



**MASTER OF SCIENCE IN TECHNICAL EDUCATION
(ELECTRICAL AND ELECTRONICS ENGINEERING)**

**Science, Technology, Engineering and Mathematics (STEM) Teachers'
Attitudes towards Technology use in teaching in developing countries:
Bangladesh Perspective.**

BY

ABDULLAHI BINTA SULEIMAN

Student No: 161031203

MSC. TE (EEE)

**DEPARTMENT OF TECHNICAL AND VOCATIONAL EDUCATION
ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT) DHAKA-BANGLADESH
OCTOBER, 2018**

**SCIENCE TECHNOLOGY ENGINEERING AND MATHEMATICS
(STEM) TEACHERS ATTITUDE TOWARDS TECHNOLOGY USE IN
TEACHING IN DEVELOPING COUNTRIES: BANGLADESH
PERSPECTIVE**

BY

ABDULLAHI BINTA SULEIMAN

STUDENT NO: 161031203

MSC. TE (EEE)

**Thesis submitted in partial fulfillment of the requirements of the degree of
Master of Science in Technical Education with specialization
In Electrical and Electronics Engineering**

DEPARTMENT OF TECHNICAL AND VOCATIONAL EDUCATION

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)

ORGANISATION OF ISLAMIC COOPERATION (OIC)

BOARD BAZAR, GAZIPUR-1704, DHAKA BANGLADESH

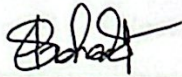
OCTOBER 2018

Islamic University of Technology (IUT)
Organisation of Islamic Cooperation (OIC)
Department of Technical and Vocational Education (TVE)

26 October 2018

We hereby recommend that the thesis prepared by **Abdullah Binta Suleiman** (Student No. 161031203) entitled "**Science, Technology Engineering and Mathematics (STEM) teachers' attitude towards Technology use in teaching in developing countries : Bangladesh peerspective**" be accepted as fulfilling the part of requirement for the degree of Master of Science in Technical Education (M. Sc.T.E.) with specialization in **EEE**.

Board of Examiners



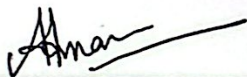
Prof. Dr. Md. Shahadat Hossain Khan
TVE Department

Chairman
(Supervisor)



Prof. Dr. Che Kum Clement
Head, TVE Department and
Dean, Faculty of Science in Technical Education

Member
(Ex-Officio)



Dr. Abdullah Al Mamun
TVE Department and

Member



Prof. Dr. Iqbal Aziz Muttaqi
Ex Director
IER Department
Dhaka University

Member
(External)

DECLARATION

This is to certify that the work presented in this thesis is the outcome of investigation carried out by **Abdullahi Binta Suleiman** under the supervision of **Prof. Dr. Md .Shahadat Hossain Khan** in the Department of Technical and Vocational Education (TVE), Islamic University of Technology (IUT). Gazipur, Bangladesh. It is hereby declared that this thesis/report or part of it has not been submitted elsewhere for the award of any Degree or Diploma

 02/11/2018

Prof. Dr. Md. Shahadat Hossain Khan

2/11/2018 

ABDULLAHI BINTA SULEIMAN

Supervisor and Professor
Department of Technical and Vocational Education (TVE)
Islamic University of Technology (IUT) Gazipur, Bangladesh

Student No. 161031203
Academic Year: 2017-2018

DEDICATION

To my Family, without them I would be nowhere. The success of this work is the answer to their prayers for my graduation from one level to another. May almighty Allah tally the support they have rendered to me upon their heavenly treasures, AMEEN!

ACKNOWLEDGEMENT

First and foremost, I thank almighty Allah for giving me strength and health to permit me finishes my Master degree and thesis successfully, despite my difficult times. The task of writing a thesis of this nature was a unique one. Nevertheless, it required patience, hard work, understanding, perseverance and sympathy. I bared little of any of these therefore; I am grateful to Prof. Dr.Md.Shahadat Hossain Khan my thesis supervisor, for his vital suggestions, criticisms, contributions and encouragement provided, enabled me cross over the hurdles of a challenging educational programme of this nature. In fact I cannot thank him enough for all he has done to me during the entire programme. May Almighty Allah Bless him AMEEN

I owe invaluable gratitude to my beloved Parents Abdullahi Suleiman and Mar yam Abdullahi Omar, not forgetting my good friend for many years Salisu Musa who are always there for me in whatever situation. I can't measure your support, care, love, advice, encouragement and understanding. May almighty Allah reward you all

I also owe my gratitude to Dr Omar jah and his family, for their support and encouragement through this course of study. Many thanks to my friends and colleagues

I convey my gratitude and appreciation to Mr. Adam A. Ali for his overwhelming guidance, support, and suggestion to mention but a few until the completion of this thesis.

I would like to acknowledge my teachers, Prof. Dr. Faruque Ahmad Hoalader, Dr Abdullah Al Mamun, and special regards to the teachers that I have worked with during my teaching assistantship, Prof. Dr Md. Abu Raihan, Mr. Rashedul Huq Shamim and Mr.Hamisi Ramadan Mubarak, under the leadership of the Head and dean faculty of Technical and vocation education Prof. Dr Che kum Clement. It's my great pleasure working with you.

Special thanks go to my brothers and sisters most especially Abu-Bakr, Ali and Omar for endless support, motivation you have rendered to me during this course.

Table of Contents	
DECLARATION	i
DEDICATION	ii
ACKNOWLEDGEMENT	iii
ABSTRACT	iv
ACRONYMS	ix
CHAPTER ONE: INTRODUCTION	1
1.1 Background of the Study.....	1
1.2 Statement of Problem.....	4
1.3 Objectives of Study.....	5
1.4 Research Question.....	6
CHAPTER TWO: REVIEW OF RELATED LITERATURE	7
2.1 Introduction.....	7
2.2 Awareness about the Use of Technology in Education.....	8
2.3 Supporting Technologies in STEM Teaching.....	8
2.4 Teacher's Attitude towards Technology Use.....	10
2.5 Theoretical Framework.....	11
CHAPTER THREE: METHODOLOGY	14
3.1 Research Design.....	14
3.2 Research context.....	14
3.3 Population and Sample.....	14
3.4 Research Tool.....	16
3.5 Data Collection Procedure.....	17
3.6 Data analysis procedure.....	17
3.7 Validity and Reliability.....	18
3.8 Ethical Consideration.....	18
CHAPTER FOUR: RESULTS & FINDINGS	19
4.1 Data Analysis and Interpretation.....	19
4.2 Demographic data Analysis and interpretation.....	19
4.3 Descriptive Analysis and interpretation of CAS using weighted mean (W.M) and standard deviation (S.D).	22
4.4 Analysis and Interpretation of data Using Chi square (χ^2) test.....	23

ABSTRACT

Given the importance that ICT has gained popularity in universal education, in the past two decades, as new capabilities for technology integration emerged, their use in educational contexts has steadily increased. The use of technology for a broad range of learning purposes is now established in many universities of Bangladesh. Many studies have been conducted about technology use attitude in education but majority have concentrated on how to replace traditional with blended methods of instructions. This study wants to find out Science Technology Engineering and Mathematics (STEM) teacher's attitude towards technology use in teaching and learning in universities of Bangladesh.

A descriptive approach was used. A questionnaire in form of an attitude scale adopted from Teo (2010) was used as a tool to collect data and analysis was done based on weighted for the 120 teachers from three universities of Bangladesh.

It was discovered that awareness of teachers based on affective, perceived usefulness, behavioral intentions and overall attitude towards use of technology was significantly high, though challenges such as infrastructure, power, skills, and cost attached to installing and using the technology could not go unnoticed.

The findings of this study have provided a significant role in understanding what teacher's view about technology use in STEM education, what challenges they face and what is needed to be put in place in the universities in order to use technology as a teaching mode in universities and higher education institutions of Bangladesh.

4.4.1 Chi square for Affective Components of Technology use in teaching STEM.....	24
4.4.2 Chi Square for Perceived Usefulness (PU) of technology use in STEM teaching.....	24
4.4.3 Chi-square for Perceived control components (PC) of use of technology in teaching STEM ...	25
4.4.4 Chi-square for Behavioral intension (B.I) components of technology use in STEM teaching ..	26
4.4.5 Chi-square for social intervention (S.I) components of technology use in STEM teaching	27
4.5 ANOVA TESTS	29
4.5.1 One way ANOVA of overall technology attitude components	35
4.6 Correlation analyses	36
CHAPTER FIVE: DISCUSSIONS, LIMITATIONS, RECOMMENDATIONS, IMPLICATIONS	
AND CONCLUSIONS	39
5.1. Discussion on major findings.....	39
5.2 Limitations and Recommendations of the Study.....	41
5.3 Implication	44
5.4 Conclusion	45
Reference.....	46
APPENDIX	48

Tables

Table 3.1: Distribution of Questionnaires and responses.....	13
Table 4.1: Showing demographic data	20
Table 4.4: showing descriptive statistics.....	20
Table 4.3: Chi-square for Affective component.....	23
Table 4.4: Chi-square for perceived useful components.....	24
Table 4.4: Chi-square for perceived control components.....	25
Table 4.6: Chi-square for Behavioural intension	26
Table 4.7: Chi-square for social intension.....	27
Table 4.8: Chi-square for overall technology use attitude.....	28
Table 4.9: MANOVA for participant's technology use attitude, age, gender, and confidence....	30
Table 4.10: One way ANOVA for overall technology use attitude.....	35
Table 4.11: Correlation analysis.....	37

Table of Figures

Figure 1.1 Teachers' attitudes toward teaching STEM a conceptual Framework Source: Thibaut et al.....	3
Figure 1.2 The elements of teachers' cognition Source: Yunus et al.....	3
Figure 2. 1 UTAUT: Unified theory of acceptance and use of technology (Venkatesh et al., 2003)	10
Figure 2.2: Modified Unified theory of acceptance and use of Technologies (Venkatesh, Morris, Davis & Davis, 2003)	11
Figure 4. 1 Pie chart showing percentages of age groups.....	Error! Bookmark not defined.
Figure 4.2 Teaching experience and Age groups.....	31
Figure 4.3 Teaching experience and confidence.....	32
Figure 4.4 Specialization and confidence.....	33

ACRONYMS

ABBREVIATION

ICT

STEM

CAS

TAM

TRA

TPB

SPSS

UTAUT

W.M

APEID

IUT

BUET

DIU

ACRONYM

- Information and Communication Technology
- Science, Technology, Engineering and Mathematics
- Computer Attitude Scale
- Technology Acceptance Model
- Theory of Reasoned Action
- Theory of Planned Behavior
- Software Package for Statistics and Simulation
- Unified Theory of Acceptance and Use of Technology
- Weighted mean
- Asian and the Pacific Programme of Educational Innovation for Development
- Islamic University of Technology
- Bangladesh University of Engineering and Technology
- Daffodil International University

CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

Science, Technology, Engineering and Mathematics (STEM) curriculum is a recent interdisciplinary area which has been discussed by various experts around the world as an important aspect of development. Its role and significance in the overall development of the world cannot be over looked. For instance, STEM education contributes to increase problem-solving skills, critical thinking, and analytical skill that enable students not only to attain skills for innovation but also create avenues for them to create their job opportunities. In addition, leads to better real-world development and better life for citizens (Henderson, Beach, & Finkelstein, 2011) .

With STEM education it is believed that by increasing Mathematics and Science requirements in schools, along with infusing Technology and Engineering concepts, allows students to perform better and be better prepared for advanced education and jobs opportunities(Brown, Brown, Reardon, & Merrill, 2011).For developing Countries like Bangladesh; STEM is visualized to play the following roles as highlighted by Khumbah (2016) .

