AFGHANISTAN CHEMISTRY LECTURERS' KNOWLEDGE AND ATTITUDE TOWARD USING EDUCATIONAL TECHNOLOGY IN THE CLASS

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DEDICATION

This project report is dedicated to my beloved parents, who, by enduring suffering and hardship, provided me with the ground for growth and excellence and taught us the lesson of living right. It is also dedicated to my dear brothers and sister, and especially my wife.

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ABSTRACT

The education system must be upgraded according to today's needs and requirements in line with the fourth industrial revolution. Therefore, education 4.0 need to be introduced to overcome the challenges that arise from industrial revolution. The main feature of Education 4.0 is technology integration in teaching and learning. This also implies higher education. Therefore, lecturers in universities also need to integrate the technology into their classes. The integration starts with lecturers because they are the ones who will design the teaching and learning. Their knowledge and attitudes will reflect their implementation in the class. Hence, lecturers' knowledge and attitudes towards using educational technology need to study. This study schemed to determine the Afghanistan chemistry lecturers' level of knowledge and attitudes toward using educational technology in the class and how their level of knowledge and attitudes affect the level of using educational technology. The study utilized a quantitative approach. The instruments used are attitude and TPACK survey questionnaires. The questionnaires were validated by experts and after the pilot test, the reliability of Cronbach's alpha value is 0.9. Then, the questionnaire was distributed as both hard copy and soft copy via online google form among 154 Afghanistan chemistry lecturers and was selected through the random sampling method. The data was analyzed using the SPSS version 25. The results of this study indicated that the level of using educational technology is at high level but 70.1% of respondents are using technology traditionally. The result also showed the moderate level of lecturers' knowledge (M=3.0) and positive attitude(M=3.1) toward using educational technology in the class. Furthermore, the p value (p=.023) indicated, significant relationship between lecturers' attitudes and the level of using educational technology in the class. On the other hand, there was not significant relationship between lectures knowledge and the level of using educational technology (p=0.25). As an implication, the result of this study is very vital for Afghanistan universities to find out the effective way of using education technology in the classroom. Further researches are needed to be conducted in order to deeply study with qualitative method to find out the common internal and external factors to the teachers toward using educational technology in teaching and learning chemistry in Afghanistan Universities.

ABSTRAK

Sistem pendidikan perlu dinaiktaraf berdasarkan kepada keperluan dan kehendak semasa selari dengan revolusi industri keempat. Oleh itu, Pendidikan 4.0 perlu diperkenalkan bagi mengatasi cabaran yang wujud daripada revolusi industri. Ciri utama Pendidikan 4.0 adalah pengintegrasian teknologi dalam pengajaran dan pembelajaran. Ini turut terpakai kepada pengajian tinggi. Oleh itu, pensyarah di universiti juga perlu mengintegrasikan teknologi dalam kelas mereka. Pengintegrasian bermula daripada pensyarah kerana mereka yang akan merekabentuk pengajaran dan pembelajaran. Pengetahuan dan sikap mereka akan mencerminkan pelaksanaan mereka di dalam kelas. Maka, pengetahuan dan sikap pensyarah terhadap penggunaan teknologi pendidikan perlu dikaji. Kajian ini dijalankan untuk menentukan tahap pengetahuan dan sikap Pensyarah Kimia Afghanistan terhadap penggunaan teknologi pendidikan di dalam kelas dan bagaimana tahap pengetahuan dan sikap mereka mempengaruhi tahap penggunaan teknologi pendidikan. Kajian ini menggunakan kaedah kuantitatif. Instrumen yang digunakan adalah soal selidik sikap dan TPACK. Soal selidik telah disahkan oleh pakar dan setelah kajian rintis, nilai kebolehpercayaan Cronbach's alpha adalah 0.9. Kemudian, soal selidik telah diedarkan dalam bentuk bercetak dan atas talian melalui google form kepada 154 pensyarah kimia Afghanistandan telah dipilih melalui kaedh persampelan rawak. Data dianalisis menggunakan SPSS versi 25. Dapatan kajian menunjukkan tahap yang tinggi dalam penggunaan teknologi pendidikan tetapi 70.1% responden menggunakannya secara tradisional. Dapatan juga menunjukkan tahap sederhana bagi pengetahuan (M=3.0) dan sikap (M=3.1) pensyarah terhadap penggunaan teknologi pendidikan di dalam kelas. Selain itu, nilai p (p=.023) menunjukkan terdapat hubungan yang signifikan antara sikap pensyarah dengan tahap penggunaan teknologi pendidikan di dalam kelas. Namun, hubungan yang lemah antara pengetahuan dan sikap dengan tahap penggunaan teknologi pendidikan di dalam kelas (p=.25). Implikasinya, dapatan ini amat penting bagi univerisiti di Afganistan untuk mengetahui bagaimana pensyarah boleh menggunakan teknologi pendidikan secara efektif. Kajian lanjutan perlu dijalankan untuk mengkaji dengan lebih mendalam kaedah yang efektif dalam menggunakan teknologi pendidikan dalam pengajaran dan pembelajaran kimia di universiti di Afganistan.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGUR

LIST OF ABBREVIATIONS

TK	-	Technological Knowledge
PK	-	Pedagogical Knowledge
TCK	-	Technological Content Knowledge
TPK	-	Technological Pedagogical Knowledge
TPACK	-	Technological Pedagogical and Content Knowledge

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

1.1 Introduction

The industrial revolution has been changing very fast from using water steam to mechanizing manufacture in the first industrial revolution toward using technology and the digital world to revolutionized industry in fourth IR (Schwab, 2016). The fourth industrial revolution created facilities for humans and was recognized as an excellent opportunity to change the lifestyle in a better and convenient way. Actually, it has many advantages such as the infrastructure of information and communication, emerging new technologies, creativity and innovation, developing of training and education, and improving productivity (Hussin, 2018; Schwab, 2016).

