool for collecting data on the readiness degree of Ma'an Directorate in-service science teachers for integrating augmented reality in teaching according to TPACK framework and its domains.

2.1 The Study Population and Sample

The sample of this study consisted of (60) in-service science teachers in Ma'an Governorate. All the participants enrolled voluntary in two hours presentation demonstrating augment reality and received a brochure explaining its role and how to use it. The questionnaires were gathered to be analyzed:

Table 1. The Study Population and Its Sample

Years of Experience	Gender		Total
	Male	Female	
1-5	14	13	27
6-10	12	11	23
More than 10	6	6	12
Totals	30	30	60

The researcher' main concern was to measure the readiness degree of Ma'an Governorate in-service teachers science teachers for integrating augment reality in teaching according to TPACK framework and its domains in order to understand the whole picture of their aptitudes and give recommendations to the administration of Ministry of Education in Jordan, and universities for better understanding when planning for teachers' training and pre-service training. All the teachers in the study have Bachelor's degree and none of them hold a diploma.

2.2 Ethics

The study as a whole was approved by the Directorates of Education for the Governorate of Ma'an, in addition it was approved by Al-Hussein Bin Talal University Research Ethics Committee at the Faculty of Education.

2.3 The Measurement Tool

The study developed and modified the TPACK framework used by (Almalaheem, 2016, Jwaifell, M., Abu-Omar, A., & Al-Tarawneh, M. 2018) as a measurement tool for measuring the readiness degree of the teachers. When analyzing the items content, it appeared to the researchers and the four referees that those items did not have any cultural biases and not commonly applicable to the teachers in Jordan or within Middle Eastern context. The Arabic version was validated by four referees of Al-Hussein Bin Talal University instructors who hold PhD degrees in Instructional Technology, Information Technology, Curriculum and Instruction and Statistics. The reliability of the questionnaire was calculated using Cronbach's Alpha Coefficient, as shown in Table 2:

Table 2. Reliability of TPACK Domains

Domain	N of items	Cronbach's Alpha	Pearson correlation
Technological Knowledge (TK)	10	0.947	0.927**
Content Knowledge (CK)	8	0.637	0.810**
Pedagogical Knowledge (PK)	11	0.918	0.282*
Pedagogical Content Knowledge (PCK)	5	0.616	0.853**
Technological Content Knowledge (TCK)	6	0.930	0.276*
Technological Pedagogical Knowledge (TPK)	11	0.962	0.925**
Technological Pedagogical Content Knowledge (TPCK)	7	0.863	0.874**
Total of Readiness	58	0.949	

** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed)

Measurement scale of the tool was transformed into five levels of readiness as shown in table 3:

Table 3. Scaling Readiness Levels

Strongly don't agree	Don't agree	Neutral	Agree	Strongly agree
1	2	3	4	5
1-1.80	1.81-2.60	2.61-3.40	3.41-4.20	4.21-5
Very weak readiness	Weak readiness	Medium readiness	High readiness	Very high readiness

2.4 The Research Design

To answer the study questions, teachers participated in a brief workshop and read a brochure illustrating augmented reality concept, design, webhosts and usage in teaching and learning situations regarding science. The brochure was distributed after measuring their readiness by (TPACK). Teachers were given three weeks to feel free to communicate with each other and use augment reality before applying the measurement tool (TPACK) for collecting data about their readiness for integrating augmented reality. The study procedures can be mapped as the following:

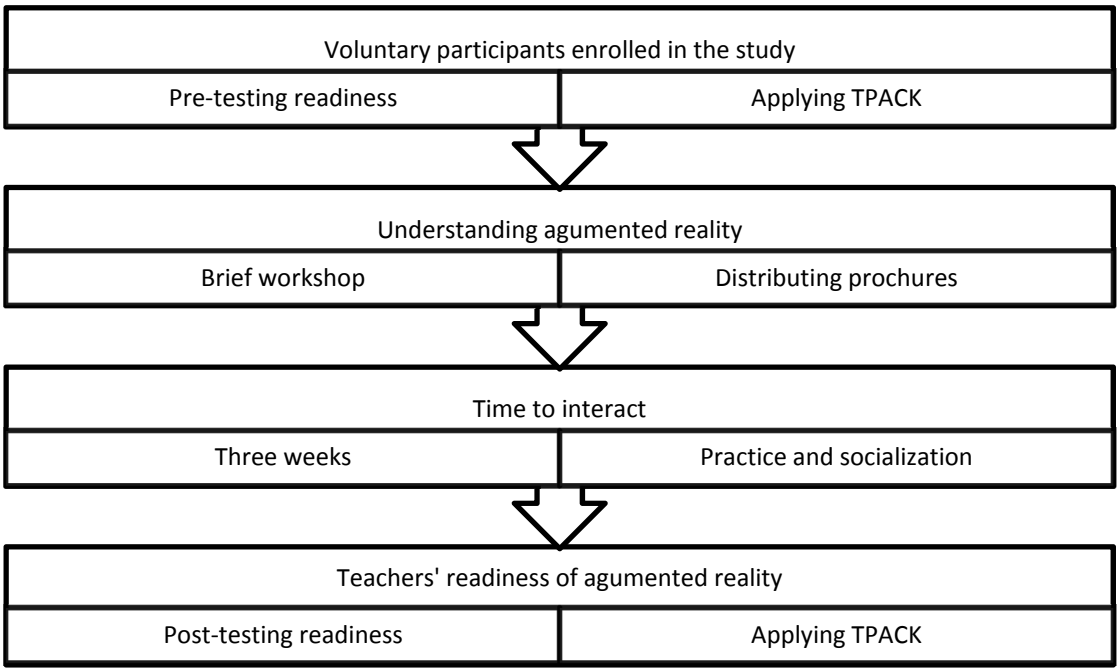

Figure 1. The Design of the Study

2.5 Data Analysis

The gathered ratio data classified and analyzed to answer the study question. Hence the classified variables have one, two or three levels; different types of statistical procedures were used: Paired sample (related means) t-test was used to answer the first question, while ANCOVA used for answering the second and third question.

3. Finding and Discussion

The Analyses of the resulting ratio data were performed using descriptive statistics. Descriptive measures including means and standard deviations for TPACK domains were calculated to answer the questions of the study. These descriptive statistical measures were also tabulated and reported for classifying the variables (gender and years of experience) to determine the teachers' readiness for integrating augmented reality according to TPACK framework as shown in Table 4:

Table 4. Results of Pre/Post Readiness

Domain	Gender	Pre-Readiness (M=Mean)								Post-Readiness (M=Mean)							
		Years of Experience						Total		Years of Experience						Total	
		1-5		6-10		>10				1-5		6-10		≥11			
		M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
TK	Male	2.54	.60	2.35	.41	2.35	.51	2.44	.52	3.58	.60	3.47	.52	3.42	.56	3.52	.55
	Female	2.45	.41	2.04	.41	2.15	.69	2.24	.50	4.34	.35	4.14	.28	4.00	.81	4.20	.46
Total		2.49	.51	2.19	.43	2.25	.59	2.34	.51	3.95	.62	3.82	.53	3.71	.72	3.86	.61
CK	Male	2.44	.47	2.34	.31	2.44	.50	2.40	.42	3.48	.43	3.48	.36	3.54	.50	3.49	.41
	Female	2.44	.23	2.18	.29	2.23	.35	2.30	.29	4.38	.27	4.25	.33	4.29	.38	4.32	.31
Total		2.44	.37	2.26	.30	2.33	.43	2.35	.36	3.92	.58	3.88	.52	3.92	.58	3.90	.55
PK	Male	2.25	.53	2.60	.58	2.45	.64	2.40	.57	3.38	.51	3.67	.59	3.53	.55	3.51	.54
	Female	2.43	.63	2.28	.47	2.82	.73	2.45	.61	1.14	.49	4.11	.28	4.38	.36	4.18	.40
Total		2.33	.58	2.43	.54	2.64	.68	2.43	.59	3.74	.62	3.90	.50	3.95	.63	3.84	.58
PCK	Male	2.49	.55	2.42	.38	2.43	.61	2.45	.50	3.52	.57	3.68	.57	3.46	.58	3.56	.56
	Female	2.45	.26	2.22	.34	2.27	.56	2.33	.37	4.40	.45	4.27	.44	4.13	.56	4.30	.47
Total		2.47	.43	2.31	3.67	2.35	.57	2.39	.44	3.94	.68	3.99	.58	3.79	.65	3.93	.63
TCK	Male	2.06	.44	2.05	.59	3.08	.98	2.26	.72	3.17	.41	3.23	.52	4.19	.85	3.39	.67
	Female	2.26	.41	2.35	.75	2.53	.63	2.34	.59	4.15	.47	4.23	.36	4.28	.23	4.21	.38
Total		2.15	.43	2.21	.68	2.81	.83	2.30	.66	3.64	.66	3.75	.67	4.24	.59	3.80	.68
TPK	Male	2.58	.62	2.39	.47	2.33	.52	2.47	.55	3.67	.61	3.52	.55	3.53	.55	3.60	.56
	Female	2.47	.41	2.06	.44	2.15	.74	2.45	.52	4.16	.36	4.07	.30	1.06	.23	4.11	.31
Total		2.53	.52	2.22	.47	2.24	.62	2.36	.54	3.91	.55	3.81	.51	3.80	.49	3.85	.52
TPCK	Male	2.51	.56	2.30	.40	2.26	.46	2.39	.49	3.60	.54	3.63	.50	3.57	.53	3.60	.51
	Female	2.41	.42	2.00	.30	2.41	.63	2.21	.46	4.15	.39	3.71	.47	3.86	.40	3.93	.46
Total		2.47	.49	2.14	.38	2.20	.53	2.30	.48	3.87	.55	3.67	.48	3.71	.48	3.77	.51
Readiness	Male	2.42	.44	2.37	.28	2.45	.41	2.41	.38	3.50	.44	3.53	.38	3.58	.43	3.53	.41
	Female	2.42	.29	2.14	.26	2.34	.41	2.31	.32	4.24	.19	4.10	.09	4.14	.25	4.17	.18
Total		2.42	.37	2.26	.29	2.39	.40	2.36	.35	3.86	.50	3.83	.40	3.86	.45	3.85	.45

Results according to the questions of the study were as follow:

Results of Q1: What are the changes of readiness degree of in-service science teachers in Ma'an Directorate for integrating augmented reality in teaching according to TPACK framework and its domains?

Means and standard deviations were calculated at the per\post measurement of teachers' readiness according to TPACK frame and its Domains, while the analyses of Paired sample t-test for means differences with (df=59) where used to determine the teacher's changes of readiness in integrating Augmented Reality in teaching:

Table 5. Results of Paired Sample T-Test

Domains	Pre Readiness		Pre Readiness Degree	Post Readiness		Post Readiness Degree	Correlation		T value	Sig
	Mean	SD		Mean	SD		R	Sig		
TK	2.34	.51	weak	3.86	.61	high	.485	.000(a)	20.451	.000(a)
CK	2.35	.36		3.90	.55		.300	.020	21.383	.000(a)
PK	2.43	.59		3.84	.58		.734	.000(a)	25.731	.000(a)
PCK	2.39	.44		3.93	.63		.466	.000(a)	20.680	.000(a)
TCK	2.30	.66		3.80	.68		.702	.000(a)	22.486	.000(a)
TPK	2.36	.54		3.85	.52		.543	.000(a)	22.730	.000(a)
TPCK	2.30	.48		3.77	.51		.659	.000(a)	27.863	.000(a)
Readiness	2.36	.35	weak	3.85	.45	high	.474	.000(a)	27.530	.000(a)

Paired sample t-test revealed that there are significant differences at $\alpha \leq 0.05$ between the means of teachers' readiness for integrating Augmented Reality according to TPACK framework and all of its domains. Thus, the in-service science teachers in Ma'an Directorate readiness for integrating augmented reality in teaching according to TPACK framework and its domains have been changed positively after understanding augmented realty when enrolled in a workshop presented augmented realty.

Teachers' readiness has been shifted from weak readiness (M=2.36) to a high readiness (3.85) and the total and all domains. Those findings show that science teachers have high competencies when they have the opportunity to explore different approaches on the basis of technologies, as the changes of readiness degrees were in all TPACK domains, which can be attributed to their competencies which have been developed by workshops in which they participated beside the three weeks of practicing augmented realty and interact with each other socially.