Increase the national workforce for both local consumption and for export.

Improve national ability to master and utilized science and production of technology, research, and innovation. The three that is technology research and innovation are the major contents that enable societies to discover their faults and devise solutions to eliminate problems that hinder the country from growing.

Shapes the curriculum of both secondary and university education to that which is more practical and less theory (Johnson & Adams, 2011) .

Teaching and learning STEM is mainly influenced by how teachers deliver the contents of STEM. Teachers' attitudes toward use of technology in teaching STEM has got a great role to play in enhancing better teaching and learning of STEM. In the global initiative STEM is critical in creating and expanding opportunities for all the children to access the kind of education that will enable them to navigate and lead the 21st century world (Global-STEM-Initiative, 2018) .

Teachers play a critical role in training and developing the STEM curriculum, in doing that their attitude is an important factor. In teaching STEM, teachers' attitudes are positively associated with instructional practices. Moreover, dissimilar aspects of school context persuade instructional practices either directly or indirectly (Thibaut, Knipprath, Dehaene, & Depaepe, 2018). Teachers' attitudes are set-up to be related to their instructional practices since they establish a teacher's level of dedication to inculcate the new values into daily classroom practices (Rockland et al., 2010). Features of teaching context are important since they produce the required conditions for teaching practices of high quality (Martin & Mullis, 2013). Measuring teachers' attitudes toward teaching integrated STEM has demonstrated to be a complex task (El-Deghaidy & Mansour, 2015; Goodpaster, Adedokun & Weaver, 2012). Attitude is an evaluative judgments' about an object. "The term 'attitude' is defined as the overall evaluation of an object on several dimensions (good/bad, pleasant/ unpleasant)" (Thibaut et al., 2018, p. 5). However on hand instruments for measuring teachers' attitudes toward STEM, only appraise attitudes toward each of the different STEM disciplines individually (Al Salami, Makela, & de Miranda, 2017). A conceptual framework for teachers' attitudes toward teaching STEM consisting of three dimensions: cognition, affect and perceived control were proposed van Aalderen-Smeets, Walma van der Molen and Asma (2012) .

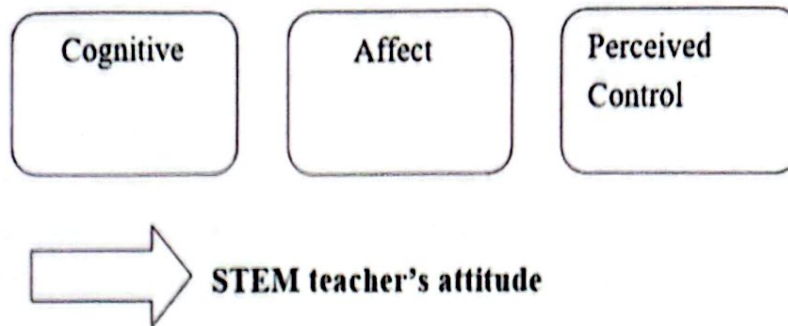


Figure 1.1 Teachers' attitudes toward teaching STEM a conceptual Framework Source: Thibaut et al. (2018, p. 5)

Cognition (perceived relevance): refer to the unobservable cognitive dimension of teaching – what teachers know, believe, and think. The impact of teacher cognition on teachers' professional lives, and this has generated a substantial body of research.(Yunus, Salehi, & Amini, 2016) Teachers are active, thinking decision-makers who make instructional choices by drawing on complex, practically-oriented, and context-sensitive knowledge, thoughts, and beliefs.

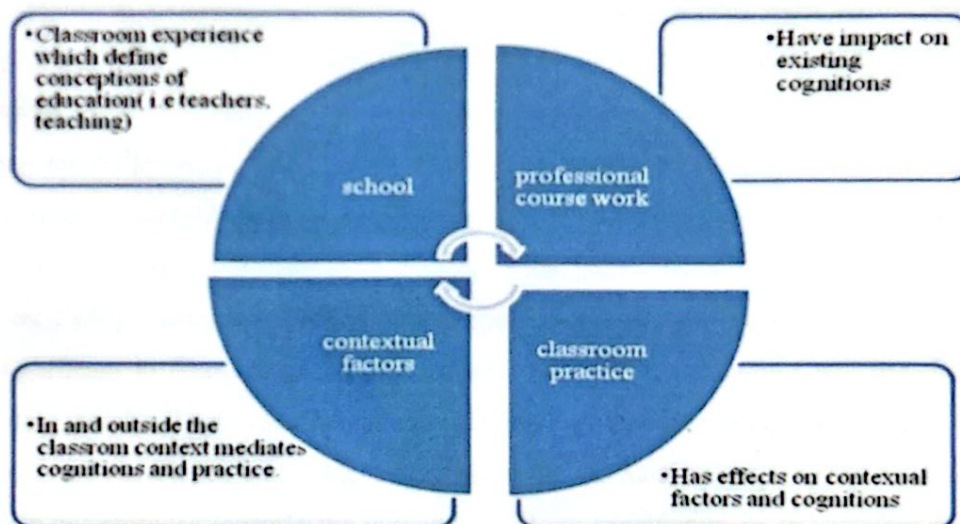


Figure 1.2 The elements of teachers' cognition Source: Yunus et al. (2016, p. 3)

An overview of the direct, indirect and total effects of teachers' attitudes and school context variables on instructional practices for each STUNF principle is given in Table 1.2 for each, a significant correlation between teachers' attitudes and teaching practices is found. Therefore, influencing teachers' attitudes can be used in order to improve STUNF education. Although attitudes are often regarded as stable personal ideas that are difficult to change, a recent study by van Aaldereen-Smeets and Walma van der Molen (2015) showed that teachers' attitudes in teaching STEM can be improved through attitude-focused professional training.

Shifting their attitude towards these interdisciplinary phenomena is important. However preparing teachers to shift to interdisciplinary teaching of STEM remains a significant challenge (Al Salami et al., 2017). In order to successfully achieve technology integration into the STEM curriculum, solid foundation has to be built more especially from teachers. This is one of the steps through which STEM teachers can be fully equipped with necessary talents and capabilities for the task ahead (Shemoff, Sinha, Bressler, & Ginsburg, 2017).

1.2 Statement of Problem

In any institution, teachers play a key role in realizing successful changes in education at classroom level (Tao, 2014). It is general practice that teachers decide on the type, frequency, and quantity of technology tools they use in their curriculum design and lesson delivery. Bahr, Shasha, Farnsworth, (Valerie, & Benson 2004) reported that teachers were comfortable with technology learning but tend to be uncomfortable teaching it. The success of student learning with computer technology will depend largely on the attitudes of teachers, and their willingness to embrace the technology (Tao, 2006). Gaining an appreciation of the teachers' attitudes towards technology use may provide useful insights into technology integration and acceptance and usage of technology in teaching and learning. Thus, the explanation of why some teachers' welcome technology integration while others reject is yet a controversial issue. It therefore remains significant to research on STEM teachers' technology acceptance and use, for better understanding, teachers' attitude towards using technology and its relation with respect to age, gender, years of experience and subject specialization. As such this study tries to investigate STEM teachers' attitudes towards the use of technology specifically in engineering education domain (Hara & Olson, 2017).

In Bangladesh, the national policy on ICT has been one of the human resources development through the provision of basic information and communication skills at all levels of higher education. STEM education can help the next generation of Bangladesh to solve real-world problems by applying concepts that cut across disciplines as well as capacities of critical thinking, collaboration, and creativity (Burrows and Slater 2015). Excellence in STEM education can impact jobs, productivity, and competitiveness in multiple sectors and fields including health, technological innovation and manufacturing, the distribution of information, political processes, and cultural change. Innovation in STEM fields drives not only economic growth, but also the quality of life (Shernoff et al., 2017). Personal characteristics such as educational level, age, gender, educational experience, experience with the technology use for educational purpose and attitude towards using it can influence the adoption of a technology (Williams & Shipley, 2018). Teachers are implored to adopt and integrate technology into teaching and learning activities, but teachers' preparedness to integrate determines the efficiency of the in the classroom (Jones, 2001). The attitudes of teachers towards technology greatly persuade their implementation into their teaching. According to (Russell & Bradley, 1997), anxiety, lack of confidence and competence and fear often takes a back seat to conventional learning methods. Therefore, an understanding of personal characteristics that sway teachers' acceptance of technology into teaching is appropriate. (Buabeng-Andoh, 2012)

1.3 Objectives of Study

The objective of this study is to investigate teacher's attitudes towards the use of technology in STEM teaching in universities of Bangladesh. Specifically, the following research objectives are addressed:

- i) Find out the attitude of the teachers towards the use of technology in teaching STEM
- ii) Establish the relationship between age, gender, and subject domain experience of technology use

1.4 Research Question

To achieve the above objectives the following research questions are answered

- i. What attitudes do teachers bear (keep in mind) towards use of technology in (STEM) teaching?
- ii. What is the relationship between age, gender, and subject domain, experience of technology use in as far technology perception is concern?

CHAPTER TWO: REVIEW OF RELATED LITERATURE

2.1 Introduction

As concerns mount regarding the quality of undergraduate education, particularly in STEM fields, policy makers, educators and student affairs professionals are increasingly focusing on how to support student learning throughout their academic careers (Hora & Oleson, 2017). STEM education encourages progression from teacher-centered passive learning environments to student-centered, active learning environments. Teachers adopting these changes integrate research-validated teaching practices that expand student learning (Pelch & McConnell, 2016). With rapid advancements in technologies, there is greater pressure on teachers to engage various types of tools in conceptualizing, preparing, and delivering their lessons. The thought that teachers' instructional practices are related to their attitudes is not new and has been examined in numerous fields of study. According to Bandura (1986), the behavior of a person is strongly influenced by his/her attitudes. Hence, teachers' attitudes are believed to play an essential role in their classroom practices, their decision making about curriculum and their acceptance of new instructional approaches, techniques, and activities (Thibaut, Knipprath, Dehaene, & Depaepe, 2018).

In addition, with covert expectations from their increasingly technologically savvy students, teachers may feel that engaging technology in the instructional process as an option that they cannot exercise. In line with this global trend, STEM education in Bangladesh aims to provide a science-based education for all students to enable them to use their science learning and knowledge for skills acquisition and development in everyday life (Sarkar & Corrigan, 2014). However STEM technology teaching in Bangladesh is also challenged by the limited resource facilities (Asia and the Pacific Programme of Educational Innovation for Development [APEID], 1991). There is no supply of adequate resources, equipments and aids to schools, yet teachers also fail to seek low-cost resources due to their lack of motivation, interest and training to improve their teaching practice (Tapan, 2010).

Given the growing interest in, and relevance of, integrated technology approaches to STEM education, there is an urgent need to understand the challenges and obstacles in developing and implementing and Use of technology in STEM curricula and instruction. This is of critical importance given the significant variation across individuals, schools, and disciplines with respect to current understandings of STEM education and its core components (Shernoff, Sinha, Bressler, & Ginsburg, 2017, p. 15) .

2.2 Awareness about the Use of Technology in Education

Lots of studies were carried out in order to assess teacher's awareness of technology use in pedagogy; (Mtebe&Raisamo, 2014; Jameela, 2014; Karunanayaka, 2012). These could help in understanding their attitudes towards using them in classroom teaching and instructions. Some of the teachers were not aware of it and some who are aware lack understanding of how to use it (Mishra, Sharma, Sharma, Singh, & Thakur, 2016), Nevertheless, there were teachers who have both knowledge and concept of technology and copyrights, yet they were Unable to share or use the resources due to lack of technology skills (Mtebe&Raisamo, 2014). Technology use in classrooms teaching encourages digital learning tools, such as computers and hand held devices; expands course offerings, experiences, and learning materials; supports learning 24 hours a day, 7 days a week; builds 21st century skills; increases student engagement and motivation; and accelerates learning. Technology also has the power to transform teaching by ushering in a new model of connected teaching. This model links teachers to their students and to professional content, resources, and systems to help them improve their own instruction and personalize learning (U.S Department of education, 2010, p3).

