MASTER OF SCIENCE IN TECHNICAL EDUCATION
(ELECTRICAL AND ELECTRONIC ENGINEERING)

MScTE THESIS

Trainee-Teachers' Attitudes Towards Technology Adaption in Tertiary Engineering Education in Bangladesh

NAFIU SALELE
STUDENT NO: 153604

Supervisor: **Dr. Md. Shahadat Hossain Khan**

DEPARTMENT OF TECHNICAL AND VOCATIONAL EDUCATION
ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
DHAKA-BANGLADESH

OCTOBER, 2017

DECLARATION

This is to certify that the work presented in this thesis is the outcome of an investigation carried out by **Nafiu Salele** under the supervision of **Dr. Md. Shahadat Hossain Khan** in the Department of Technical and Vocational Education, Islamic University of Technology (IUT) Board Bazar, Gazipur, Dhaka – Bangladesh.

Dr.Md. Shahadat Hossain Khan	**Nafiu Salele**
Supervisor and Assistant Professor	Student No: 153604
Department of Technical and Vocational Education	Academic Year: 2016/2017
Islamic University of Technology Gazipur, Bangladesh	

DEDICATION

This thesis is dedicated to my family for all their continued love and support. First and foremost to my beloved parents Alhaj Salele Muhammad and Hajiya Ikilimat Salele Muhammad, for all their years of support and encouragement. You have successfully made me the person I am becoming.

To my siblings. You continued to support me through words and actions. I value all your inputs and appreciate your confidence in me.

To my late sister Aishat Salele (the first), whose life was cut short at tender age and gone forever from our loving eyes. You left a vacuum never to be filled in our lives. May Allah (SWT) grant you Jannatul Firdaws.

I love you all and miss you beyond words.

ACKNOWLEDGEMENT

In the name of Allah the Most Merciful, the Most Compassionate all praise be to Allah, the Lord of the worlds; peace and blessings be upon Mohammad His servant and messenger.

First and foremost I must express my limitless gratitude to Allah, the Ever-Magnificent; the Ever-Merciful, for His help and blessings. This journey would have never been accomplished without His guidance.

I am heavily indebted to the Organization of Islamic Cooperation (OIC) for giving me the opportunity to achieve this feat.

I am grateful to the people, who worked with me from the beginning till the completion of this research work. I would like to thank my supervisor, Dr. Md. Shahadat Hossain Khan for the guidance, encouragement, advice and constructive criticism he has provided to me throughout the period of this research work.

I would also like thank all teachers and members of staff of the Islamic University of Technology (IUT), who helped me in one way or the other throughout the period my studies. In particular, I would like to express my sincere appreciation to my head of department, Prof. Dr. Che Kum Clement, for his constant support, motivation and words of encouragement.

I am also grateful to Prof. Dr. Md. Ashraful Hoque, head of the department of electrical and electronic engineering, for his continuous support, encouragement and fatherly advice since my undergraduate days.

In addition, I have been fortunate to be part of great community of graduate students, especially my friends and course mates who provided me with lots of great insight during the presentations and seminar sessions.

It would have been a lonely data collection without the unconditional support and friendship of Nazmin Mahmuda Lina, despite all odds. Thank you for your patience and for 'rescuing' me during that time when I was almost defeated by language barrier. Thanks to my friends Marium Sarkar and Abdullah Al-Mamun for your effort in translating my questionnaire.

Nobody has been more important to me during the pursuit of this program than the members of my family. I would like to thank my parents whose love and guidance are with me in whatever I pursue. Words cannot express how grateful I am to my mother; my father, and my siblings for all the sacrifice they have made for me to grow. Your constant prayer for me is what sustained me thus far.

Lastly, it is of great importance to extend my appreciation to Temothy Teo, Ph.D, a distinguished Professor at the University of Macau, whose data collection instrument was adopted in this research.

