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Gender differences toward using educational technology in chemistry classes of Afghanistan universities

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Abstract
In the 21st century, technology became a practical reality and has been actively used in many different ways in nearly all cultures. We need to have an education system based on 21st-century requirements that technology integration is the most feature of the modern education system. The use of technology during teaching includes several factors, but teachers have a vital role to play across all factors. This study intended to determine differences between the sexes of chemistry lecturers in Afghanistan based on their knowledge and attitudes towards the use of educational technology in the class. The random sampling method was used to select 154 respondents which are 100 males and 54 female chemistry lecturers from Afghanistan. SPSS version 26 was used to analyze the data. The result revealed that there was no significant difference between male and female lecturers' toward using educational technology in the class. The findings of this research study encourage the Ministry of Higher Education (HEM) of Afghanistan and other education stakeholders to integrate modern education technology into the education system. Because the findings showed that both male and female of Afghanistan chemistry lecturers successfully use modern technology as necessary external factors, such as training, support, and resources.

Keywords: Educational technology, gender, lecturers' knowledge and attitude

1. Introduction
Technology has become a household term in the 21st century and it is used actively in almost all cultures in various ways. It has become so normal that it is unrealistic and impractical to think and talk about this age without taking into account the different forms of technology and their undeniable and profound influence on all aspects of human lives. Furthermore, the most powerful aspect in today's educational environment is technology. Many schools in different countries increased technology levels in the classroom through hardware including tablets and laptops, increased access to the internet, and the introduction of computer literacy programs for teachers and students. On the other hand, teachers typically appreciate the advantages of educational technology, the implementation of new learning technologies is often difficult. Technology integration poses important challenges for teachers at each level of the school system, from the development of new technology equipment to adaptation of curricula and teaching strategies to the introduction of new instructional technologies.
Besides many factors to the teachers, demographic factors including gender differences contribute to the effectiveness of using educational technology in the class (Inan & Lowther, 2010; Levin & Wadmany, 2008; Valcke, Rots, Verbeke, & van Braak, 2007) [15, 23, 37]. Gender is very important to be considered in using educational technology in the class. Because without considering the teachers' attitude and knowledge based on gender differences, teachers will persist against technology integration in the education system and they don't use or use ineffectively educational technology in the class. So, government and education policymakers should offer appropriate technology training programs based on gender differences to prepare them with educational technology.
Different research studies were performed to find out the effect of teachers' gender in using technology. However, some researchers claimed that male teachers are more successful than female in using technology in the class (Tsai, Lin, 2001; Jamieson-Proctor, Burnett, Finger, & Watson, 2006; Kay, 2006; Bebetsos and Antoniou, 2009) [36, 17, 20, 3]. While, the finding of some researchers show that female teachers are using technology in the class more than male teachers (Zhou and Xu, 2007) [3]. Furthermore, the third group of investigators demonstrated that there are no significant differences between male and female teachers toward using technology (Teo, Chai, Hung, & Lee, 2008; Joseph & Buehl (2009; Anduwa-Ogiegbaen & Isah, 2005) [32, 19, 1].

They reported that the level of anxiety, the separated education system for male and female students, and lack of female experts in technology in school are the main factor of gender difference toward using educational technology in the class. For instance, Mahdi (2013) investigated about demographic differences in using ICT in Saudi Arabia and Nigeria and reported that women teacher was not allowed to teach the male students and they had waited till evening for male teachers to fix their computer because there were no any women expert in the school to fix and prepare their computers.

Afghanistan has a long history of education and after establishing many universities with various faculty before the 1970s, the Afghanistan education system was recognized as the best system among central Asia countries. But, unfortunately, after the interwar in 1970, besides other sectors the education system negatively affected the people who experience the darkest period of the education system during Taliban governing (Hayward 2015) [12]. After the Taliban Regime and the emerging new government, all education stakeholders are trying to develop the education system of the country. Curriculum development and integration of new educational technology is the top priority of the Afghanistan government.

The Ministry of Information and Communications Technology (MoCIT) has already proposed, according to Beebe & Ph (2002) [4], an ICT agreement on the use of ICT in education operations as early as November 2003. However, the higher education administration in Afghanistan has tried to encourage lecturers to use modern education technology in the teaching process, and research shows that lecturers are still not interested in using new educational technologies in the teaching process in Afghanistan's universities (Noori, 2019) [26]. In addition, chemistry is considered to be the focus of the need for new educational technologies to be used for effective teaching of abstract concepts. There is no research study in this area and it is the main gap for this research study. Furthermore, there are many factors that affect using educational technology in the class including demographic factors. So this study planned to determine the effect of gender on using educational technology in the class. In reality, this study is a small attempt to help the established research body overcome the educational research in the chemistry department of Afghanistan.