2.3 Supporting Technologies in STEM Teaching

The term technology refers to any modern technological tool (s) used in teaching and learning process, which encompasses but not limited to the following ; *desktop pc; Laptop; palmtop; tablets; iPod; E-reader; mobile phone/smart phones; smart board; multimedia presentation; using internet* for enhancing teaching and learning practice would be considered as technology use in STEM teaching . In achieving excellence in schools, it is important to ensure that teachers are able to integrates technology in to the curriculum (Teo, 2008).

Despite the significant role of technology in effective instruction there is evidence to suggest that there have lackluster response towards using technology for teaching and learning in many parts of the world (T. Teo, 2014). For example (Becker, 2001) found that the extent to which technology has been effectively employed for teaching and learning depends largely on the level of teacher's acceptance. An individual acceptance of technology is referred to as the level at which he/she is willing to use the technology for which it has been designed (T. Teo, 2011). Teaching and learning today is quite different from the earlier days. With the advances in information technology for teaching and learning, learners or students boast in class rooms. For examples a student in class attends to a teacher, a laptop connected to internet and a smart phone connected to a social media platform. Use of technology in teaching STEM has allowed students to be actively thinking about information, making choices, and executing skills than is typical in teacher-led lessons(SRI, june 2016). Technologies such as smart board, multimedia presentation, laptop are ideal to be used by STEM teachers to incarcerate the concentration of students while teaching (Deubel, 2016). There are many advantages in technology integration in teaching and learning STEM, among which includes:-

- a) Empowers educators to efficiently personalize learning with access to data and content.
- b) Prepares students for the 21st century workforce with modern technology skills and competencies.
- c) Helps create blended learning environments that make learning relevant to students' lives.
- d) Gives access to real-time feedback through digital formative and summative assessments and data.

2.4 Teacher's Attitude towards Technology Use

Teachers' perception about use of technology and in education has been investigated over years. A number of models have been suggested which includes but not limited to Theory of Reasoned action (TRA), Theory of planned behavior (TPB), Technology Acceptance Model (TAM), Unified Theory of Acceptance and Use of Technology (UTAUT) (Surendran, 2012). In this literature an important theory that relate closely to understanding perception as behavior intention has been reviewed.

Another critical aspect is the teacher's performance and their satisfaction with teaching (Dermirtas 2010). Shann (1998) mentioned "Teachers satisfaction is a pivotal link in the chain of education reform. Teacher satisfaction influences job performance, attrition, and ultimately student performance" (p.68). Thus identification of teachers' job satisfaction level is important. Teachers with low satisfaction may demonstrate low commitment to improve their instructional pedagogy and this may limit their commitment to change needed for interdisciplinary teaching (Al Salami, Makela, & de Miranda, 2017). From a recent research study Teo reported "the success of student learning with computer technology will depend on the teacher's attitudes and their willingness to embrace the technology. Gaining an appreciation of the teachers attitudes toward technology use may provide a useful insights into technology integration, acceptance and usage in teaching and learning"(T. Teo, 2011, p. 4). Beyond lack of knowledge and vision, teachers mentioned a number of other challenges, not all of which are completely new but may be particularly meaningful when applied to technology use in STEM instruction. These include needs related to lack of time (both for collaborative planning and instructional time to use technology in STEM Classroom teaching), school structure and organization, assessments for STEM achievement, perceived lack of resources, teacher education, and visible models of STEM integration (Shernoff et al., 2017, p. 11)

2.5 Theoretical Framework

In these study UTAUT (Unified Theory of Acceptance and use of Technology) (Venkatesh, Morris, Davis & Davis, 2003) was used to explain the level of users acceptance and use of information technology in teaching and learning (behavior intervention) STEM. The theory explains four major constructs that affects the intension to use technology and behavior intervention. (Venkatesh, Thong, & Xu, 2016) These construct are independent variables which influence dependent variables, behavioral and usage. Gender, age, experience, and volunteers of system use have indirectly influenced and affect the dependent variables via the four main construct (AlQudah, 2014). Behavioral intention as a critical predictor of the use (Venkatesh et al. 2000).

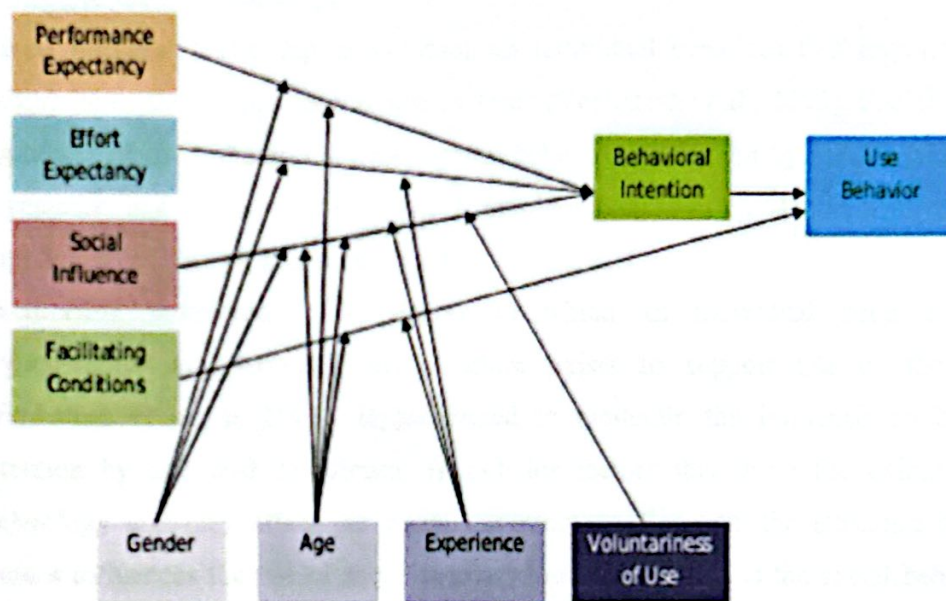


Figure 2.1 UTAUT: Unified theory of acceptance and use of technology (Venkatesh et al., 2003)

The four constructs are:

- a) **Performance expectancy**, "the degree to which an individual believes that using the system will help him or her to attain gains in job performance" (Venkatesh et al., 2003).
in this particular research performance expectation is viewed as the factors that make use of technology to improve teaching and learning of STEM
- b) **Effort expectancy**, "The degree of ease associated with the use of the system" (Venkatesh et al., 2003). Effort expectancy hypothesized to moderate the influence on behavioral intention by gender and age, and experience, that is how much intension is required to use technology in teaching STEM, these includes the ease of use of the existing technology, availability of the technology and the cost of technology let alone learning to use the technology.
- c) **Social influence** "The degree to which an individual perceives that important others believe he or she should use the new system" (Venkatesh et al., 2003). Social influence, hypothesized to moderate the influence on behavioral intention by gender and age, and experience, and volunteers of system. It involves factors of environment in nature; this bounds culture, norms, and superstitions.
- d) **Facilitating conditions** "The degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system" (Venkatesh et al., p. 2003). Hypothesized to moderate the influence on behavioral intention by age, and experience. It includes factors that drive the existing use of technology and may affect the social environment. Example the existence of mobile phones influences the use of social media which in turn affects the social behavior and technology use (AlQudah, 2014).

In these studies, therefore it identified the behavior intervention caused by the attitude of STEM teachers toward the use of technology; this in turn affects intension to use technology by learners of STEM. The Unified theory of acceptance and use of technology puts it that Perceptions of teachers and their ability to use technology can be changed by changing their behavioral intensions in teaching and learning.

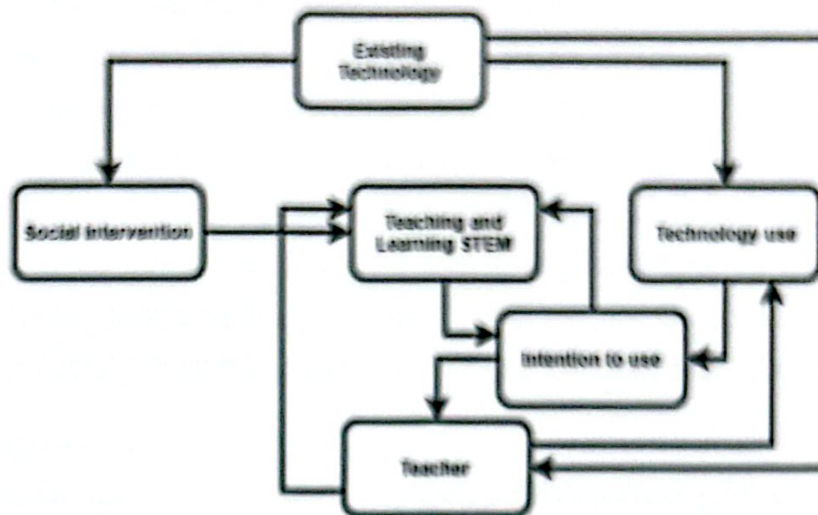


Figure 2.2: Modified Unified theory of acceptance and use of Technologies (Venkatesh, Morris, Davis & Davis, 2003)

CHAPTER THREE: METHODOLOGY

3.1 Research Design

This study employed a descriptive quantitative method of research aimed at investigating teacher's attitude towards technology use in STEM teaching. A research method which concerns itself with the present phenomena in terms of conditions, practices beliefs, processes, relationships or trends in order to explore correlations between two or more entities and attempts to gather quantifiable information that can be used to statistically analyze a particular subject is termed as descriptive survey research (Salaria, 2012). It is used to observe and describe a research problem, topic, or subject without influencing or manipulating the variables in any way. Since this research wanted to study STEM teachers attitude towards the use of technology in teaching, descriptive method of qualitative research was found to be very appropriate. In addition to that, descriptive qualitative method of research is not only about gathering data and tabulating but also includes proper analysis, interpretation, and comparison and identify if any relationship exists among or between the variables in the research.

3.2 Research context

The research was conducted on teachers with specialization in Science, Technology, Engineering and Mathematics in three Universities of Bangladesh namely: Islamic University of Technology (IUT); Daffodil International University (DIU) and Bangladesh University of Engineering and Technology (BUET).

3.3 Population and Sample

The researcher selected participants from a total population of STEM teachers in Bangladesh universities, where by three Universities were chosen, one public University that's Bangladesh University of Engineering and Technology (BUET), one private Daffodil International University (DIU), and one international (IUT).

In Bangladesh the universities are classified in to three: private, public and international. In order to cover the population of universities in Bangladesh those universities were selected from each category. BUET and IUT were selected because 90% of teachers in these universities are mainly STEM teachers and they were selected from specializations of Science (25%), Technology (25%), Engineering (25%) and Mathematics (25%) from each of them. On the other hand DIU was selected from private universities of Bangladesh and also have a large number STEM teachers as engineering and science departments are the largest having the highest number of students and teachers. A total sample of 120 STEM teachers which comprises of male (93) and female (27) was used for this study. The sampling technique of data collection for both IUT & Daffodil Universities was random sampling. The main reasons of choosing this method of sampling include:

It is considered as a fair way of selecting participants or sample of a given population since every member is given equal chance of being selected, it's representativeness of the population. Whereas for BUET snowballing method of sampling was used. The reason as to why snowballing was used is that the researcher not familiar with the BUET environment and therefore needed to consult with few individuals who could link to respondents with knowledge about the subject content, through the help of some individuals will be able to collect data within a few participant and these is what is called snowball sampling technique. In this regard STEM teachers were classified by their age, gender, level of education, Specialization, institutions and their experience in the use of technology.