On the other hand, the fourth revolution is also considered a challenge among worldwide nations, especially for underdeveloped and developing countries. For instance, Hussin (2018) stated that IR4.0 create some issues for human, especially in term of potential jobless, skill challenges, infrastructure challenges, security, and privacy challenges. However, some developed countries seem to catch up with this industrial revolution; they still have some problems. Dredger et al. (2016) reported the fourth industrial revolution is not without its challenges. In Germany, one of the developed countries, job loss, disqualification, new kinds of stress, social insecurity, changing business models, data issues, and skills mismatches were identified as some of the significant challenges that they faced during IR4.0.

IR 4.0 demands a better and gifted workforce has caused" a tipping point " of changing the course of instruction and way of teaching and learning (Bellanca and Brandt, 2010). Fisk (2017) stated that the new learning vision encourages learners to learn the requisite skills and knowledge and identify the source for education. Understanding how to learn and track their success through data-based optimization is

developed around them. People in their education become very important. They learn from each other and together, while the teachers play the leading role in the education system.

Therefore, education 4.0 was introduced to meet the demand of IR4.0. Education 4.0 lead to integrate new educational technology to support and strengthening the traditional education system. These technologies support teaching programs, including planning, implementing, evaluating, and reaching a successful and responsible system to answer community expectations (Zakiree, 2012).

It is indispensable to determine a clear trend for Education 4.0. Fisk (2017) emphasized that Education 4.0 acquire nine directions that involved direction for the policymaker, teachers, and students. Among the nine instructions, some of them required new teaching tools and technologies. In contrast, without using technologies, the implementation of them is impossible. These include e-learning, project-based learning, internship learning, applying theoretical knowledge to numerical, and personalized learning to individual students. So, technology integration and using them effectively in teaching and learning is significant for Education 4.0.

Based on Abdelrazeq et al. (2016), the teaching process influenced by the fourth industrial revolution with the new industrial period. It is essential to improve instructors' knowledge, skill, and ability to use technology based on education 4.0. It means that for education 4.0, we need the concept of "Teacher 4.0" to modern teaching strategy. Furthermore, schools should adapt to new teaching strategies to find the capacity to accept the basic alter occurring with new technologies. Therefore, the educator experts should consider the new concept of education system called "Teacher 4.0" to have a successful education based on IR4.0 (Karre et al., 2017). Based on a new perspective, the education system needs to use new educational technology in the teaching and learning process.

1.2 Necessity of Using Educational Technology in Chemistry Education

Chemistry is considered a complicated subject by students due to its abstractness (Adesoji et al., 2017). Similarly, Horvat et al. (2016) and Tüysüz (2009) explicated that learning and teaching chemistry is very difficult because most chemical principles are generalized and abstract. For example, the theory of chemical bonding and the interaction between electrons and their pulling forces to form chemical bonds and produce the compound is intellectual and challenging for students to comprehend. The abstract concepts of chemicals will make it difficult for students to understand how electrons interact. Simplifying the concepts under the Lewis system employing the actual conditions allows students to understand the theory even if certain students are confused. The existing ambiguity leads the students and experts to be inconsistent with their definitions. According to Mohd Nor and Mohd Izham (2011), learning and teaching chemistry concepts are complicated. This difficulty related to the nature of science, three primary roots in chemistry learning, is matter, concept, and application, and teaching method regardless of student's learning and different intelligence. Students need to understand the chemical symbol, theories, and chemistry concepts that most of them have difficulty understanding the chemical symbol, where they cannot memorize and analyze each element. Johnstone (1991) stated that chemistry can be represented in three level of representation which are macroscopic, sub-micro, and symbolic as in Figure 1.1.

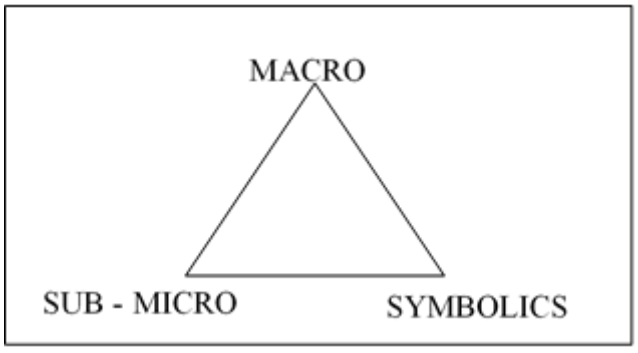

Figure 1.1 Three Level of Chemistry Concept Representation by Johnstone (1991)

The macro-level can be defined as a visible and macroscopic attribute (Becker, Stanford, Towns, and Cole, 2015). Based on Abdullah, Surif, and Ismail (2016), the sub-microscopic level can be defined as the level of understanding of chemistry at different levels of particles such as molecules, ions, atoms, and subatomic particles and others. While symbolic is represent images and information of the molecular level (Davidowitz, and Chittleborough, 2009).

Kay and Yiin, (2010) reported that the microscopic level and symbolic level of chemistry concepts are the main cause of its difficulty. For instance, explaining of changing the state of matter from solid to liquid and liquid to gas and vice versa, forming the chemical bonding, and proportion of every atom in a molecule is very difficult, and that contribute to a misconception among chemistry students. For instance, Ozmen (2007) stated that students believe when water is boiling, the boiling bubbles contain hydrogen and oxygen gas. They fail to understand that the water goes thru the physical changes from liquid to gas. By using simulation and virtual reality in teaching chemical bonds and changing the state of matter, teachers can show students how the chemical bonding formed and how the state of maters is changed. So, students understand that the bonds between the water molecule are broken, and not the bonding inside the molecule.