ABSTRACT

Adequate technological engagement is required in preparing students to fit in today's digital world. In this regard, teachers are the major agents through which students could be infused with the desire to accept, adapt and use those technologies in the pursuit of their career. However, regardless of the evidences that indicate positive effect of technology on educational policy and practices, and its possibility of transforming the primitive conceptions of learning processes, application at instructional level still remain negligible in many cases. This leads to great deal of researches that sought to examine the in-service teachers' attitudes towards technology acceptance and, more recently trainee-teachers at the teachers training level. While prior research focused on in-service-teachers and trainee-teachers with social and general science background, the current examines the teachers' attitudes towards technology adoption and use in tertiary engineering education. The scale used in this study was adopted from computer attitude scale (CAS). In addition, social influence component was integrated in the scale, in order to examine whether social norms affect the acceptance of technology by teachers, as it was suggested by prior research to have significant influence on individual's attitude. Findings from 110 trainee-teachers reveled that their attitudes towards technology were positive. Such as: the way they liked and intend to use technology, their perception on its usefulness in their daily tasks and the control they perceived to have over technology while using. The most significant finding of this research is that, in addition to the widely reported components of computer attitude scale, social influence is also an important predictor of trainee-teachers attitude towards using technology. Overall, the study provides new influential factor (social) which could be merged with other four major components (affect, perceived usefulness, perceived control and behavioral intention) that influence technology integration in tertiary engineering education of Bangladesh.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I – Introduction

1.1 Introduction

Technology has been changing the global trends over decades, ranging from business and economic, social-life and health-care, to agriculture and education. There have always been new and evolving opportunities as well as challenges for almost every country in their efforts towards producing viable and knowledge oriented citizens (Ref?). The dynamics of today's evolving technology is influencing nearly every aspect of human life, and is till changing the way we do everything, hence education is not an exception. The increasing involvement of human-technology interaction in more tasks has become more positively correlated with occupational and personal success. For students of today's digital age to succeed in their quest of knowledge, skill and attitude, there is the need for educational planners, policy makers and practitioners to embrace the modern technology. It is also imperative that classroom experiences be adequately equipped with the equitable and unbiased technological tools among male and female students (Teo, 2008).

In doing so, teachers are the motivational force through which these tools can be introduced, implemented and adopted. For example, McKnight et al. (2016) opined in their work on how educators use technology to improve students learning that, the most important role in technology integration was organizing the learning environment that will provide the learners with active, hands-on and veritable learning activities as well as giving attention to their work. This role fall in the hands of teachers. Teachers play key role in realizing successful changes in education at both classroom and school level (Van der Heijden, Geldens, Beijaard, & Popeijus, 2015).

Different works have explored the positive impact of technology in learning environment. Some of these include the research work of González et al. (2017) on the use of mobile technologies to teach physics. In which they reported their developed mobile applications (for complimenting traditional learning) to have very positive influence on students engagement. Henderson, Selwyn, and Aston (2017) on student perception on useful digital technology in university teaching and learning. Their results revealed a wide range of distinct digital benefits; from flexibility of time, place and location, organizing and managing the logistics of studying, reviewing replaying and revising, researching information and supporting basic tasks to communicating and collaborating. However, regardless of these evidences which show positive influence of technology on educational practice and being that technology has been advocated to have the potential of transforming the traditional teaching and learning processes (Galley, Conole, & Alevizou, 2014), teacher resistance to its application at instructional level still exist in many cases (Keegan, 2016). More so, a study on instructional technology practices in Texas reported teachers to be ineffective in using digital technology/programs in classroom (Martirosyan, Kennon, Saxon, Edmonson, & Skidmore, 2017). It is therefore imperative to investigate the teachers prejudice against the technology and also the factors that may likely facilitate its explorability, acceptability and usability in teaching and learning process.

Researchers reaffirm in various studies the importance of teachers' attitude towards technology use being that though guided by government policies on how to integrate technology in the teaching learning process, they still hold the autonomy to decide how and when they use it (Teo, 2011). Teachers' attitudes and their willingness to embrace technology were evidently proven to have direct impact on their technology use in classroom instruction (Zhao et al., 2001) and also on the success of the student learning with technology.

1.2 Statement of the problem

In Bangladesh, the national policy on ICT has been one of the encouraging human resource development promoting knowledge oriented society through the provision of basic information and communication skills into school system at all levels. Technology is being integrated into education with the support and collaboration of international organizations such as Asian Development Bank (ADB) and the Department of International Development UK (Pouezevara & Khan, 2007; M. M. C. Shohel & T. Power, 2010) through various projects and programs that are geared towards training educators who will then train teachers and trainee-teachers on how to integrate technology into classroom instruction.