2. Literature Review

There is a different factor that should be considered in using educational technology in the class. Among all factors, indeed, teachers have an important role in educational technology integration in the education system and using them in the classroom. There are many factors like teachers' knowledge and attitude, technology support, training. Besides these factors, demographic factors are also play important role in using educational technology in the class. Among demographic factor, gender, age, years of experience, Self-Efficacy, academic level are the factors that various researcher conducted study about effectiveness of them on using educational technology in education (Teo, 2008; Yaghi, 2001; Egbert, Paulus & Nakamichi 2002; Inan & Lowther, 2010; Levin & Wadmany, 2008; Valcke, Rots, Verbeke, & van Braak, 2007; Todman 2000) [23, 37, 32, 39,, 15, 34].

Researchers performed studies in different countries toward using educational technology in terms of the effect of demographic factors in using educational technology and found different results. In term of gender differences toward using educational technology in the class, some researcher found and believed that male teachers are more successful than female in using educational technology in the classroom (Tsai, Lin, & Tsai, 2001 [36]; Jamieson-Proctor, Burnett, Finger, & Watson, 2006; Kay, 2006 [17]; Bebetsos and Antoniou,2009 [3]; Tou *et al.*, 2020 Goktas, 2012; Kretschmann, 2015 [21]. While some other research studies indicated that female teachers are more successful the female toward technology integration in the teaching process. Furthermore, there is the third group of researchers who found out and highlighted that there are no significant differences between male and female teacher in using technology in an educational setting (Teo, Chai, Hung, and Lee 2008 [32]; Henry, 2008; Joseph and Buehl, 2009 [19]; Baker, Al-Gahtani, and Hubona, 2007; Gorder, 2008).

A quantitative investigation about gender difference toward using the internet among school teachers of Taiwan performed by Tsai, Lin, & Tsai, (2001) [36]. He selected 753 respondents including male and female. He highlighted that male teachers had a more positive attitude than female in using educational technology and also male teachers were more successful than female teachers in the technology integration in the education system. Likewise, Jamieson - Proctor, Burnett, Finger, & Watson (2006) [17] conducted quantitative research in Queensland. He selected 929 teachers with different years of experience from 38 schools of Queensland State to respond to the survey question. The purpose of the study was to identify the significant effect of ICT in teaching and learning and compare male and female teachers in using technology in the class. The result of this study indicates that 73% of female teachers were significantly less confident than male teachers in using educational technology.

Teo, Chai, Hung, and Lee, (2008) [32] investigated teachers feeling based on gender differences toward using educational technology in the class. He concluded that gender cannot be a predictor of the level of technology integration in the education system. it means that there are no significant differences between male and female teachers in using technology in the classroom. Likewise, Henry (2005) [13] also performed a study toward using technology in the class based on years of experience, gender age, and personal style difference in level of using technology in teaching and learning in the school. He found out that there are no significant differences between teachers in terms of gender toward using technology in the class. Furthermore, Baker, Al-Gahtani, and Hubona (2007) [2] also highlighted that there are no differences between male and female teachers in using technology in the class.

Earlier researchers highlighted that male teachers had a more positive attitude than female teachers toward technology and male teachers were more successful than female teachers in using educational technology in the classroom. While last research studies indicated that there are no significant gender differences in using educational technology in the class. There is a possible reason for this conflict between the result of earlier research studies and the latest investigations toward using technology based on gender differences. Teo *et al*. 2008 [32] mentioned that these differences occurred due to frequent use of technology and all teachers especially female teachers become more

familiar with technology and using of them in the teaching process. This topic needs more investigation to determine and understand the gender factor in using educational technology in the class.

How about Afghanistan? how is lecturers' attitude and knowledge toward using technology in the class based on gender difference? Is the gender can be the main factor of predictor for the level of using educational technology in the class. This study is designed to answer these questions and investigate Afghanistan chemistry lecturers' knowledge and attitude toward using educational technology in chemistry class.