Table 3.1: Showing distribution of Questionnaire (Attitude scale Teo 2010) and Responses obtained

S/NO	Name of the University	Status	Number Issued	Number Returned
1.	Islamic University of Technology(IUT)	OIC	80	60
2.	Daffodil International University (DIU)	Private	60	50
3.	Bangladesh University of Engineering and Technology(BUET)	Public	20	10
Total			160	120

3.4 Research Tool

An Attitude scale was adopted from Teo (2010) Teo (2010), presented in the APPENDIX SECTION. The attitude scale is named, as a questionnaire which was used in this research; the questionnaire was designed to include different sections:-

- Demographic background,
- Technology experience,
- Perceived confidence.

It was summarized in two main parts as follows:-

Part A: computer experience and perceived confidence: it refers to an individual's judgment of their capabilities to use computers in diverse situations (Marakas, Yi, & Johnson, 1998). Hassan (2003) described computer experience and perceived confidence as a judgment of success or skill in performing a well-defined computing task using a particular application, such as word processing, spreadsheet, or database programs. Computer experience expresses the cumulative effect of exposure to computers and related events (Ciampa, 2013, p. 12). However, to date, there is no commonly accepted approach for its measurement. This study used an analytical approach of computer experience CAS that enabled us to examine its correlation.

Part B: computer attitude scale , has been defined as a person's general evaluation or feeling of favor or antipathy toward computer technologies and specific computer related activities (Smith et al. 2000). Computer attitude evaluation usually encompasses statements that examine users' interaction with computer hardware, computer software, other persons relating to computers, and activities that involve computer use (Palaigeorgiou, Siozos, Konstantakis, & Tsoukalas, 2005, p. 2). This part consists of:-

a) Evaluation of computer experience: this is a measure "On average" the number of years one has used the information technology.

b) Perceived confidence: this is a measure "How confident" one uses technology in teaching STEM.

c) Social confidence: a measure of " how social norms" influence the use of technology. Items of each measure was presented in five-point liker scale from 1 = very low Confidence, to 5 = very high confidence. A scale of 3= neutral.

The CAS was used to measure the attitude of teachers towards the use of technology. Items of each measure was presented in five-point likert scale from 1 = very low attitude, to 5 = very high attitude. A scale of 3= neutral.

Weighted Mean (W.M) of each component of conceptual framework (perceived ease of use, perceived usefulness and attitude towards use) was determined. Table 2 below provides weighted mean based on five point scale.

3.5 Data Collection Procedure

Attitude scale measure Adopted from (Teo, 2010) inform of a questionnaire which contained teachers demographic information, experience in the use of technology, and perceived confidence was dispatched to the STEM teachers, whereby they were asked to freely and willingly respond. Responses were collected after a period of 21 days (Habibi et al., 2015; Lakhal, Khechine, &Pascot, 2013; Şahin & Uluyol, 2016) the returned Questionnaires (Attitude scale Teo 2010) were tabulated and quantified using SPSS Software.

3.6 Data analysis procedure

The scores obtained from the items on each component i.e. those components in part A and part B above will be aggregated to provide corresponding scores for the components. Statistical methods that were used for the analysis of data in this research are descriptive statistics such as frequency, means, and standard deviations. Chi-Square and analysis of variance (ANOVA) will be performed to find out if there is any difference(s) between the participants in terms of the dependent variables like gender, age, specialization and level of education. Bi-variant correlation analyses will be carried out between pairs to find out if correlation exists. Data analysis will be performed using Statistical Package for Social Sciences software (IBM SPSS version 20). The first section will discuss the demographic data of the participants. The second section will involve analysis of data related to the overall attitude of teachers towards technology use in STEM teaching.

3.7 Validity and Reliability

The validity of the questionnaire used in this study was evaluated and confirmed by experts in this field. This was to ensure that the attitude scale inform of questionnaire have an appropriate face and contents validity. A pilot survey study was conducted on 30 questionnaires and confirmed for consistency by using SPSS Cronbach's Alpha test. The questionnaire items will be adopted from the frame work presented in unified theory of acceptance and use of technology theory (UTAUT).

3.8 Ethical Consideration

The data collected will be treated with confidentiality as per the rules and regulation governing data by IUT in relation to the people's government of Bangladesh. The selection process of participants and their participation in this study was conducted with the approval of their respective Universities. Besides, all information related to the participants was kept confidential.

CHAPTER FOUR: RESULTS & FINDINGS

4.1 Data Analysis and Interpretation

This chapter deals with the analysis and interpretation of the data obtained and collected from the participants. The analysis was designed to include three different sections. The first part discussed the demographic data of the participants. While the second section analyzed data related the research first question, *the attitude of teachers towards the use of technology in STEM teaching*, where by the data collected from the participants was computed and aggregated based on the independent variables and tabulated. In this part descriptive statistics was carried out, such as weighted average mean, and standard deviations were calculated for the five components of the attitude scale measure, which at the end gives the overall technology use attitude of the participants. The third section involves analysis of data related to the research second question that is, *to establish relationship between age, gender, and teaching experience and the overall attitude of technology use*. Analysis of variance (ANOVA) was performed to find out if there is any difference(s) between the participants in terms of the dependent variables like gender, age, specialization and teaching experience and confidence in the technology use. Chi-square test was conducted for the components in order to find out if any relation or association exists among or between these components. Bi-variant correlation analyses between the variables were carried out in order to identify if correlation exist or not.

4.2 Demographic data Analysis and interpretation

Demographic data refers to the data that is statistically socio-economic in nature, for example population, education level and employment, gender, marital status, profession, which represent specific geographic locations and are often associated with time.

The sample was categorized according to age, gender, specialization, years of technology use and experience (Arnheim, 1954). 60 participants were obtained from IUT, 50 from DIU and 10 participants from BUET.

Gender: the participants include male and female STEM teachers, from the total participants 77.5% were males and the remaining 22.5% were females.

Specialization: Four STEM specializations were used, science, technology, engineering and mathematics. 17.5 % were science teachers, 12.5% technology teachers. Engineering teachers were 55% of the total participants, while mathematics had 15% of the total participants.

Technology use and teaching experience: this were classified in to three, low experience (1-5 yrs) of teaching, Medium (6-10 yrs), and high experience (11+ yrs) of teaching.

Age: the age was divided in to different groups, as (20-29), (30-39), (40-49), (50-59) and 60 to above. The detail of demographic data is shown in table 4.1 below

Table 4. 1: Showing Demographic Data of the participants

er	Age-group	Count	%	Teaching experience	Count	%	Specialization	Count	%
	20 – 29	33	27.5	Low (1-5)	21	17.5	Science	16	13.3
	30 – 39	29	24.2	Medium (6-10)	22	18.3	Technology	12	10.0
	40 – 49	19	15.8	High (11+)	50	41.7	Engineering	51	42.5
	50 – 59	12	10.0				Mathematics	14	11.7
		93	77.5		93	77.5		93	77.5

b)	20-29	10	8.3	Low (1-5)	6	5.0	Science	5	4.2
	30-39	9	7.5		7	5.8	Technology	3	2.5
	40-49	5	4.2	High (11+)	14	11.7	Engineering	15	12.5
	50-59	3	2.5				Mathematics	4	3.3
d)		27	22.5		27	22.5		27	22.5
	20-29	43	35.8	Medium (6-10)	27		Science	21	17.5
	30-39	38	31.7		29	24.2	Technology	15	12.5
	40-49	24	20.0	High(11+)	64	53.3	Engineering	66	55.0
	50-59	15	12.5				Mathematics	18	15.0
Total(Male Female)		120	100		120	100		120	100

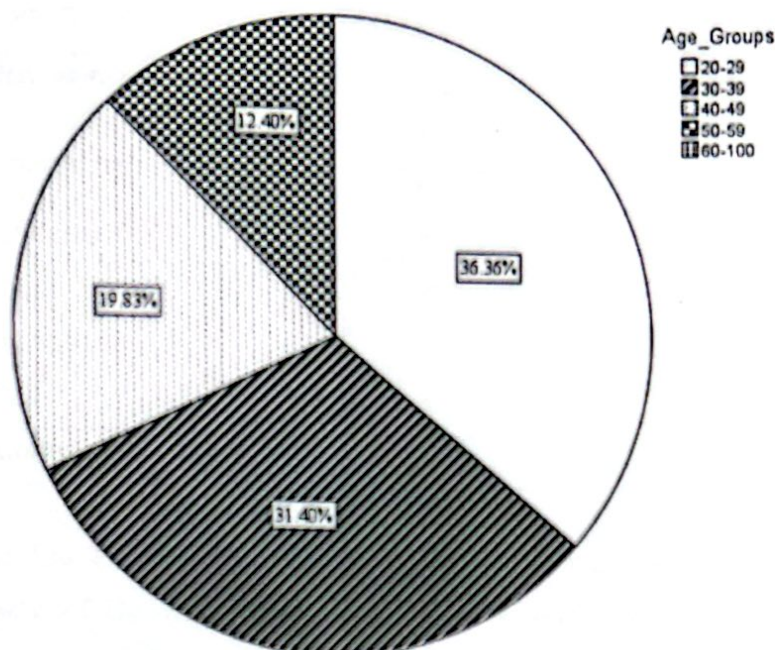


Figure 4.1 Pie chart showing percentages of age groups

4.3 Descriptive Analysis and interpretation of CAS using weighted mean (W.M) and standard deviation (S.D).

The tables 4.2 below show the five components of CAS which are, affective components, perceived usefulness of technology use in teaching and learning at universities of Bangladesh, perceived control components, behavioral intension of the technology user, and social influences over the use of technology in teaching STEM.CAS is the attitude scale measure adopted in this study, also the components were highlighted in the UTAUT (refer to chapter 2).The table represent five components of computer attitude scale measure (CAS), which also comprises of variables or items under each component, the test components and their variables were categorized and rated based on five point scale(5-point Likert scale) refer to chapter 3.Weighted mean and std. deviation were calculated and computed respectively as shown in table 4.2 below

Table 4. 2: descriptive Statistics

Test parameter/components	Variables/Items	W.M	Std. Deviation
Affective	6	3.84	.724
Perceived usefulness	5	3.68	.673
Perceived control	7	3.42	.450
Behavioural intensions	4	3.60	.637
Social influence	3	3.46	.726
Overall technology use attitude	25	3.60	.756

According to Teo Timothy "at global level the overall technology/computer attitude is well above midpoint of the scale (3.00) when using 5-point Likert scale" this indicated that participants in this study held a positive attitude towards the use of technology in STEM teaching (Teo, 2008, p. 6)

The participants showed positive attitudes towards technology use, as shown by the mean score for each subscale being 3.00 and above (on a 5-point scale). The overall positive level of technology use attitude could be attributed to the availability and accessibility to technology (computers & other devices considered in this study as mentioned in detail in chapter two of this study given to the STEM teachers for teaching at various universities in Bangladesh.

4.4 Analysis and Interpretation of data Using Chi square (χ^2) test

In this section, an alternative measure of opinion and confidence has been given to justify the results obtained in section 4.2. The chi-square is carried out to test if there is any association/ link or relationship between the variable/components in the research study. Chi-square (χ^2) has a significance value (Asymp value) of 0.05 at 95% confidence level. The null hypothesis of chi-square assumes that there is no relationship/association among or between the components or variables in question. If p value is less than or equal to 0.05 then its statistically significant and null hypothesis should be rejected.