The usage of educational technology is very useful in overcoming students' misconception in a macro level such as Material conditions, metal magnetic characteristics, acids and base, solution (Cetingul and Geban, 2005), ozone layer, molecular proportion of atoms (Taber, 2008), (Boyer and Tracz, 2014), micro-level like vapour pressure, matter classification and phases (Johnson 2005) and conceptualization growth among students in understanding phase shift , nuclear structure (Nakiboglu, 2003, water evaporation process (Dhindsa and Treagust, 2009), temperature, metal oxidization (Unal, Costu and Ayas, 2009), and symbolic level such as Changes in phase and temperature (Driver,2013), the proportion of atoms in molecules, exothermic and endothermic chemical reactions (Ahtee, Asunta, and Palm,2012) and chemical bonds Unal, Costu and Ayas, 2010) ; Oliveira, Camacho and Gisbert, 2014; Osman and Vebrianto, 2013). Indeed, the emerging of new technologies offers an opportunity for chemistry teachers and lecturers to teach the concepts of

chemistry effectively, especially at a sub-micro and symbolic level, and overcome misconceptions among students. For example, Teachers usually teach molecular geometry by using chalk and blackboard in the traditional classroom. They explain the topic with some examples about the shape of molecules and ask students to use plastic balls and sticks to apply VSEPR theory. This way cannot show the three dimensions of the molecule structure setting adequately, so it can be a contributing misconception among chemistry students. Actually, educational technologies like simulation and virtual reality create opportunities for supporting a three-dimension visual tool to improve student learning achievement in chemistry concepts (Levy, 2013).

Based on Barak and Dori (2005), using new technology in the chemistry classroom can improve understanding of chemistry concepts, the structure of a molecule, and chemical theories. Other researchers also found out that using ICT in the class has a positive effect on students' learning achievements, preparing the students to engage with the class environment actively and supplying grave for learning individually and visualizing o the micro-level and micro level of the world. Without using new technology, the instructors and whole program face challenges. (Dori et al., 2003; Stieff and Wilensky, 2003).

Although chemistry considered a very difficult subject in the schools and the level of misconception is very high among chemistry learners, teachers can use educational technology to overcome these issues. Teachers need to use educational technologies in teaching chemistry to develop the student's comprehension of chemistry concepts and decrease the level of misconception among chemistry students. Therefore, this research designed to determine the level of Afghan chemistry lecturers' knowledge and attitudes toward using technology in chemistry class.

1.3 Lack of Using Educational Technology in Learning and Teaching

There are many advantages of using educational technologies in the teaching and learning process. Undoubtedly, using educational technology helps teachers to

overcome the difficulty of abstract and three levels of chemistry concepts and decreases misconception among chemistry students. Unfortunately, some teachers still are not interested in using technology in the class or cannot use it effectively. They use educational technology in schools, but only for personal tasks like e-mail and just for showing the slides, videos, or pictures in the class, which are not specific to the teaching strategy (Ruggiero and Mong, 2015). Therefore, the use of technology in the class is ineffective because they do not know how to use technology to support their teaching method to improve students' learning and achievements (Kurt, 2013).

According to the National Education Association NEA (2018) report, billions of dollars have been contributed to providing technologies to prepare schools with instructive technology equipment. However, there are still more educators doesn't utilize technology effectively in their instruction and teaching process. Similarly, Herold (2015) reported that even though technologies' availability is increasing, teachers are not interested in using new technology in their teaching.

Developed counties are assumed to have no problem using educational technology in the class because they started using technology in their teaching and learning process a long time ago. However, the researcher reported that still, teachers have problems in using technologies meaningfully. For instance, the United States of America is one of the developed countries that are still having problems with using educational technology effectively in the classroom. According to the U.S. Office of Instruction (2016), new technology in instruction, particularly in learning and teaching, has gotten to be a fundamental issue universally. The U.S government's expectation in 2016 was to increase the use of technology in students' learning to assist learners in developing their skills, knowledge, and ability to overcome future challenges. Unfortunately, they couldn't achieve that because they face challenges in integrating technology effectively in teaching, learning, and evaluating strategies even though the government spent millions of dollars on technology development. Based on Quality Education Data (2004), just in 2003 and 2004, the United States spent around $7.87 billion technology tools for schools, and in ten years, this country spent approximately $66 billion dollars to equip the schools with technology. In spite of the fact that numerous systems of teaching have rapidly grasped advanced technologies,

the successful consideration of these educational technology faces and will encounter in to future in barriers of pedagogy and practice (Wood et al., 2008).

Saudi Arabia is an example of a developing country that tried to use the newest educational technology in the class. Even though Saudi Arabia did not have any economic issues like other countries, this country could not effectively integrate technology in the classroom. More schools have appropriate facilities, equipment, and teaching tools in Saudi Arabia, but teachers are not comfortable in using technology in their teaching process. The main barrier can be because of the unwillingness of teachers toward using educational technology. The cause of teachers' reluctant can be, their lack of knowledge, and skills especially in rural culture (Baker, Al-Gahtani, and Hubona, 2007; Elizabeth,2007).

Undoubtedly, in underdeveloped countries, educational technology usage seems to be more challenging because of a lack of facilities, inadequate skill, and knowledge of using educational technology for both teachers and students. For instance, Oyo is one of the underdeveloped countries located in Africa and has problems using educational technology. Technology integration in Oyo is considered a new concept in the education system, and both teachers and students are not familiar with modern educational technology. Even some schools still did not have a computer. Because some schools don't have facilities, supports and teachers are not familiar with new technology, and they don't use new educational technology in their teaching and learning process (Fakeye, 2010). Miima (2013) performed a study in Kenya and found out that technologies are not being used in the class. Even though there is government support, most teachers are not using technology in their teaching, so they are afraid of using new technology because they don't have the skill and knowledge of using them.