From the forgoing therefore emerges the need for research, to investigate the impact of these programs on teachers and trainee-teachers with regards to acceptability and uses of those instructional technologies

At the present moment, however, several researches have been conducted on the teachers' attitude towards technology acceptance and use in classroom instruction. Although most of these studies validate the findings of each other in relation to some of the determinant of the attitudes towards technology adaption, they were also found to have contradicts in some of the determinants. For example, Jackson, Ervin, Gardner, and Schmitt (2001) in their study on the relationship of gender to faculty use of online educational tools at the University of Alabama, reported that female users are found to be more inclined to hold negative response to technology compared to male users and such difference may result in gender variations in using technology. Conversely, Teo (2008) in a study on student-teachers attitudes towards computer use revealed that, there was no gender or age difference among students-teachers with respect to their attitude on technology. More so, Bahr, Shaha, Farnsworth, Valerie, and Benson (2004) discovered that trainee teachers were comfortable with the technology learning, but tend to be uncomfortable teaching it to school pupils. Thus, the explanation of why some teachers welcome technology integration while other reject it, is yet controversial issue. It therefore remains imperative to research more on the teacher technology acceptance and use for better and thorough understanding of the teachers' behavior for using technology as well as the dynamics of the determinants of these behaviors with respect to age, gender, years of experience and subject specialization. Furthermore, the role of teachers in the development of students' aptitudes and capabilities is highly significant. The employment of technology in education is likely to succeed at trainee-teachers level, being that they are less likely to be conservative to traditional methods at their evolution stage. Hence, the present study tries to investigate trainee-teachers' attitudes on the adaption and use of technology, specifically in engineering higher education domain.

1.3 Purpose of the study

The aim of this study is to examine the trainee-teachers attitudes towards technology use in tertiary engineering education in Bangladesh universities, with respect to their attitudes towards technology use.

1.4 Research questions

In relation to the purpose of the study, the following research questions were addressed:

1. What is the overall attribute (composition) of trainee-teachers' attitudes towards technology use in tertiary engineering education?
2. What are the similarities and dissimilarities of attitudes in relation to age, gender, specialization, perceived confidence, and years of experience in technology use?

1.5 Assumptions

Being that the study focused primarily on engineering education trainee-teachers, the research assumed that all respondent are selected from engineering background trainee-teachers who have undergone the teachers training program for a period of not less than one year.

CHAPTER II – Literature review

2.1 Introduction

This chapter will review the articles that focused on the teachers' attitudes towards technology use and the impact of those attitudes on the students' learning outcomes. Adequate technological engagement is required in preparing students to fit in today's digital world. In this regard, teachers are the major device through which students could be infused with the desire to accept, adapt and use those technologies in the pursuit of their present and future accomplishments.

2.2 Technology integration in education

The term technology here 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, PDA; Smartboard, Multimedia presentation* and other technology in teaching and learning.

More meaningful integration of technology into the classroom instruction is essential in any effort to prepare students and teachers for the 21st century (Ertmer, 2005; Polly, Mims, Shepherd, & Inan, 2010). Both experienced and student teacher believed that learning how to use technology as a tool is the key to its application into the classroom (Bliss, 2003; Kafyulilo, 2012; Willis & de Montes, 2002).The utilization of technology in classroom takes time and paradigm change for teacher to adopt it. (Baturay, Gökçearslan, & Ke, 2017). To achieve this integration in a meaningful way, it is imperative to understand the teachers' attitudes and beliefs, intentions and readiness to adopt and use technology.

In spite of the progress made so far in educational technology, there still exist pressing concerns with regard to effectiveness, efficiency and competency in its implementation at instructional level (Brzycki & Dudt, 2005). Wedman and Diggs (2001) claimed that rather than provision of authentic and essential technology based learning environment, teacher training programmes were designed more on technology applications. In their research, Bahr et al. (2004) discovered that student teachers were comfortable with the technology learning, but tend to be uncomfortable teaching it to school pupils. Thus, it remains imperative to research more on the teacher technology acceptance and use for better and thorough understanding of teachers' behavior for using technology.