There is a statistical relationship between the categorical variables/components of the study. On contrary to that if p value is greater than 0.05 it is not significant statistically and consequently the null hypothesis fails to reject, which may either means there exists no any relationship between the variables or other factors may intervene.

4.4.1 Chi square for Affective Components of Technology use in teaching STEM.

The table below shows the chi-square analysis for the six variables of affective component

Table 4. 3: Chi square for Affective Components

	Affect 1	Affect 2	Affect 3	Affect 4	Affect 5	Affect 6
Ch-square	13.400	21.33	62.875	152.083	67.750	87.513
df	2	3	3	4	4	4
Asymp. sign	.000	.000	.000	.000	.000	.000

The six variable representing affective component of technology/computer use, when subjected to chi-square test, from the results obtained it is seen that there is no difference in opinion of the respondents about affective component of technology use in teaching and learning STEM

4.4.2 Chi Square for Perceived Usefulness (PU) of technology use in STEM teaching.

The table below shows chi-square statistical test for five variables representing perceived usefulness of technology use in teaching STEM

Table 4. 4: Chi Square for Perceived Usefulness

	PU 1	PU 2	PU 3	PU 4	PU 5
Ch-square	112.583	123.500	68.917	16.850	29.850
Df	4	4	2	4	2
Asymp. Sign	.000	.000	.000	.050	.000

Chi-square analysis of this component was conducted and these were obtained i) Technology help me improve my teaching and learning process (PU1 $\lambda^2=112.583$, Asymp. Sig =0.000), ii) Technology makes it possible for me to work more (PU2 $\lambda^2=123.500$, Asymp. Sig= 0.000), iii) Technology can allow me to do more interesting and creative work (PU3 $\lambda^2=68.917$, Asymp. Sig=0.001), IV) Most of the things that technology is used for, I can do them just without the technology as well (PU4 $\lambda^2= 16.850$, Asymp. Sig= 0.050), v) Technology can enhance better teaching and learning methods to a degree which justify extra effort needed to familiarize with it (PU5= 29.850, Asymp. Sig= 0.000).

From the results produced by chi-square test of these components, there is no difference in opinion of the respondents about perceived usefulness of technology use in teaching and learning. These results do not differ from the measure obtained by weighted mean.

4.4.3 Chi-square for Perceived control components (PC) of use of technology in teaching STEM

The table below shows chi-square statistical test for seven variables representing perceived Control components of technology use of STEM teaching

Table 4. 5: Perceived Control Component

	PC 1	PC 2	PC 3	PC 4	PC 5	PC 6	PC 7
Chi-square	61.750	53.333	38.600	110.250	86.012	76.000	73.417
df	4	4	3	4	4	4	4
Asymp. sign	.000	.000	.000	.0060	.0051	.000	.0062

The seven variable representing perceived control component of technology use, when subjected to chi-square test yielded that i)I can probably teach myself most of the technology that is required in teaching and learning or (I can be able to learn by myself most of the technology that is required in teaching and learning)(PC1 $\lambda^2=61.750$,Asymp. Sig= 0.000), ii)I can make use of technology and manipulate it the way I want (PC2 $\lambda^2=53.333$, Asymp. Sig=0.000), iii)If I get problem using technology, I can usually solve this problem (PC3 $\lambda^2=38.600$,Asymp. Sig= 0.000),IV)I am not in complete control when I use technology in teaching (PC4= λ^2 110.250,Asymp. Sig=0.060), V)I need an experienced person nearby when I use technology (PC5 $\lambda^2=86.012$,Asymp. Sig=0.051), VI) I do not need someone to tell me the best way to use technology (PC6= λ^2 76.000,Asymp. Sig=0.000), and vii) I need additional training for using technology in teaching(PC7 $\lambda^2=73.417$, Asymp. Sig=0.062).

4.4.4 Chi-square for Behavioral intension (B.I) components of technology use in STEM teaching

The table below gives the chi-square tests for the four items under the behavioral intensions of technology use in teaching

Table 4.6 Chi - square for Behavioural Intension

	B.I 1	B.I 2	B.I 3	B.I 4
Chi-square	87.750	81.750	31.500	99.583
Df	4	4	4	4
Asymp.sig	.000	.000	.000	.000
(p value)				

The four variable representing behavioral Intention to use technology in STEM teaching, under chi-square test yielded that i) I would avoid any classroom instructions if I knew it involved working with technology (BI1 $\chi^2=87.750$, Asymp. Sig= 0.000), ii) I avoid coming in contact with technology in university (BI2 $\chi^2=81.750$, Asymp. Sig=0.000), iii)I only use technology at university when I am told to so (BI3 $\chi^2=31.500$, Asymp. Sig= 0.000),iv) I will use technology regularly throughout university (BI4 $\chi^2=99.583$, Asymp .Sig= 0.000).These results provide positive intension by respondents towards using technology in their teaching as seen above from the values obtained. Most of the participant has good intension to use the technology in their teaching and they are willing to use it more.

4.4.5 Chi-square for social intervention (S.I) components of technology use in STEM teaching

Table below shows the social intervention components of technology use in STEM teaching.

Table 4. 7: Social Intention

	S.I 1	S.I 2	S.I 3
Chi-square	70.583	40.083	16.417
Df	4	4	4
Asymp. Sign	.000	.000	.003

Social influence (Venkatesh& Davis, 2000), it is the extent to which the participants believes that people surrounding them appreciates their use of technology in teaching STEM. Social influence does have a positive relationship with the behavioral intension to use technology (Unified of Acceptance and Use of Technology UTAUT), refer to chapter two of this study for more clarification about UTAUT.

4.5 ANOVA TESTS

ANOVA (Analysis of variance) is a statistical technique for testing if population means are all equal. When an ANOVA test is conducted, it's attempting to determine if there is a statistically significant difference among the groups. If it is found that there is a difference, then there is need to examine where the group differences occur. In this technique all data are treated together and a general null hypothesis of no difference among the means of the various samples is tested. In ANOVA analysis also p value (Asymp value) is 0.05 at 95% level of confidence and it could also be equal to 0.01 under 99% confidence levels.

In this study all the tests/simulations by the software SPSS were carried at 95% level of confidence for SPSS. Therefore cutoff p value is 0.05. The null hypothesis for ANOVA assumes that the population means are all exactly equal. As mentioned earlier if Asymp value is found to be less than reference value or equal, that is 0.05, then differences between some of the means are statistically significant and the null hypothesis should be rejected and conclude that all population means are equal.

But if the value is greater than 0.05 then the differences between the mean are not statistically significant and no enough evidence to reject the null hypothesis that all the population means are equal. For deriving more useful results, analysis of variance can be used as a measure of dispersion (deviations from the mean). The variance of an individual score from the grand mean can be broken down in to two parts, within group variance and between groups variance. The comparison of the size of between group variance and within group variance is called F- ratio or F- value. The variables for which one-way ANOVA test were tested are age, gender, teaching experience, confidence in technology use and specialization.

From the chi-square tests carried on social influence variables above, it showed that the participant are using technology in their classroom teaching because they wanted to and they had a positive notion about using it as such they feel comfortable and enjoyed using it, irrespective of others perception and thinking.

Table 4. 8: Overall Technology Use Attitude

	Affective component	Perceived useful component	Perceived control component	Behavioral intention	Social influence
Chi-square	93.400	85.883	59.750	81.800	67.650
df	11	10	14	11	8
Asymp. value	.000	.000	.000	.000	.000

Table 4.8 above shows the chi-square analysis of the overall technology use attitude components towards teaching STEM. From these tests, p value (Asymp sig) is found to be less than 0.05 at 95% level of confidence. It is statistically significant and the null hypothesis being rejected. It can be concluded that the variables are related to each other and that there is a statistical relationship between the variables. On the other hand the results also verifies (UTAUT), Unified theory of acceptance and use of technology in chapter 2 above, which puts it that Perceptions of teachers and their ability to use technology can be changed by changing their behavioral intentions in teaching and learning (Venkatesh, Thong, & Xu, 2016). The first question were analyzed using weighted mean of descriptive analysis, but descriptive analysis does not give conclusion, as it is further analyzed using chi-square analysis and answered by the tests conducted. Based on that it can be said that the participants in this study so far held a positive believe, and attitude towards the use of technology in STEM teaching.

Table 4.9: MANOVA Analysis for the Participants attitudes towards technology usage with respect to gender, age, confidence in technology use, and specialization

		Sum Squares	df	Mean Square	F	Sig.
Gender	Between Group	.539	2	.270	1.547	.217
	Within Groups	20.386	117	.174		
Specialization	Between Groups	.910	2	.455	.515	.599
	Within Groups	103.415	117	.884		
Age Groups	Between Groups	49.884	2	24.942	38.343	.000
	Within Groups	76.108	117	.650		
How confident teacher is	Between Groups	2.273	2	1.137	2.834	.063
	Within Groups	46.927	117	.401		

based on the obtained results above from table 4.9, p value is greater than .05, for the following variables, gender [F (2,117) =1.547, p=.217], specialization [F (2,117) =.515, P =.599], confidence of a teacher [F (2,117) =2.834, P =.063]. There are no statistically significant differences between their group mean, gender has no effects on these variables, confidence in use of technology, specialization and experience in teaching. As such the null hypothesis may be accepted then teaching experiences of the participants varies accordingly with their gender, specialization, and their confidence in the use of technology for teaching STEM.

But for the age groups [F (2,117) = 38.343, p =.000] which is below than p =.05. Then there are statistically significant differences between the means of these variables. Teaching experiences and one or all the age groups as determined from the analysis, but specifically which group differs that can be found in mean plots and bar chart below. It is not significant statistically and consequently there is no enough prove to reject the null hypothesis. Therefore it can be concluded that there is no differences in the mean of the age group, specialization, and their confidence in teaching. P value for differs in the case of teaching experience and the age groups, for teaching experience. This is statistically significant and therefore null hypothesis being rejected and there is/are difference(s) in the mean of age group and the teaching experience. This is shown below.

Mean plot graph of the teaching experience, age, specialization and confidence in teaching STEM.

Mean plots are most commonly used types of graph because they are simple to create and very easy to interpret. They are also a flexible chart type and there are several variations of the standard bar chart including horizontal bar charts, grouped or component charts, and stacked bar charts. Nominal data are categorized according to descriptive or qualitative information such as county of birth, or subject studied at university. Ordinal data are similar but the different categories can also be ranked, for example in a survey people may be asked to say whether they thought something was very poor, poor, fair, good or very good. On the other hand mean plots are used to see if the mean varies between different groups of the data. In most cases the data contains a specific grouping variable. Mean plots are formed by vertical axis (group mean) and a horizontal axis (group Identifier).