According to UNESCO (2012), Afghanistan is one of the underdeveloped countries. The insecurity, instability, poverty, and lack of steady political hinder Afghanistan from better education to improve the national situation. Although, the system of education in Afghanistan has confronted various challenges; after 2001, by emerging democracy in Afghanistan, the whole country and its education system have been starting to improve (Noori et al., .2017; and Qasemi, 2015). Furthermore, after

the Taliban Regime, the Afghanistan government has been trying to improve the educations system by integrating the new educational technology in the teaching and learning process. According to Beeb (2002), the Ministry of Information Communication Technology in Afghanistan, established ICT policy focusing on incorporating ICT in education. The Ministry of Education (MOE), Ministry of Higher Education (MOHE), align with the Ministry of Information Communication Technology (MOICT) wanted to develop ICT curriculum, create opportunities for foreign universities to help ICT-building in Afghan universities and encourage distance learning. Those study's outcome will be aware of (MOE), (MOHE) and (MOICT) the challenges and benefits of ICT in education that help them in developing an effective ICT curriculum, encouraging foreigners to develop ICT in Afghanistan universities and promoting distance learning. After all of the effort done by Afghanistan Ministry of Education, are educators use it in the class? If they use it how? If they do not use it then why they do not use it?

Based on Kopcha (2012), the main reason why educators cannot use technology efficiently in the classroom is the lack of training and technical understanding of the new technologies and the teachers' beliefs and attitudes towards technology. The technical obstacles are significant predictors of a teachers' potential use of technology. Besides, teachers often feel empowered to use technology in their classrooms in the future. This can lead to the use of technology meaningfully in teaching and learning (Kopcha, 2012).

1.4 Lack of lecturers' Knowledge Toward Using Educational Technology in the class

Undoubtedly, teacher's knowledge is an essential factor that contributes to the effectiveness of using educational technology in the class (National Education Association, 2008; Chaika, 2006; Valdez, 2005; Jackson, 2004; Culp et al., 2003; Rodriguez and Knuth, 2000; Sivin-Kachala and Bialo, 2000). Moreover, determining every teacher's technological skill and knowledge is essential before designing the lesson (Bonifaz and Zucker, 2004; Gahala, 2001). The Instructors Conversation Tech

2005 overview (CDW-G, 2005), reported that 28 percent of instructors across South Texas detailed they were not prepared or insufficiently prepared to integrate technology in their lesson plans. Thirty-one percent of instructors demonstrated that they did not know how to use a computer from 2004 to 2005. Therefore, teachers need to know using educational technology in the class effectively.

Different types of knowledge are very important in using educational technologies in the class. The most crucial knowledge of teachers that nowadays emphasize for technology integration is TPACK. It is essential for a teacher to integrate technology into learning process and also to teach effectively. TPACK is comprised of technological knowledge (TK), pedagogical knowledge (PK), content knowledge (CK), and technological pedagogical content knowledge (TPCK). Technological knowledge refers to the knowledge of using technology effectively in the class. In contrast, pedagogical knowledge refers to the effective way of teaching, content knowledge refers to the comprehending of the content of the specific subject, and technological pedagogical content knowledge focus on educators' knowledge to use specific technology based on the subject content and teaching method (Schmidt et al., 2009).

Kalonde (2017) found out that teachers and students still have problems in knowledge and accessibility of using educational technology in the class in some schools. For instance, the studies stated that there is a lack of knowledge of instruction and implementation of technology in the class. The other researchers (Conley, 2010; Gray, Thomas and Lewis (2010) also reported the same issue in the past. For instance, Cooley (2001) revealed that a school spent a lot of money on preparing technology. Still, they don’t consider teacher preparation programs for technology implementation, so the technology has very less effect on improving the pupils’ understand because the teachers’ had no knowledge to use educational technology based on subject content to support the teaching method.

Moreover, the relationship between teachers' knowledge and attitude is very important and should be considered in educational technology integration. Indeed, the attitude of teachers toward using technology in the class is whether positive or

negative. But we should know if their attitude toward using educational technology in class related to their knowledge or not. The majority of previous research studies indicated that there is a significant relationship between teachers' knowledge and attitudes (Chang and Chen,2015 and Howard,2013).

The finding of various investigations in using educational technology in the teaching and learning process has shown that teachers' computer skills are very necessary and an can be an important predictor of teachers' attitudes toward using educational technology in the class (Berner, 2003). Similarly, Al-Oteawi (2002) highlighted the main cause of teachers' negative attitude toward using educational technology in the class is their lacked computer knowledge and skills to enable them to make "informed decisions" (p. 253).

In conclusion, technological, pedagogical, content knowledge, selecting specific technology to teach a particular topic based on the teaching method is very important. If teachers do not have these skills, they will not be interested in using technology or use technology ineffectively. Therefore, this study will investigate the level of Afghan chemistry lecturers TPACK knowledge in using educational technology in the chemistry class.

1.5 Lack of Teachers' Attitude Toward Using Educational Technology in the class

Besides teachers' knowledge, teachers' attitude is also an important internal factor for teachers to use educational technology in teaching and learning process. Even though some schools and universities have appropriate teaching tools, educational technology, and great internet access, educators face challenges toward integrating technology in the classroom. No matter how advanced and effective the state of computer innovation is, the degree to which it is executed depends on instructors having a positive state of mind or attitude towards it (Huang and Liaw, 2005). Teachers' attitudes toward using technology in the class are the reflection of how they use it in the class (Gu, Zhu and Guo, 2013).

Teacher’s attitude toward using new educational technology in the class is one of the most important factors being considered by policymakers and administrators in implementing technology in the education system. Various researcher reported that beliefs (Ertmer, andSendurur, 2012; Kim, Spector and DeMeester, 2013), perception (Kopcha, 2012; Georgina and Hosford, 2009), and attitudes (Buabeng-Andoh, 2012; Alharbi, 2013) of teacher affect the integration of technology in teaching and learning. We cannot neglect the teachers’ attitudes of using technology in the class. According to (Fouzieh Sabzian, 2013), teachers’ attitudes about computers influence the effective utilizing of computers within the classroom, and these precepts, whether positive or negative, influence how instructors react to advances. In turn, this influences the way learners see the significance of computers in schools (Teo, 2006) and influences current and future computer utilization.