Based on these results, it appears that the teachers' readiness is high, but the obstacles are still having its role this region, as Jwaifell, Abu-Omar, and Al-Tarawneh (2018, p 863) pointed:

> "Teachers have 24 classes every week, which is considered a very high load and they are restricted to a low range of pedagogies that are supervised by the administration. On the other hand, not all parents have an open mind for new methodologies of learning and teaching nor all of them can afford smart phones to their children. The Ministry of Education in Jordan is working within a very humble budget to reform and organize curriculum based on this kind of technology and pedagogical methodologies"

Ministry of education in Jordan have to rethink of its budget for more attention to the new era of technologies to find its way in students classrooms, it is not the matter of teachers' competencies more than finding funds to do the work .

Results of Q2: Do male\female in-service science teachers in Ma'an Directorate differ in their readiness for integrating augmented reality in teaching according to TPACK framework and its domains?

To answer the second question, means and standard deviations were calculated to examine the differences of readiness according to their gender:

Table 6. Means and Standard Deviations According to Gender of Teachers

Domains	Pre Measurements				Post Measurements			
	Male		Female		Male		Female	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
TK	2.44	.52	2.24	.50	3.52	.55	4.20	0.46
CK	2.40	.42	2.30	.29	3.49	.41	4.32	.31
PK	2.40	.57	2.45	.61	3.51	.54	4.18	.40
PCK	2.45	.50	2.33	.37	3.56	.56	4.30	.47
TCK	2.26	.72	2.34	.59	3.39	.67	4.21	.38
TPK	2.47	.55	2.45	.52	3.59	.56	4.11	.31
TPCK	2.39	.49	2.21	.46	3.60	.51	3.93	.46
Readiness	2.41	.38	2.31	.32	3.53	.41	4.17	.18

Table 6 shows observed differences between the means of readiness for integrating augmented reality in teaching according to gender of teachers. ANCOVA was conducted to examine means differences as shown in Table 7:

Table 7. ANCOVA Summery According to Gender of Teachers

Source of Variance		Sum of Squares	df	Mean Square	F	Sig.
TK	Pre-TK	8.119	1	8.119	86.036	.000(a)
	Gender	9.989	1	9.989	83.708	.000(a)
	Error	6.802	57	0.119		
CK	Pre-CK	2.997	1	2.997	36.254	.000(a)
	Gender	11.593	1	11.593	140.255	.000(a)
	Error	4.712	57	0.083		
PK	Pre-PK	10.008	1	10.008	183.438	.000(a)
	Gender	5.050	1	5.050	110.884	.000(a)
	Error	3.110	57	0.055		
PCK	Pre-PCK	7.342	1	7.342	52.851	.000(a)
	Gender	10.478	1	10.478	75.423	.000(a)
	Error	7.918	57	0.139		
TCK	Pre-TCK	11.993	1	11.993	130.501	.000(a)
	Gender	8.492	1	8.492	92.400	.000(a)
	Error	5.238	57	0.092		
TPK	Pre-TPK	6.923	1	6.923	77.019	.000(a)
	Gender	6.173	1	6.173	68.669	.000(a)
	Error	5.124	57	0.090		
TPCK	Pre-TPCK	8.244	1	8.244	86.929	.000(a)
	Gender	3.229	1	3.229	37.046	.000(a)
	Error	5.406	57	0.095		
Readiness	Pre-Readiness	4.136	1	4.136	147.008	.000(a)
	Gender	7.659	1	7.659	272.255	.000(a)
	Error	1.604	57	0.028		

Results of the ACNOVA revealed significant differences at $\alpha \leq 0.05$ between the means of pre\post means according to their gender at the domains (TK, CK, PK, PCK, TCK TPK, TPCK and Readiness) due to female teachers, which means that female teachers' readiness is higher than male teachers. Thus, female in-service science teachers in Ma'an Directorate differ in their readiness for integrating augmented reality in teaching according to TPACK framework and its domains.

This result can be referred to female teachers' culture, where they have more social relations than male teachers, beside the competition between them as far as of the researchers' experience. In this matter the Ministry of Education in Jordan need to promote more crediting for teachers and consider a budget for using augmented realty.

Results of Q3: Do years of experience of in-service science teachers in Ma'an Directorate have an effect on their readiness for integrating augmented reality in teaching according to TPACK framework and its

domains?