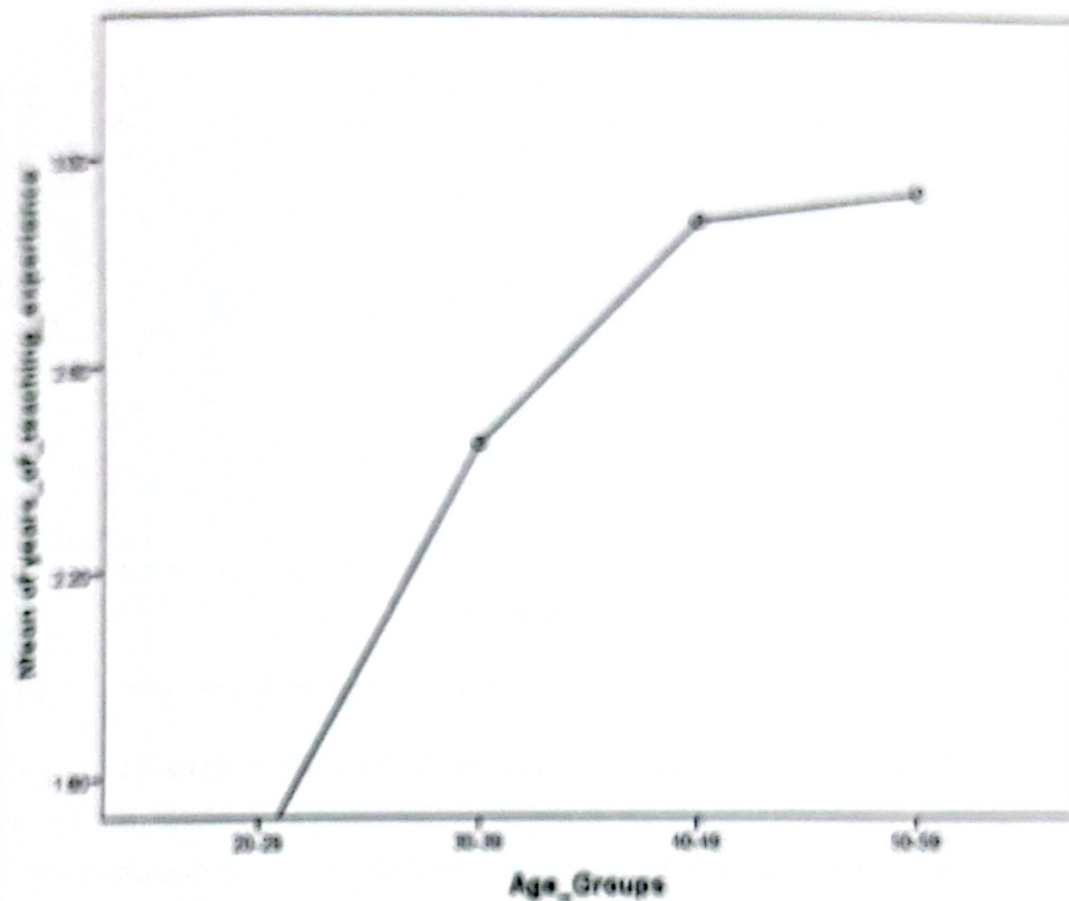
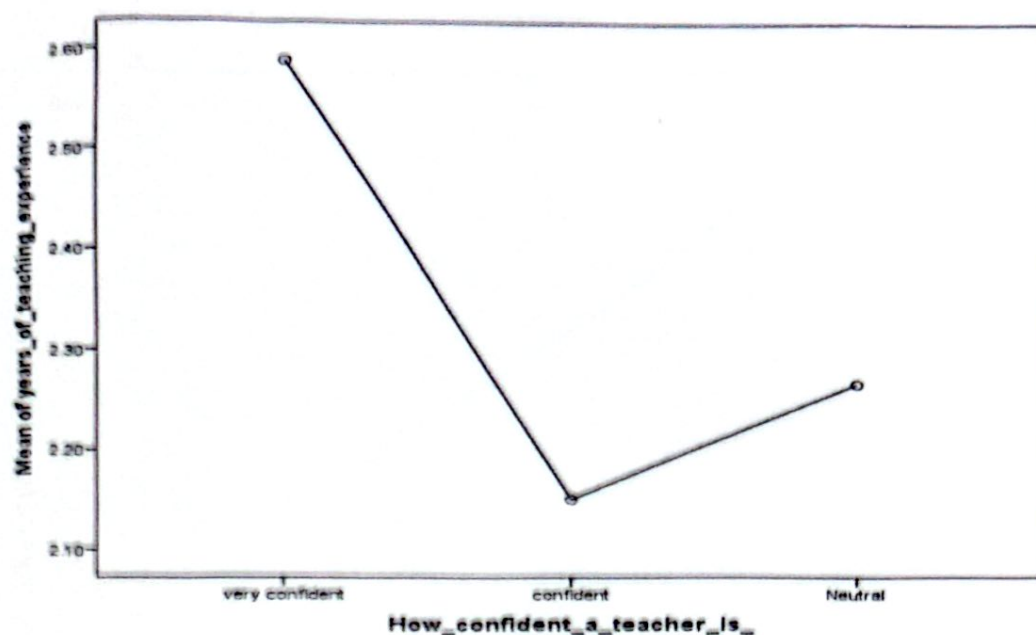


Figure 4. 2: Mean Graph of Age Group and Teaching Experience

The figures above shows a plot mean of teaching experience and age groups and a bar chart also, it shows how teaching experience change with the age. It can be seen that age group 50-59 are having the highest experience, followed by 40-49 and 30-39 age groups. This indicates that teachers obtained more experience in teaching as he/she spends more years of teaching.



Fi

Figure 4.3 : Teaching Experience and Confidence

From the mean graph of teaching experience and confidence in the use of technology, it can be observed that, teaching experience and confidence in the use of technology in teaching has a positive relationship and the two are directly proportional to each other, meaning that experience in teaching brings about confidence in the use of technology, this is because the more a teacher is using these technologies in teaching the more confident he/she become in using them, which also increase his/her intension to use them more, this in general has makes a teacher to have a better attitude in the use of technology in STEM teaching.

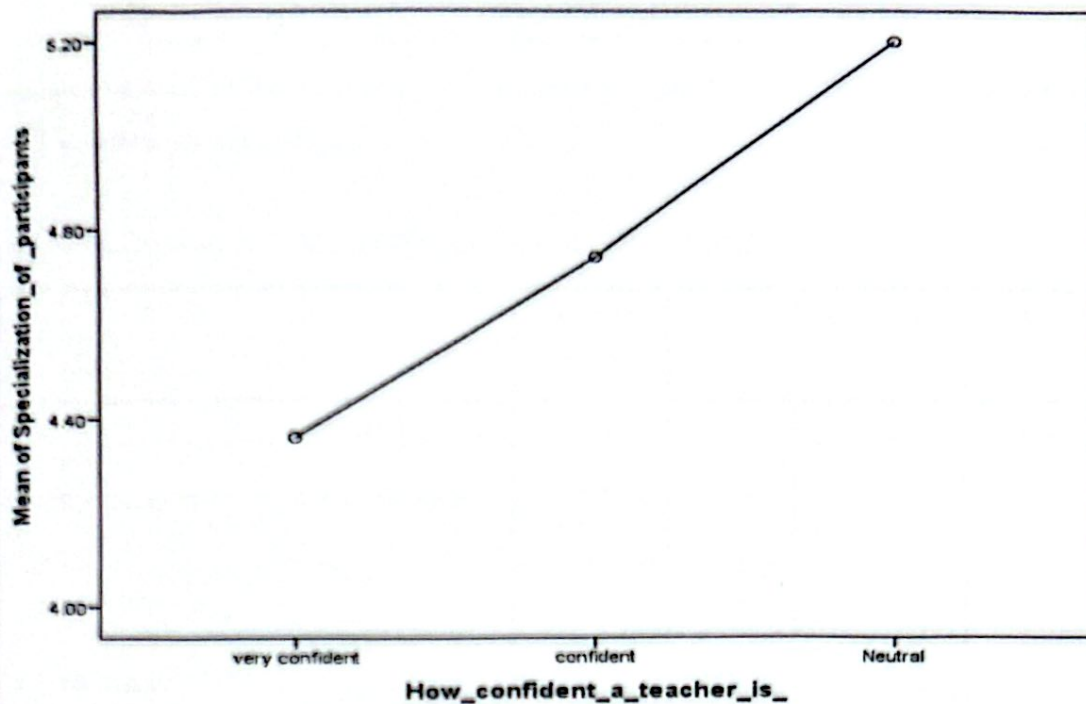


Figure 4. 4: Specialization and confidence

Mean plot of specialization and confidence in teaching. From the mean plot of specialization and confidence in the use of technology, the results shows that specialization effect on the confidence in the use of technology, the teachers stands neutral, that is neither confident nor nervous. It can be said that specialization does affect confidence in technology use.

4.5.1 One way ANOVA of overall technology attitude components

A one way, between groups multivariate analysis of variance was performed on the five dependent variables (affective, perceived usefulness, perceived control, behavioral intention and social influence) for age and gender.

Table 4. 10: One-way ANOVA for Overall Technology use Attitude

		Sum of Squares	df	Mean Square	F	Sig.
Affective component	Between Groups	8.161	3	2.720	1.454	.116
	Within Groups	497.964	116	4.293		
	Total	506.125	119			
perceived useful component	Between Groups	5.162	3	1.721	2.022	.012
	Within Groups	453.763	116	3.912		
	Total	458.925	119			
perceived control component	Between Groups	15.106	3	5.035	3.268	.017
	Within Groups	1128.061	116	9.725		
	Total	1143.167	119			
Behavioral intent	Between Groups	26.285	3	8.762	3.109	.000
	Within Groups	540.082	116	4.656		
	Total	566.367	119			
Social influence	Between Groups	13.528	3	4.509	1.290	.204
	Within Groups	520.438	116	4.487		
	Total	533.967	119			

The results obtained for social influence, [$F(3,119) = 1.290, P = .204$], and affective component, [$F(3,119) = 1.454, p = .116$]. p value obtained is above .050 at 95% confidence level, this means the differences between their means is not statistically significant on age and gender, and no enough evidence to reject the null hypothesis that their means are all equal.. These results suggest that both male and females STEM teachers at all ages were similar in their attitudes towards the technology use. For other three variables, behavioral intervention [$F(3,119) = 3.109, p = .000$], perceived control component, [$F(20,119) = 3.268, P = .017$] and perceived useful components, [$F(20, 119) = 2.022, P = .012$]. It is statistically significant

The differences between some of their means is significant statistically and null hypothesis rejected, meaning that not all the means of the population variables are equal. This also indicates how much control they have over technology (perceived control), and their behavioural intentions in using the technology (behavioural intention). For the, perceived usefulness, behavioural intention and the perceived control components, significant differences were found. The results suggest that while most STEM teachers were similar in their attitudes towards the use of technology, they had different views regarding each component within computer attitude had different views regarding each component within computer attitude.

4.6 Correlation analyses

To study the relationship between technology use attitudes, years of teaching and confidence in the use of technology among STEM teachers, a bi-variant correlation was performed. Table 4.11 below shows the summary

Table 4.11 correlation analysis between confidence, teaching experience and technology use

The table below shows correlation analysis between teaching experience, confidence and overall technology use attitude, this is carried out in order to determine the relationship between these variables.

Table 4.11 correlation analysis between confidence, teaching experience and technology use

		Confidence tech use	in Teaching experience	Technology use attitude
Confident technology use	Pearson	1	-.187*	.534
	Correlation			
	Sig. (2-tailed)		.040	.058
	N	121	121	119
Teaching experience	Pearson	-.187*	1	.816
	Correlation			
	Sig. (2-tailed)	.040		.022
	N	121	121	119
Technology use attitude	Pearson	.534	.816	1
	Correlation			
	Sig. (2-tailed)	.058	.022	
	N	119	119	119

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

The results show a non-significant but strong correlation between teaching experience of and overall technology use attitude. There was also a significant and strong relationship between the confidence in technology use, teaching experience and technology use attitude. However, there were significant correlations between the overall computer attitudes and teaching experience.

From the various tests carried above, such as descriptive statistics, correlation test, chi-square, and analysis of means of variances (ANOVA). It was found that the participants had a positive attitude toward the use of technology as the means of overall technology attitude scale found to be (3.66) above the midpoint (3.00) for a 5-point Scale (Teo 2008).