Based on Fardanesh (2007) and Yusuf (2005), investigating and understanding teachers’ attitudes and interests toward technology in their professional activities is the basic necessity of the education system. Teachers’ attitude of using a specific type of educational technology reflects their application of educational technology in their class because performing of responsibly acquire willingness to do it. Furthermore, previous researches indicate that instructors do not only use new technologies as a complement of teaching strategies in the class; they also use them to improve their personal and professional skills. So, educators are the factor of interactive changing of learner and technology and are the key to the effective performance of using technologies in the class. Because of that, the role of the teacher’s attitude toward using educational technology is revealed as a very important necessity. Stokes, 2010; Ruggiero, 2015; (Bauer, J., and Kenton, J. (2005; Zakiree, 2012).

According to Guzey (2012), teachers' attitude almost the viability of innovation on pupil learning was found to be closely related to teachers' past encounters with changes and their identity. In specific, the positive encounters of utilizing innovation and new educational technology in their educating instruction program made a difference. Instructors' past technology experience is the impact of innovation on them possess learning and create a vision of what educational technology integration ought to be in actual classrooms. Their individual eagerness to learn about educational

technology apparatuses moreover contributed to their convictions around innovation integration. Luft and Roehring (2007) pointed out that teachers' beliefs are related to their educational performance and activities. Within the setting of innovation integration, teachers' acceptance toward innovation affects their utilization of new educational technology in classroom instruction. Teachers who are the foremost frequently used technology hold heavily constructivist acceptance as request instructors talked about (Luft and Roehring,2007).

A negative attitude toward new educational technologies has been the main cause of unrevealing the feature and philosophy of using them in the learning and teaching process. This lead to the deprived of benefit and achievement new technology in the education system and also teachers with negative attitude affect the students' interest in using technology negatively. This type of attitude is the most challenging discussion topic of today's educational technology investigations (Zakiree, 2012; Oates and Hashimi, 2016). Teachers with a negative attitude toward using educational technology affect learner's aspect of technology as a learning tool. Generally, the teacher attitudes should be considered if request a teacher to use technology in the class because this conservation can be decreased or increase student learning in different aspects (Swan and Hofer 2011).

Zakiree (2012) highlighted that without consideration of teacher's attitudes toward using and expanding of using educational technology in the teaching process may face the contrary of teachers, managers and will not have a useful effect in the education system. He added that teachers usually have negative attitudes in using new educational technologies because they are afraid of using them, so this issue undoubtedly affects educational technology integration in the education system.

To sum up, we can conclude that teachers' attitude is considered an important factor in using technology in the class. Indeed, expansion and effective utilizing of new technology in the class without considering teachers' attitudes and perceptions may cause teachers to persist in using educational technology in the class. It also may lead to use educational technology ineffectively in the class. Past studies have also shown that teachers are scare and have a negative attitude when they are facing new

technology (Zakiree,2012; Roehrig and Luft,2000; Roehrig and Luft,2004; Fardanesh, 2007; Dana Ruggiero, 2015; Zakiree, 2012; Hashimi, 2016; Teo, 2006; Zhao, Tan and Mishra 2001; Huang and Liaw, 2005). The question is, how about Afghanistan? Are Afghan chemistry lecturers' attitudes towards using educational technology in their teaching is positive or negative? Do instructors' attitudes affect them toward using technology in the class? Therefore, this study conducted to find the answer the above questions.

1.6 Problem Statement

Among all science fields, chemistry is the most challenging subject, and existing ambiguity leads the students to be too afraid to learn this subject. The main cause of chemistry difficulty is the abstractness of chemistry concepts and the need to integrate three-level representations of chemistry: macro, sub-micro, and symbolic. Nowadays, the emerging of new educational technologies and using them in the teaching and learning process is an excellent opportunity for teachers to teach chemistry conveniently and effectively. Furthermore, using new educational technology provide a three-dimension visual tool to support conceptual learning. It means that by using educational technologies, students learn the chemistry concepts meaningfully. Using educational technology is a great opportunity for instructors to effectively teach abstract chemistry concepts and reduce misconceptions among chemistry students. For example, Teachers usually teach molecular geometry using chalk and blackboard in traditional classrooms. They explain the topic with some examples about the shape of molecules and ask students to use plastic balls and sticks to apply VSEPR theory. This way cannot show the three dimensions of the molecule structure setting adequately, so it can contribute misconception among chemistry students. Educational technologies like simulation and virtual reality create an opportunity for supporting three-dimension visual tool to improve student-learning achievement in chemistry concepts

Due to the many advantages of implementing educational technology in teaching and learning chemistry, countries have been using new technology in their

education system. However, they still have challenges in the effective use of technology in the teaching and learning process. Researchers reported that although the availability of new education technology in developed and developing countries is increasing, there is considerable evidence indicating the reluctance of teachers to transform the ways they are teaching. Even though the countries spent lots of money to support the education system to be equipped with adequate educational technologies and encourage the teachers to use educational technology in their teaching process, they are unsuccessful in using technology in the education system effectively.

Undoubtedly, underdeveloped countries like Afghanistan have more challenges in using educational technology in teaching and learning in the school and event in the universities. However, the governments tried a lot and specified the budget to equip the education system with modern educational technology. Some schools and universities have enough educational technology, but the teachers are still reluctant to use educational technology. They are using it but in traditional ways. Many factors affect the level of using educational technologies in the class.