In conclusion, among demographic factor that considered as an important factor, gender also have vital role in the effective use of educational technology in the class. Many studies performed to find out the level of using educational technology in the class based on gender and have found various results. Some researchers found out and believe that male teachers are more successful in using technology in the class than female teachers. While latest studies highlighted that there is no significant difference between male and female teachers in using technology in the class. The possible reason for this conflict can be the familiarity of teachers with new technology by increased use of them in their real life and teaching and learning. This study planned to investigate the level of using educational technology based on gender and years of experience differences.

3. Research Question

This research study planned to respond the following research questions:

a) Are there any differences between male and female lecturers toward using educational technoglogy based on their attitude?
b) Are there any differences between male and female lecturers toward using educational technoglogy based on their knowledg?

4. Data Collection, Sampling and data collection tools and method

A quantitative approach to answering the questions and achieving the research goals has been used in this analysis. In fact, descriptive and inferential statistics have been used in this research to achieve the research objectives. This study was performed among chemistry lecturers in Afghanistan universities. There are 260 chemistry lectures teaching chemistry at 26 universities in Afghanistan. Out of this population, 154 lecturers, including males and females, were randomly selected for this analysis. Of all respondents, 100 (65 percent) are male and 50 (35 percent) are female and are between 25 and 50 years of age. Respondents include many years of teaching experiences.

Table 1: The respondents' distribution based on gender

Gender		Years of teaching experiences		
Male	**Female**	**1-5**	**6-10**	**More than 10**
100 (65%)	54 (35%)	72 (46.7%)	42 (27.3%)	40 (26.0%)
Total		154		100%

Furthermore, this phase corresponds to the data survey method, which demonstrates the methods and instruments used by the researcher to collect the data. However, this section concerns the actual data collection instrument and also how the reliability and validity of the data are evaluated. The researcher used version 26 of the SPSS to verify the reliability and validity of the data collected. In this article, the researcher used the questionnaire to answer the questions and receive the research objectives. The attitude survey questionnaire was used for this analysis. This questionnaire, adapted from the above, has three main constructs, such as feeling, belief, and attitude. The attitude part consists of 8 items (1-8), the belief section includes 21 items (9-29) and the action part contains 6 items (30-35). Overall, the questionnaires consist of 35 closed questions grouped by Likert Scale

5. Findings

The main goal of this study was determining the differences between male and female chemistry lecturers', more experienced chemistry lecturers', and moderately experienced chemistry lecturers' toward using educational technology in the class. The researcher planned to examine the differences based on the respondents' attitudes and knowledge in using educational technology. Independent t-test and non-parametric tests such as Mann Whitney u test and Kruskal Wallis were used to determine the differences.

5.1 Non-significant differences between male and female lecturers' attitude in using educational technology

Researchers planned to determine gender differences toward using educational technology based on their attitude in Afghanistan universities among chemistry lecturers. For using the parametric tests in data analysis, it is important to ensure the data represents the normal distribution. Hence, the normality test of the Shapiro-Wilk was used to analyze the standard score distribution because it was more appropriate for the limited sample size. The p-value for the Shapiro-Wilk check is 0.005, which indicates that the data has not been distributed normally. Nonparametric sample tests (e. Mann Whitney u test) were used because the data was not normal. Through 154 respondents, 100 teachers (64%) were female and 54(35%) were female in this study.

Question

Are there any differences between male and female chemistry lecturers toward using educational technology in the class based on their attitude?

Hypothesis

H_0: $\mu 1 = \mu 2$ (There is no significant differences between male and female chemistry lecturers toward using educational technology in the class based on their attitude).

H_1: $\mu_1 \neq \mu_2$ (There is significant differences between male and female chemistry lecturers toward using educational technology in the class based on their attitude).

When reviewing the bellow table (Table 1) it was found that the mean rank for male is (M=82.28) more than female (M=68.66), but there is no statistically significant difference between male and female (U=2222.5; $P>0.05$, p=0.7). Based on this result, we fail to reject the null hypothesis and can conclude that there are not any significant differences between male and female Afghanistan chemistry lecturers toward using educational technology in the class based on attitude.

Table 2: Gender differences toward using educational technology based on lecturers' attitude

Using Educational Technology Base on Attitude	Gender	N	Rank Mean	Rank Total	U	P
	Male	100	82.28	8227.50	2222.5	0.07
	Female	54	68.66	4545.00		

5.2 Non-significant differences between male and female lecturers' knowledge in using educational technology

Based on the objective of this research study, the question was related to clarifying gender differences toward using educational technology in the class-based knowledge. The normality test of the Shapiro-Wilk was used to analyze the standard score distribution because it was more appropriate for the limited sample size. The p-value for the Shapiro-Wilk check is 0.005, which indicates that the data has not been distributed normally. So, nonparametric sample tests (Mann Whitney u test) were used because the data was not normal. Through 154 respondents, 100 teachers (64%) were female and 54(35%) were female in this study.