There was also a positive linear relationship between the age groups, gender, teaching experience, specialization and the confidence in the use of technology in STEM teaching, these was obtained from chi-square test results where by the components were found not to have a significant relationship with each other which proves the relationship that exists between these variable or components.

However some of the variables were found to have differences between their means from ANOVA test conducted, these is due to effect of other intervening variables which are not considered in this study. Correlation analysis shows a strong significant relationship between technology use attitude, teaching experience and confidence in the use of technology.

CHAPTER FIVE: DISCUSSIONS, LIMITATIONS, RECOMMENDATIONS, IMPLICATIONS AND CONCLUSIONS

5.1. Discussion on major findings

Attitude towards computer use was measured in terms of the affective, perceived usefulness, perceived control, social intervention and behavioral intention components in the CAS (Selwyn, 1997). All 120 participants responded to all items in the CAS and no missing data was found in the survey. Table 4.3 presents the participants' weighted mean scores with the standard deviations of the five components of computer attitude scale. These suggested that participants were more positive about their affect towards technology and intention to use technology than their perceptions of the usefulness of the technology and their control of it (technology) as overall technology use attitude is found to be 3.66. The results, however, also suggested that participants perceived themselves to be in control of technology to a lesser degree than they thought the technology was useful and had liked (affective) and intent to use (behavioral) the technology. Overall, the participants showed positive attitudes towards the computer, as shown by the mean score for each subscale being 3.00 and above (on a 5-point scale). The overall positive level of technology use attitude could be attributed to the availability and accessibility to technology given to the STEM teachers at various universities of Bangladesh.

As the results of Table 4.2 of descriptive statistics reveals the highest weighted mean belongs to the affective component, followed by perceived useful component, then behavioral intentions to use the technology, social influence was found to be second to the last and perceived control component got the least score. Analyzing the results pertaining to attitudes toward technology use with CAS component revealed that the five components (Affective component, perceived useful component, perceived control component, behavioral intension and social influence) was mostly concerned with the computer appreciation.

This may be influenced by the expansion in the use of technology in various dimensions including social, educational, economic and cultural interactions as well as home, workplace and other social contexts. The research findings of Ben-Jacob and Liebman (2010) demonstrated that fear of technology (technophobia) is still one of the most prominent factors in non-usage or low-usage of the available technology at hand in teaching. Teachers play an important role in the implementation of technology in our universities and their attitudes have proved to be significant predictors of technology use, in other words teachers' attitude towards the use of technology in STEM teaching is one key factor for the success of the technology utilization in the universities.

A multivariate analysis was conducted to investigate the effects of gender, specialization, age and confidence on participant's attitudes towards the use of technology. MANOVA results regarding the gender, specialization, age, and confidence are presented in Table 4.9. The results indicated no statistically significant effect of gender on the combined dependent variables ($F(2, 117) = 1.547, p = .217$). Moreover, no statistically significant effect of confidence on the combined dependent variables ($F(2, 117) = 2.834, p = .63$). On the other hand, no statistically significant effect of specialization on the combined dependent variables ($F(2, 117) = .515, p = .599$). Participants in different group of ages differ in their attitude towards technology use ($F(2, 117) = 38.343, p < 0.05$).

From table 4.10, one way, between groups multivariate analysis of variance was performed on the five dependent variables (affective, perceived usefulness, perceived control, behavioral intention and social influence) for age and gender. No significant differences were found: $F(20, 119) = 1.454, p = .116$. These results suggest that both male and females STEM teachers at all ages were similar in their attitudes towards the technology use. For other three variables, behavioral intervention [$F(20, 119) = 3.109, p = .000$], perceived control component, [$F(20, 119) = 3.268, P = .000$] and perceived useful components, [$F(20, 119) = 2.022, P = .012$]. It is statistically significant.

The differences between some of their means are significant statistically and null hypothesis rejected, meaning that not all the means of the population variables are equal. This also indicates how much control they have over technology (perceived control), and their behavioral intentions in using the technology (behavioral intention). For the, perceived usefulness, behavioral intention and the perceived control components, significant differences were found.

The results suggest that while most STEM teachers were similar in their attitudes towards the use of technology, they had different views regarding each component within computer attitude had different views regarding each component within computer attitude.

To examine the relationship between technology attitude and years of teaching and level of computer confidence among STEM teachers, a bivariate correlation was performed. Table 4.11 shows the summary; there was no significant relationship between the level of technology use confidence and behavioral intention to use it. However, there were significant correlations between the overall technology use attitude and years of teaching and level of confidence in the use of technology in teaching.

5.2 Limitations and Recommendations of the Study

There are several limitations in this study. Firstly, the data collected was through self reports and this may lead to a common method variance, a situation that may raise the true associations between variables, resulting in counterfeit significant findings. Secondly, the sample size in this study is relatively small, thus limiting the extent to which the findings of this study may be generalized. Thirdly, the data was collected using a cross-sectional, single administration design and it was not possible to establish the stability of the attitudes of the participants. Finally, the variables chosen in this study were determined by the selection of the CAS for data collection.

As a result, other significant variables that influence computer attitudes are excluded, leading to a limited understanding of computer attitudes. For example, Teo, Lee and Chai (2008) and Teo (in press) found evidence to suggest that computer attitudes may be studied using the Technology Acceptance Model (TAM) with variables external to the model, such as subjective norms, facilitating conditions, and technological complexity. Outside the premise of the TAM, Teo (2007) found the perceived importance of computers, enjoyment, and anxiety to be associated significantly with computer attitudes.

Future research may include comparison of the results of this study against a larger sample using a longitudinal design to examine computer attitudes over time. Other variables could be added to examine their impact on computer attitudes.

Additional research will be needed to validate the results of the current study. Moreover, some reasons from the limitation of study, undergraduate students showed positive attitudes toward technology use on account of the availability and accessibility to computers and Internet given to students at the University premises and campuses. Future studies could add other variables to examine their impact on technology use attitude in STEM teaching.

It is found that the teachers' opinions are high about technology use being useful, easy to use and also the attitude towards of using it being positive.

The following **recommendations** may suite putting into consideration the suggestions made by the participants: -

Curriculum developer

The goals of any successful educational program such as STEM teaching using technology depend on the effective curriculum. The curriculum should be made in order to meet the needs and current demands of the society, and the expectations of the people. Teachers' involvement in the curriculum development process is essential in meeting the needs of society. Hence, teacher involvement is important for successful and meaningful curriculum development. This study may contribute to the development of STEM teaching curriculum that would give more emphasis on the use of technology in teaching STEM, by including more syllabus that requires practical and use of technology ,a project-based that would reflects learners carriers and also to improve performances with the use of these technologies.

Policy makers

The commitment of the management, stakeholders, government agencies and policy makers with inclusive- education and technology (ICT) are important factor of creating enthusiasm and motivation towards increased and improved use of these technologies in teaching and learning STEM in the faculties of our universities and other higher institutions of Bangladesh. As the study sees a positive attitude of teachers toward use of these technologies, it may stress the needs of policy makers' involvement by providing adequate technologies for STEM teaching and learning.

Improve Infrastructures and increase facility

The study reveals that many universities are challenged because of insufficient infrastructure. The infrastructure in this context comprises of hardware and software required to integrate the technology in teaching and learning, internet, electricity and laboratory facility. Building and improving the existing infrastructures will increase accessibility to technology. Hence making teachers get familiar to the technology and there by using it in teaching STEM.

In order to improve the skills and knowledge of the teachers on how to effectively use technology as a teaching approach, this can be done through training like workshops, conferences and short courses designed to impart pedagogy. By doing so the necessary skills needed by the teacher to embrace the use of the technology can be increased. Stable, affordable internet connectivity is a requirement for efficient technology use in teaching STEM. There should be an effort to extend the internet even to the rural areas, for effective use of technology in all parts of the country. This will help universities to conduct their classes anywhere by any user.

Future research

This study tried to find out the attitudes of teachers towards the use of technology in teaching STEM. The study has contributed to the research about the use of technology in the process of teaching and learning especially STEM in Bangladesh universities. The findings of this research have given more attention to the technology use attitude in order to increase and encourage the use of these technologies in universities of Bangladesh in particular. The study recommends that future researchers should consider the in-depth qualitative studies such as classroom observations and in-depth interviews to investigate the level technology use by STEM teachers.

5.3 Implication

Although STEM teachers of different disciplines/level of education, gender, and universities may benefit from the study still there are challenges that this studies did not consider which are part of the limitations and gap for other researchers to fill (Zwiep and Benken 2013).

An important implication is the importance of the involvement of universities administrators in the STEM technology attitudes development in teaching. The curriculum designers should create opportunities and roles for university teachers and administrators to increase their familiarity with STEM education. Teachers need to be aware that collaboration and discussions with their colleagues enhance their learning and understanding of new technology skills and help them to successfully integrate the learning into their existing classroom practices. However, this study contributes to body of knowledge in as far as technology use attitude towards STEM as a mode of teaching has been appreciated in universities education of Bangladesh. The contributions of this study are as follows.

- i) Provide useful knowledge on teacher's opinion on technology use attitude in teaching and learning in existing literature.
- ii) The finding of the study provides useful insights to the curriculum developers, and understanding of technology use attitude in teaching and learning STEM.
- iii) The study contributed to the existing body of research regarding the use of technology for STEM teaching in developing countries.

5.4 Conclusion

This study identified that teachers have high opinion on the use of technology as a mode of teaching and learning at universities in Bangladesh. However, they encounter many challenges. Infrastructure, pedagogy, insufficient funds and inadequate levels of skills in the use of these technologies is the center of all challenges in the implementation of this great educational endeavor. Improvement of infrastructure, deliberate action to impart skills in use of technology, funding of technology programs at the universities and sensitization of teachers to use technology in teaching. Components increase the probability of excellent integration of technology in teaching-learning process. In doing so teachers will increase the attitude towards the technology use as a mode of teaching and learning at universities and higher educational institution of Bangladesh.

Reference

- Al Salami, M. K., Makela, C. J., & de Miranda, M. A. (2017). Assessing changes in teachers' attitudes toward interdisciplinary STEM teaching. *International Journal of Technology and Design Education*, 27(1), 63-88.
- Brown, R., Brown, J., Reardon, K., & Merrill, C. (2011). Understanding STEM: current perceptions. *Technology and Engineering Teacher*, 70(6), 5.
- Buabeng-Andoh, C. (2012). Factors Influencing Teachers' Adoption and Integration of Information and Communication Technology into Teaching: A Review of the Literature. *International Journal of Education and Development using Information and Communication Technology*, 8(1), 136-155.
- Global-STEM-Initiative. (2018). STEM Teaching and Learning. Retrieved from <https://teachforall.org/global-stem-initiative>
- Henderson, C., Beach, A., & Finkelstein, N. (2011). Facilitating change in undergraduate STEM instructional practices: An analytic review of the literature. *Journal of research in science teaching*, 48(8), 952-984.
- Hora, M. T., & Oleson, A. K. (2017). Examining study habits in undergraduate STEM courses from a situative perspective. *International Journal of STEM Education*, 4(1), 1.
- Khumbah, N. (2016). STEM Education and African Development. *African Policy Review*.
- Shernoff, D. J., Sinha, S., Bressler, D. M., & Ginsburg, L. (2017). Assessing teacher education and professional development needs for the implementation of integrated approaches to STEM education. *International Journal of STEM Education*, 4(1), 13.
- Williams, D. H., & Shipley, G. P. (2018). Cultural taboos as a factor in the participation rate of Native Americans in STEM. *International Journal of STEM Education*, 5(1), 17.
- Yunus, M. M., Salehi, H., & Amini, M. (2016). EFL teachers' cognition of teaching English pronunciation techniques: A mixed-method approach. *English Language Teaching*, 9(2), 20.
- AlQudah, A. A. (2014). Accepting Moodle by academic staff at the University of Jordan: Applying and extending TAM in technical support factors. *European Scientific Journal, ESJ*, 10(18).
- Deubel, P. (2016). Technology integration: Essential questions. *Computing Technology for Math Excellence. CT4ME*.
- Mishra, S., Sharma, M., Sharma, R. C., Singh, A., & Thakur, A. (2016). Development of a scale to measure faculty attitude towards open educational resources. *Open Praxis*, 8(1), 55-69.
- Pelch, M. A., & McConnell, D. A. (2016). Challenging instructors to change: A mixed methods investigation on the effects of material development on the pedagogical beliefs of geoscience instructors. *International Journal of STEM Education*, 3(1), 5.
- Sarkar, M., & Corrigan, D. (2014). BANGLADESHI SCIENCE TEACHERS' PERSPECTIVES OF SCIENTIFIC LITERACY AND TEACHING PRACTICES. *International Journal of Science and Mathematics Education*, 12(5), 1117-1141.
- SRI. (june 2016). Technology and Education Reform.
- Surendran, P. (2012). Technology acceptance model: A survey of literature. *International Journal of Business and Social Research*, 2(4), 175-178.
- Teo. (2008). Pre-service teachers' attitudes towards computer use: A Singapore survey. *Australasian Journal of Educational Technology*, 11(12), 24.