Teachers' attitudes is one of the contributing factor that inhibit teacher to use educational technology effectively in class. Teachers with positive attitudes usually are more successful in using technology in their teaching, while teachers with negative attitudes are reluctant to use technology in the class. Therefore, consideration of teacher's attitude toward using educational technology is crucial because if a teacher has a negative effect on using educational technology, he/she will stand against it, and the organization cannot succeed in using educational technology effectively in the education system.

Besides teachers' attitudes toward using technology in the classroom, knowledge is also considered an important and fundamental factor of significant utilization of technology in the education system. Various researchers indicated that the reason of why teachers are not interested in using technology is their lack of knowledge in using new educational technology. Without consideration of teachers' knowledge of using technology, integrating educational technology in the education system is wasting time and money. Because if teachers don't have adequate knowledge

and skill of using technology, undoubtedly, they don't want to use or cannot use educational technology effectively in the class.

Moreover, we cannot neglect the demographic differences like genders, years, and experiences of using technology in the class. It was proved that gender, years and experience do affect the usage of educational technology effectively in class based on previous research. Furthermore, the policymaker should consider the demographic difference when they want to integrate educational technology into the education system and should provide appropriate training programs based on demographic differences like instructors' different attitudes, knowledge, and necessities.

Based on problems explained before, this study intended to investigate the implementation of educational technology in Afghanistan throughout Afghan chemistry lecturers' attitudes and knowledge toward using educational technology. This research also intended to examine the relationship between lecturers' knowledge and attitudes regarding the level of using educational technology in the class.

1.7 Research Objectives

This research planned to receive the following objectives:

(a) To determine the level of using educational technology in chemistry classes of Afghanistan universities.

(b) To determine the level of Knowledge of Afghanistan chemistry lecturer in implementing educational technology in the classroom.

(c) To determine the chemistry lecturers' attitude toward using educational technology in the classroom.

(d) To determine the relationship between chemistry lecturers' attitudes and the level of using educational technology in the classroom.

(e) To determine the relationship between chemistry lecturers' knowledge and the level of using educational technology in the classroom.

1.8 Research Question

The following research questions were answered in this study:

(a) What is the level of using educational technology in Afghanistan chemistry classes?

(b) What is Afghanistan chemistry lectures' attitudes in using educational technology in the class?

(c) What is Afghanistan chemistry lectures' knowledge in using educational technology in the class?

(d) Is there any significant relationship between chemistry lecturers' attitudes and the level of using educational technology in the class?

(e) Is there any significant relationship between chemistry lecturers' knowledge and the level of using educational technology in the class?

1.9 Research Hypothesis

Based on the fourth and fifth objective, there is two following research hypothesis in this study:

(a) The first hypothesis:

H0: p =0 (There is no significant relationship between lecturers' knowledge and level of using educational technology in the class).

H1: $p \neq 0$ (There is significant relationship between lecturers' knowledge and level of using educational technology in the class).

(f) The second Hypothesis:

H0: $p = 0$ (There is no significant relationship between lecturers' attitudes and level of using educational technology in the class).

H1: $p \neq 0$ (There is significant relationship between lecturers' attitudes and level of using educational technology in the class)

1.10 Conceptual Framework

This research emphasizes to study and determine the level of knowledge and attitude of Afghan chemistry lecturers in using educational technology in the class. Therefore, in the conceptual framework, the related ideas and concepts needed are involved and give a picture of this study. Furthermore, two important and key research questions responded by searching for the outcome of Afghan chemistry lecturers' knowledge and attitude toward using educational technology in the classroom. Figure 1.2 shows the conceptual framework for this research.