Question

Are there any differences between male and female chemistry lecturers toward using educational technology in the class based on their knowledge?

Hypothesis

H_0: $\mu 1 = \mu 2$ (There is no significant differences between male and female chemistry lecturers toward using educational technology in the class based on their knowledge).

H_1: $\mu_1 \neq \mu_2$ (There is significant differences between male and female chemistry lecturers toward using educational technology in the class based on their knowledge).

The following table (Table 2) shows the output of the nonparametric sample test (Mann Whitney u test) analysis and whether there is no statistically significant difference between the group means. However, we can see that the mean rank of female is 84.17vwith a total rank of 4545.00 and the rank mean for male is 73.90 with a total rank of 7390.00. This result indicates that the female mean rank is more than the male, but the significance value is 1.73 (i.e., p =. 1.73), which is more than 0.05 (U=2340.0; P>0.005). Based on this result, we fail to reject the null hypothesis and can infer that there are no significant differences based on gender among chemistry lectures in Afghanistan universities.

Table 3: Gender differences toward using educational technology based on lecturers' knowledge

Using Educational Technology Based On knowledge	Gender	N	Rank Mean	Rank Total	U	P
	Male	100	73.90	7390.00	2340.0	.173
	Female	54				

6. Discussion

The purpose of this study was to determine the differences between male and female chemistry lecturers of Afghanistan universities toward using educational technology in the class. The first question of the study was related to determining gender differences in using educational technology based on their knowledge. According to the result, there were no significant differences between male and female lecturers' knowledge toward using educational technology in the class. In light of past research, we can infer that there are no significant differences in term of gender among chemistry lectures toward using educational technology because many research indicated a direct relationship between teachers 'knowledge and the level of using educational technology in the class (Sivin-Kachala & Bialo, 2000; Rodriguez & Knuth, 2000; Culp *et al*., 2003; Jackson, 2004; Valdez, 2005; Chaika, 2006; Park, 2009; Howley *et al*. 2011; Capo and Orellana 2011; Larkin & Finger, 2011; Ertmer *et al*., 2012; Miranda and Russell 2012; Botha & Herselman, 2015; Tilton & Hartnett, 2016) [29, 28, 7, 16, 38, 6, 15, 5, 22, 9, 25, 33]. A study performed by Motshegwe & Batane (2015) and revealed that the positive attitude of teachers directly leads to technology integration in the class. Furthermore, the result indicated non-significant differences in terms of gender among chemistry lecturers of Afghanistan universities toward using educational technology in the classroom based on their knowledge.

Furthermore, the result of the study revealed that there are no differences between male and female lecturers' attitudes in using educational technology in the class. Past researches indicated that teachers with positive attitudes are more successful in using technology and using technology is usually at a high level (Luft, 2007; Swan and Haver 2011; Zakiree, 2012; Ertmer *et al*.2012; Hashimi, 2016) [7, 30, 9]. The result of this study is aligned with other research studies performed previously in various countries which revealed non-significant differences between male and female teachers toward using educational technology in the class (Tsai, Lin, 2001; Henry,2005 Calvert *et al*. (2005) Tai and Ku (2013) Raman *et al*. (2014) [36, 13].

7. Conclusion and implication

The main purpose of this research study was to determine the differences between Afghanistan chemistry male and female lecturers toward using educational technology in the class based on their knowledge and attitude. The result revealed non-significant differences in terms of gender among chemistry lecturers of Afghanistan universities based on their knowledge. Similarly, there were no gender differences among chemistry lecturers toward using educational technology based on their attitude.

However, gender differences are considered to be essential factors in the use of education technology in the classroom, the outcome of this research highlighted the non-significant disparities between male and female lecturers in the use of education technology. The findings encourage the Afghanistan Ministry of Higher Education (HEM) and other education stakeholders to incorporate modern education technology into the education system. Since the findings show that male and female lectures successfully introduce integration of modern technology in the Department of Chemistry of the Universities in Afghanistan with the requisite external factors, such as training, support, and resources.

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