- Teo, T. (2011). Factors influencing teachers' intention to use technology: Model development and test. *Computers & Education*, 57(4), 2432-2440.
- Teo, T. (2014). Unpacking teachers' acceptance of technology: Tests of measurement invariance and latent mean differences. *Computers & Education*, 75, 127-135.
- Thibaut, L., Knipprath, H., Dehaene, W., & Depaepe, F. (2018). The influence of teachers' attitudes and school context on instructional practices in integrated STEM education. *Teaching and Teacher Education*, 71, 190-205.
- Venkatesh, V., Thong, J. Y., & Xu, X. (2016). Unified theory of acceptance and use of technology: A synthesis and the road ahead.
- Habibi, M., Springer, C., Spence, M., Hansen-Petrik, M., Fouts, H., & Kavanagh, K. (2015). Using Videoconferencing for Lactation Consultation: An Online Survey of Acceptance among a Sample of Mothers in the United States. *The FASEB Journal*, 29(1 Supplement), 581.585.
- Lakhal, S., Khechine, H., & Pascot, D. (2013). Student behavioural intentions to use desktop video conferencing in a distance course: integration of autonomy to the UTAUT model. *Journal of Computing in Higher Education*, 25(2), 93-121.
- Şahin, S., & Uluyol, Ç. (2016). Preservice Teachers' Perception and Use of Personal Learning Environments (PLEs). *The International Review of Research in Open and Distributed Learning*, 17(2).
- Salari, N. (2012). Meaning of the term descriptive survey research method. *International journal of transformations in business management*, 1(6), 1-7.
- Teo, (2010). The development, validation, and analysis of measurement invariance of the technology acceptance measure for preservice teachers (TAMPST). *Educational and Psychological Measurement*, 70(6), 990-1006.
- Arnheim, R. (1954). *Art and visual perception: A psychology of the creative eye*: Univ of California Press.
- (5) *Teachers' Attitudes and Levels of Technology Use in Classrooms: The Case of Jordan Schools* | Request PDF. Available from: https://www.researchgate.net/publication/43199030_Teachers'_Attitudes_and_Levels_of_Technology_Use_in_Classrooms_The_Case_of_Jordan_Schools [accessed Oct 11 2018].
- Cheung, R., & Vogel, D. (2013). Predicting user acceptance of collaborative technologies: An extension of the technology acceptance model for e-learning. *Computers & Education*, 63, 160-175.
- Fauziah, Taib, M., Ramayah, T., & Abdul Razak, D. (2008). Factors influencing intention to use diminishing partnership home financing. *International Journal of Islamic and Middle Eastern Finance and Management*, 1(3), 235-248.
- Park, S. Y. (2009). An Analysis of the Technology Acceptance Model in Understanding University Students' Behavioral Intention to Use e-Learning. *Educational Technology & Society*, 12(3), 150-162.

APPENDIX

Islamic University of Technology (IUT)

Department of Technical and Vocational Education (TVE)

Survey Questionnaire

Introduction:

As part of my MScTE thesis at Islamic University of Technology (IUT) Dhaka, We are conducting a survey to investigate teachers' attitudes towards use of technology in STEM (science, technology, engineering, mathematics) teaching. We will appreciate if you could complete the following sections. Any information obtained herein will remain confidential. Your name and identifications will keep confidential and use anonymously.

Please note that your honest response will have a serious impact on this research and will be highly appreciated.

Meaning of Technology (in this research):

The term technology refers to any modern technological tool(s) used in teaching and learning process, which encompasses but not limited to the following: *Desktop pc; Laptop; Palmtop; Tablet, iPad, iPod; E-Reader, Mobile phone/Smart Phone; Smartboard, Multimedia presentation or any other technology you might have used before in teaching and learning. Even using Internet for enhancing teaching and learning practice would be considered as technology use in STEM.*

Objectives: The aim of this study is to investigate the attitudes of teachers towards use of technology in STEM teaching.

Research questions

This study is designed to identify the following questions:

1. What attitudes do teachers bear (keep in mind) toward use of technology in Interdisciplinary (STEM) teaching?
2. Do these attitudes differ by age, gender, subject domain, years of technology use and perceived confidence?

Respondent's Details:

Age: _____ Gender: _____ Nationality: _____

Department: _____

Discipline taught:

Science/Technology/Engineering/ Math

If other: _____

Teacher education level: _____

Part A: Computer experience and perceived confidence

1. How many years on average have you used technology in teaching? _____
2. How confident are you in using the technology while teaching?
[1]Very confident [2] Confident [3] Neutral [4] Nervous [timorous] [5] Very nervous
[very timorous]

Computer Attitude Scale

Direction: please check (✓) and rate yourself based on what you actually do given the statements using the following scale:

[1]Strongly agree [2] Agree [3] Neutral [4] Disagree [5] strongly disagree

No.	Section 1: Affective Component	1	2	3	4	5
1.	If given the opportunity to use technology such as computer, I am afraid that I might damage it in some way*					
2.	I hesitate to use technology for a fear of making mistakes I can't correct*					
3.	I don't feel apprehensive (worried) using technology					
4.	Technology make me feel uncomfortable*					
5.	Using technology does not scare me at all					
6.	I hesitate to use technology in teaching because of my lack of experience.*					
No.	Section 2: Perceived Useful Component	1	2	3	4	5
1.	Technology help me improve my teaching and learning process					
2.	Technology makes it possible for me to work more					
3.	Technology can allow me to do more interesting and creative work					
4.	Most of the things that technology is used for, I can do them just without the technology as well*					
5.	Technology can enhance better teaching and learning methods to a degree which justify extra effort needed to familiarize with it.					
No.	Section 3: Perceived Control Component	1	2	3	4	5
1.	I can probably teach myself most of the technology that is required in teaching and learning or (I do able to learn myself most of the technology that is required in teaching and learning)					
2.	I can make use of technology and manipulate it the way I want					
3.	If I get problem using technology, I can usually solve this problem					
4.	I am not in complete control when I use technology in teaching					

5.	I need an experienced person nearby when I use technology*					
6.	I do not need someone to tell me the best way to use technology					
7.	I need additional training for using technology in teaching					

No.	Section 4: Behavioral Intention Component	1	2	3	4	5
1.	I would avoid any classroom instructions if I knew it involved working with technology*					
2.	I avoid coming in contact with technology in university*					
3.	I only use technology at university when I am told to so*					
4.	I will use technology regularly throughout university					
No.	Section 5: Social influence	1	2	3	4	5
1.	I use technology because my colleagues believe that I should do so.					
2.	I am using technology because many teachers are using it and Encouraging me to do so.					
3.	Technology is generally being used in university so I feel ashamed not to use it as well.					

Thank you for your sincere cooperation.

Researcher

Abdullahi Binta Suleiman

Student No: 161031203

Chief Investigator

Dr. Md. Shahadat Hossain Khan,

Assistant Professor

Room: 302, Academic building 1,

Department of Technical and Vocational Education (TVE)

Islamic University of Technology (IUT), Board Bazar, Gazipur-1704, Bangladesh

Email: skha8285@uni.sydney.edu.au; skha8285@iut-dhaka.edu

Mob: +8801798470248



STEM Teachers Attitudes towards Technology use in teaching in developing countries (Bangladesh)

PARTICIPANT INFORMATION STATEMENT

(1) What is the study about

The aim of this study is to investigate the attitudes of teachers towards use of technology in STEM teaching. It would like to explore your understanding and behaviour towards technology while you are teaching in Science, Technology, Engineering and Mathematics disciplines.

(2) Who is carrying out the study?

This study is being conducted by M.sc TE student of the Department of Technical and Vocational Education (TVE), Islamic University of Technology, a subsidiary organ of the Organisation of Islamic Cooperation (OIC), under the supervision of Dr. Shahadat Hossain Khan, Assistant Professor Technical and Vocational Education (TVE) Department; Islamic University of Technology (IUT).

(3) What does the study involve?

This study involves filling a questionnaire and you will be distributed a structured questionnaire to complete at a time suitable for you.

(4) How much time will the study take?

It may take 20-30 minutes.

(5) Can I withdraw from the study?

Yes. Being in this study is completely voluntary you are not under any obligation to consent and - if you do consent - you can withdraw at any time without affecting your relationship with Islamic University of Technology, and without having to give a reason. If you decide to withdraw from the study, please inform Dr. Shahadat Hossain Khan. (telephone: +8801798470248, Email: skha8285@iut-dhaka.edu).

(6) Will anyone else know the results?

All aspects of the study, including results, will be strictly confidential and only the researcher will have access to information about participants. A report of the study will be prepared and submit to the IUT for partial fulfilments for the award of masters of Science in Technical Education in Electrical and Electronics Engineering. It is important to note that Individual participants will not be identifiable in such reports.

(7) Will the study benefit me?

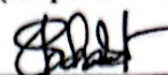
While there are no direct benefits to the participants, as there is no reward or reimbursement for participation in this study, but there may be indirect benefits in terms of the findings of this study contributing for improving current pedagogical techniques in STEM education of developing countries like Bangladesh.

(8) Can I tell other people about the study?

Yes.

(9) What if I require further information about the study or my involvement in it?

When you have read this information, the researchers will discuss it with you further and answer any questions you may have. If you would like to know more at any stage, please feel free to contact: Dr. Shahadat Hossain Khan (telephone: +8801798470248; email: shkhants@gmail.com; skha8285@iut-dhaka.edu).



<p>Ms Abdullah Binte Suleman ID No:161031203 M.Sc. TE student Technical and Vocational Education (TVE) Department; Islamic University of Technology (IUT) Room: F102, Female Hall, IUT campus, Board Bazar, Gazipur-1704, Bangladesh Email:</p>	<p>Dr. Shahadat Hossain Khan Chief Researcher Assistant Professor Technical and Vocational Education (TVE) Department; Islamic University of Technology (IUT) Room: 302 Academic Building 1, IUT campus, Board Bazar, Gazipur-1704 Bangladesh Email: shkhants@gmail.com Web: http://www.iutoic-dhaka.edu Mobile: +8801798470248</p>
---	--

This information sheet is for you to keep