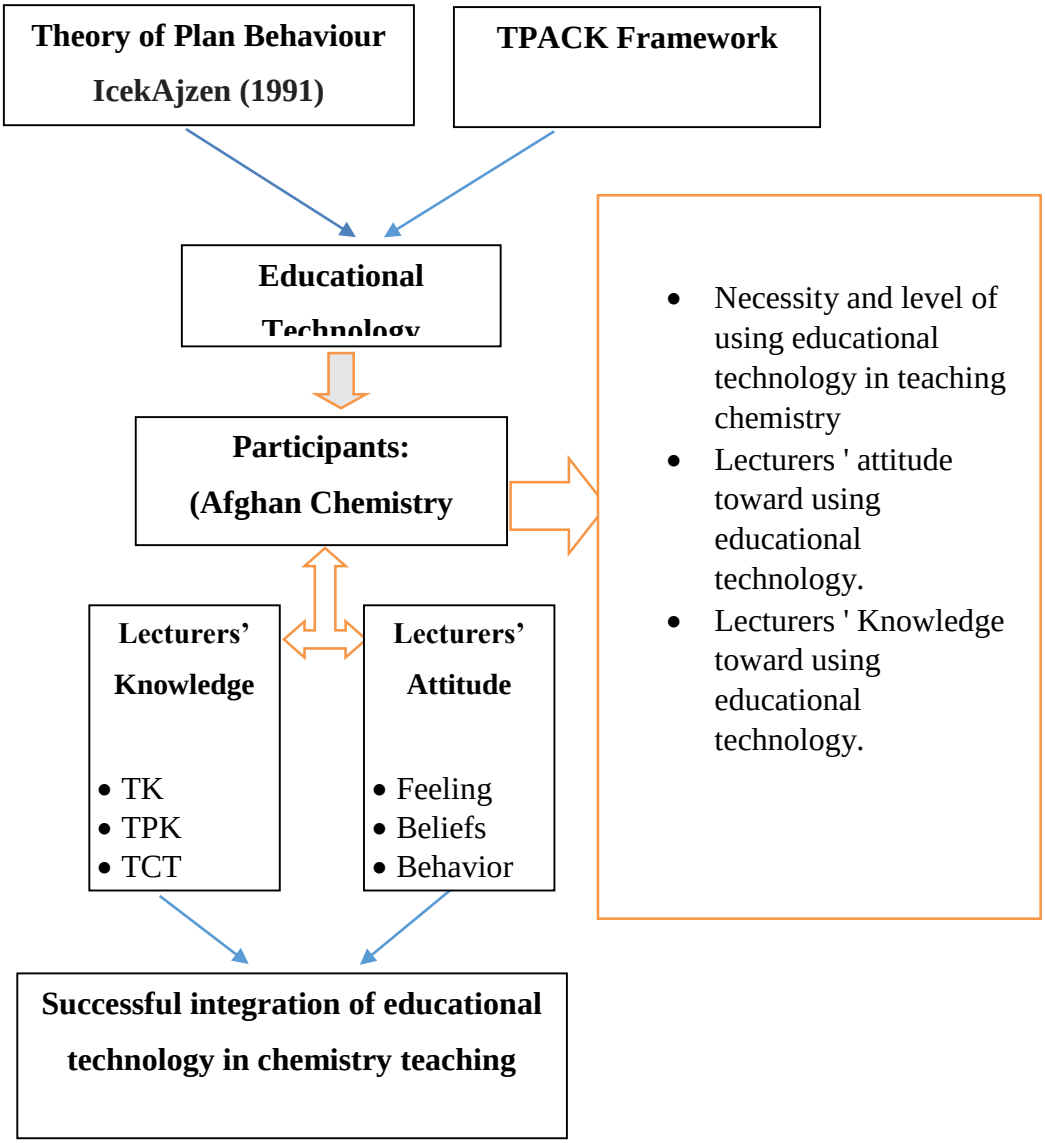

Figure 1.2: Conceptual Framework for this research

The education experts have developed many theories, models, and frameworks for technology integration with the particular objective of using technology in the class. The most popular technology framework in the last years has involved the model of RAT, STR, TIM, technology acceptance model, and TAPAK (Hanover Research, 2013; Hughes et al., 2008; Gray, Thomas and Lewis (2010); Koehler and Mishra, 2009). The researcher used the TPACK framework and planned behavior theory by Ajzen (1991) in this study.

TPACK comprises TK, PK, CK, and each knowledge's interaction (Schmidt et al., 2009). Teachers need to be able to implement technology effectively. In the beginning, the TPACK theory is the basis for understanding the relationships between a teacher's TK, PK, and CK. It is believed that the three types of knowledge are what teachers need to integrate technology into their programs effectively (Koehler and Mishra, 2009). TPK, TCK, and PCK are the inter-relationships between the three main components of TK, PK, and CK. An educator TPACK represents the convergence of the three main types of knowledge and connection knowledge. The purpose of the system is to help researchers think and calculate (as surveys were carried out in the model), the teachers of information must use technologies in lessons (Schmidt et al. 2009). The TPACK models served as the framework for the entire study since this study aimed to understand the correlation between theory and practice (for example, TPACK scores for teachers and their usage of the educational technology).

Pedagogical values and the education of the students are affected by theoretical, emotional, and developed expectations of understanding. In essence, incorporation of technology depends on educator values, the technology available, and expectations. Ajzen's (1991) theory of planned behavior provides the basis for the present study. In specific contexts, the theory aims at predicting and describing human behavior. The proposed behavior model has three models that are expected to herald a behavioral result: behaviors, personal expectations, and perceived behavioral management. This hypothesis has also been advocated as an effective method by some researchers to educate participants on their technology attitudes (Sugar, Crawley and Fine, 2005). Essentially, decision-making that leads to or does not do something can be based on attitudes and motivation levels. Ajzen (2005) notes that positive or negative attitudes are the principal indicators of a person's intention to achieve a behavior, built out of our beliefs and experiences.

Moreover, Ajzen reveals that teachers have difficulty changing their educational beliefs in technologies, based on experience that expands Pajares (1992)'s research, which led scientists to explore teacher convictions. In her study, Ertmer (2005) emphasized that researchers still need to understand the role of teaching beliefs in their excitement for using technology and the need for new means to test different

teaching beliefs. In 2006, Ajzen noted that it was to look at their attitudes and behavior to understand teachers' thoughts. Palak and Walls (2009) have found that teachers ' attitudes toward technology are the strongest indicator of whether and how they implement high tech education approaches into their classrooms in their analysis of teachers who do not change their practices despite targeted professional development.

1.11 Significance of Study

This research examined the attitudes and knowledge of Afghanistan chemistry lecturers towards using educational technology in the class. Besides, this report discussed the use of technology in classes as well as the relationship between lecturers' knowledge and attitude with the level of using educational technology in the classroom. This research carried out based on motivation and inspiration in education where lecturers are not familiar with the potential, efficient, and beneficial use of technology and its challenges in learning and teaching chemistry.

Education in Afghanistan is deficient due to war and poverty compared to developed countries. So, the Ministry of Education and the Ministry of Higher Education in Afghanistan are preparing to upgrade the education system with technical resources on the education list of developed countries Baha (2006). He Indicated that technology growth and development in Afghanistan is growing day by day, affecting all fields, especially education. He also pointed out that the development of technology in education is significant and can bring about improvements in teaching and learning. Therefore, the result of this study will assist the Ministry of Education and Higher Education to efficiently and successfully incorporate technology into the teaching and learning process in Afghanistan's schools and universities. Because this study would enable the Ministry of Education and the Ministry of Higher Education to recognize such problems as the lack of knowledge of lecturers, the lack of attitudes of lecturers, and demographic gaps in educational technology and how to address them.

According to Beebe (2002), In Afghanistan, the Ministry of Information Communication Technology established an ICT policy focusing on integrating ICT in

education. The Ministry of Education (MOE), Ministry of Higher Education (MOHE), along with the Ministry of Information Communication Technology (MOICT), wanted to develop an ICT curriculum, create opportunities for foreign universities to help ICT-building Afghan universities, and encourage distance learning. The study's outcome will be aware of (MOE) (MOHE) and (MOICT) the challenges and benefits of ICT in education that help them in developing an effective ICT curriculum, encouraging foreigners to develop ICT in Afghan universities, and promoting distance learning.