To answer the third question, means and standard deviations were calculated to examine the differences changes of readiness according to years of experience as shown in Table 8:

Table 8. Means and Standard Deviations According to Years of Experience

Domains	Readiness Measurement	1-5 years. N=27		6-10 years. N=21		11 years and more. N=12	
		Mean	SD	Mean	SD	Mean	SD
TK	Pre	2.49	.51	2.19	.43	2.25	.59
	Post	3.95	.62	3.82	.53	3.71	.73
CK	Pre	2.44	.37	2.26	.30	2.33	.43
	Post	3.92	.58	3.88	.52	3.92	.58
PK	Pre	2.33	.58	2.43	.54	2.64	.68
	Post	3.74	.62	3.90	.50	3.95	.63
PCK	Pre	2.47	.43	2.31	3.67	2.35	.57
	Post	3.94	.68	3.99	.58	3.79	.65
TCK	Pre	2.15	.43	2.21	.68	2.81	.83
	Post	3.64	.66	3.75	.67	4.24	.59
TPK	Pre	2.53	.52	2.22	.47	2.24	.62
	Post	3.91	.55	3.81	.51	3.80	.49
TPCK	Pre	2.47	.49	2.14	.38	2.20	.53
	Post	3.87	.55	3.67	.48	3.71	.48
Readiness	Pre	2.42	.37	2.26	.29	2.39	.40
	Post	3.86	.50	3.83	.40	3.86	.45

Table 8 shows observed differences between the means of readiness for integrating augmented reality in teaching according to years of experience of teachers. ANCOVA was conducted to examine means differences as shown in Table 9:

Table 9. ANCOVA Summery According to Years of Experience

Source of Variance		Sum of Squares	df	Mean Square	F	Sig.
TK	Pre-TK	4.824	1	4.824	16.248	.000(a)
	Years of Experience	0.166	2	0.083	0.280	.757
	Error	16.625	56	0.297		
CK	Pre-CK	1.632	1	1.632	5.616	.000(a)
	Years of Experience	0.036	2	0.018	0.062	.939
	Error	16.269	56	0.291		
PK	Pre-PK	10.315	1	10.315	63.845	.000(a)
	Years of Experience	0.112	2	0.056	0.346	.709
	Error	9.048	56	0.162		
PCK	Pre-PCK	5.248	1	5.248	16.367	.000(a)
	Years of Experience	0.439	2	0.220	0.685	.508
	Error	17.957	56	0.321		
TCK	Pre-TCK	10.530	1	10.530	43.456	.000(a)
	Years of Experience	0.161	2	0.080	0.332	.719
	Error	13.569	56	0.242		
TPK	Pre-TPK	4.623	1	4.623	23.028	.000(a)
	Years of Experience	0.053	2	0.027	0.133	.876
	Error	11.243	56	0.201		
TPCK	Pre-TPCK	6.160	1	6.160	40.031	.000(a)
	Years of Experience	0.017	2	0.008	0.054	.948
	Error	8.618	56	0.154		
Readiness	Pre-Readiness	2.737	1	2.737	16.670	.000(a)
	Years of Experience	0.069	2	0.034	0.209	.812
	Error	9.194	56	0.164		

Results of the ACNOVA revealed no significant differences at $\alpha \leq 0.05$ between the means of pre\post means according to their gender at the domains (TK, CK, PK, PCK, TCK TPK, TPCK and Readiness) due to years of experience of teachers, which means that years of teachers experience didn't affect the change of their readiness.

Findings of the study are very consistent with the findings of related studies. This study revealed the high degree of teachers' readiness for using Augmented Reality after the workshop they took, which reflects their positive perceptions of using it. Overall, findings of related studies about Augmented Reality showed its importance and how it can change attitudes toward using it as an effective tool in education.

3. Conclusion

This study revealed the changes in teachers' of science readiness to integrate Augmented Reality in teaching. These findings have implications for efforts to use technologies in teaching as an effective tool. The results of this descriptive study help to clarify the aptitude of in-service teachers to use new technologies as Augmented Realty. For example policy makers can take advantages of technology and integrating them into learning situations and give more attention in considering a budget for using technologies in schools.

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