This study helps the developing process of science education in Afghanistan. The result of this study will reveal the level of knowledge and attitude of lecturers toward using educational technology so that the policymaker can arrange the training program based on lecturers' attitudes and knowledge. When the level of knowledge of lecturers is increased, they can use educational technology effectively. By using educational technology in teaching and learning chemistry, students will learn chemistry and other science concepts meaningfully, and their learning achievement will be improved. Indeed, using educational technology creates a fantastic, interactive, and practical learning environment for students. It is an excellent way of conceptual learning to decrease the rate of misconception among science learners.

1.12 Scope and Limitation of the Study

In this study, the researcher attempted to find the Afghan chemistry lecturers' knowledge and attitudes toward using technology in the class. The researcher used the quantities method and supported the data by a qualitative approach. He wanted to collect data through questionnaires to achieve the goal. The researcher selected 154 Afghan chemistry lecturer for responding to the questioners and lecturers for doing interviews with them from various public universities of Afghanistan.

The researcher focused on the attitude and knowledge of university lecturers in this research study. The investigation results can be generalized in all chemistry departments in Afghanistan universities, educati institutions and schools. In this study, participants are limited to Afghanistan universities' lecturers. Students and schools'

chemistry teachers are not involved in this study. Furthermore, this research limited to teachers' attitudes and knowledge toward using educational technology in chemistry class.

1.13 Operational Definition

The researcher used the following expressions in this study. The following are the definition of them to help the reader for understanding better the conducted research study:

1.13.1 Educational technology

Educational Technology: The consider and moral hone of encouraging learning and improving execution by making, utilizing, and overseeing appropriate technological preparation and assets (Ozdaml, Hürsen, and Özçinar, 2009, Lever-Duffy and McDonald, 2011). Educational tech is any innovation, such as computers and other applications, for informative purposes. For this study, digital educational technologies will be focused on.

1.13.2 Attitude

Attitude is the disposition, point of view, or mental set of someone to refer to them to show how they act, feel, and think. (Webster's New World Dictionary,2000). Similarly, to Hogg and Vaughan (2005), define attitude as characterized as a generally persevering organization of beliefs, feelings, and behavioral inclinations towards socially unusual objects, bunches, occasions, or images. In this study, the researcher will focus on feelings and beliefs.

1.13.3 Teachers' Feeling

Feeling refers to the general state of consciousness considered independently of particular sensations, thoughts, etc. In this research, feeling indicates the lecturers' sensation, anticipate, and comprehension toward using educational technology.

1.13.4 Teachers' Belief

Richardson (1996) described the definition of belief as "psychologically held worldwide understandings, assumptions, or propositions felt to be valid." In this study, belief refers to understanding and predicting the benefit of using educational technology in teaching and learning.

1.13.5 Teachers' behavior

"Behaviour is *describable* as an attempt on the part of an individual to bring about some state of affairs -- either to effect a change from one state of affairs to another or to maintain a currently existing one (Ossorio, 2006, p. 49)". In this article, behavior refers to the teachers who behave toward using new education technology in the class.

1.13.6 Technological Pedagogical and Content Knowledge

(TPACK) Technological Pedagogical Content Knowledge is the knowledge required of instructors to utilize educational technology effectively and comprises technological knowledge, pedagogical knowledge, content knowledge, and the interaction of each information with each other information (Schmidt et al.,2009). Technological pedagogical and content knowledge is essential for every teacher if he wants to use educational technology in teaching processes like planning,

implementing, assessing, and evaluating the outcome. It is a way to determine the ability of a teacher in using technology in the class effectively (Koehler, and Mishra, 209)

1.13.7 Technological Content Knowledge(TCK)

Knowledge of technological content indicates knowledge of the representation of content with technology. Mishra and Koehler (2006). In this research, PCK also refers to how a teacher can use the effective way of educational technology-based the subject content

1.13.8 Technological Pedagogical Knowledge(TPK)

Technological Pedagogical Knowledge (TPK) points to knowledge regarding utilizing and implementing technology-based on different teaching methods (Schmidt et al., 2009, p. 125). In this study, the teachers' knowledge of how to use various educational technologies in teaching chemistry and understand that the way and method of teaching chemistry subject can be changed by using educational technology.

1.13.9 Technological Knowledge

Researchers define the technological knowledge as the knowledge of using both old tools like blackboard, chalk, book, and so on and new technology like the internet and video conferencing (Koehler et al., 2008). At the same time, other researchers define the technological knowledge as one of the constructs of TPACK that refers to how teachers use emerging (new) educational technology in their teaching process (Cox and Graham,2009). In this study, technological Knowledge(TK) is defined as knowledge of using new educational technologies.

1.14 Summary

Industry developed from the first revolution to IR4.0. The main feature of IR4.0 is an immerging new technology that creates facilities and challenges for humans worldwide. Indeed, we need to have an education based on IR4.0 to educate and prepare students with high technology capacity for a better and secure life. For this aim, we should improve the traditional education system by using educational technology in the learning and teaching process. Chemistry is one of the difficult subjects in science with abstract concepts and three representation levels like macro, sub-micro, and symbolic that need educational technology and visual tools to understand chemistry content better and overcome misconceptions among chemistry learners. Many countries invested in technology integration in their education system, but they still have challenges using technology effectively. Among all factors, teachers' attitudes, teachers' knowledge, and demographic differences are considered essential factors in using educational technology. Furthermore, there is a significant relationship between teachers' knowledge and attitude with the level of using educational technology, and policymakers should consider this when integrating educational technology into the education system. To conclude, teachers' knowledge, attitude, and demographic differences are considered important factors that affect using educational technology.

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