2.4 Teachers' attitudes towards technology use

It has been suggested that teachers are likely to introduce technology into their classroom instruction only if they believed those programmes are capable of fulfilling either their own or their students' needs. One of the basic factors that influence the successful integration of technology in teaching and learning are the teachers' attitudes towards the technology use (Huang & Liaw, 2005). These attitudes are of various dimensions which constitutes; perceived usefulness, control, liking, behavioural intention and confidence (Mahajan, 2016). Other factors include age, gender (Hrtoňová, Kohout, Rohlíková, & Zounek, 2015; Teo, 2014), technology confidence (Miller, Christensen, & Knezek, 2017), anxiety (Chiu & Churchill, 2016), and self-efficacy (Brantley & Bradshaw, 2017).

Nearly all schools in most developed countries are equipped with infrastructures necessary for technology mediated teaching and learning. However, positive teachers' attitudes are of critical concern for the technology to be effectively integrated into the school curriculum (Teo, 2008). The main aim behind the studies of teachers attitudes towards technology use, is its being the major predictor of the success or otherwise of technology integration in the classroom (Mathew Myers & Halpin, 2002). Baturay et al. (2017) in a study on the relationship among pre-service teachers' computer competence, attitude towards computer-assisted education, and intention of technology acceptance, found a significant and positive relationship among computer competence, attitude towards computer-assisted education, and intention to technology in classroom instruction. This finding was also validated by Nikou and Economides (2017) whose study , revealed that effective attitudes, general usefulness, effort expectancy and perceived playfulness are significant in determinants of behavioral intention to use technology. (Teo, 2008) found a significant relationship between years of experience and positive attitudes towards the technology use. More so, Bahr et al. (2004) in their study "preparing tomorrow's teachers to use technology" funded by the **US** Department of Education, discovered that trainee teachers were comfortable with the technology learning, but tend to be uncomfortable teaching it to school pupils. (Jackson et al., 2001) in their study on the relationship of gender to faculty use of online educational tools at the University of Alabama USA, reported that female users are found to be more inclined to hold negative response to technology compared to male users and such difference may result in gender variations in using technology. Hrtoňová et al. (2015) in their study “Factors influencing acceptance of e-learning by teachers” in the Czech Republic found that that age and gender factors that had no significant impact on e-learning acceptance include age and gender. Distinctively, Teo (2008) in a study on 139 student-teachers in Singapore revealed that there was no gender or age difference among trainee-teachers on their attitude towards technology, but found significant difference based on the subject domain they were being trained. In Turkey, Aypay, Celik, Aypay, and Sever (2012) conducted a “study on technology acceptance in education” particularly on pre-service teachers and found self-efficacy to be ineffective on technology acceptance level of pre-service teachers. In another vein, Teo (2014) in a study “Unpacking teachers’ acceptance of technology” conducted on a sample of 673 primary and secondary school teachers in China found significant differences by gender for perceived ease of use, with male teachers rating higher than their female counterparts.

To sum up, though most studies shows that teachers are positive towards technology use, it is necessary to emphasize that there are studies which discuss the negative attitude of teachers towards technology. Moreover, while some studies reported significant difference of these attitudes among teachers in terms of age, gender, experience, anxiety and subject domain, others reported non-significant difference in these variables. However, none of these researches was conducted to investigate the trainee-teachers attitude in engineering education. It was also theoretically known that social norms influence an individual’s attitude towards performing a behavior. Taking all these into account, the purpose of the present study was to investigate the trainee-teachers’ attitude towards technology in engineering education in Bangladesh. It is assumed that the attitude of trainee-teachers of engineering education will provide valuable information concerning the current status of technology integration in engineering classroom instruction, so that necessary improvement can be provided.

2.5 Theoretical framework

The theoretical framework upon which the foundation of this study is laid was adapted from the theory of planned behaviour (Ajzen, 1991), theory of reasoned action (Ajzen & Fishbein, 1975), technology acceptance model (Davis, 1989), as well as unified theory of acceptance and use of technology (Venkatesh & Zhang, 2010). These models were generally reported by many researchers to have significant effect in predicting adaptability and use of technology by teachers.

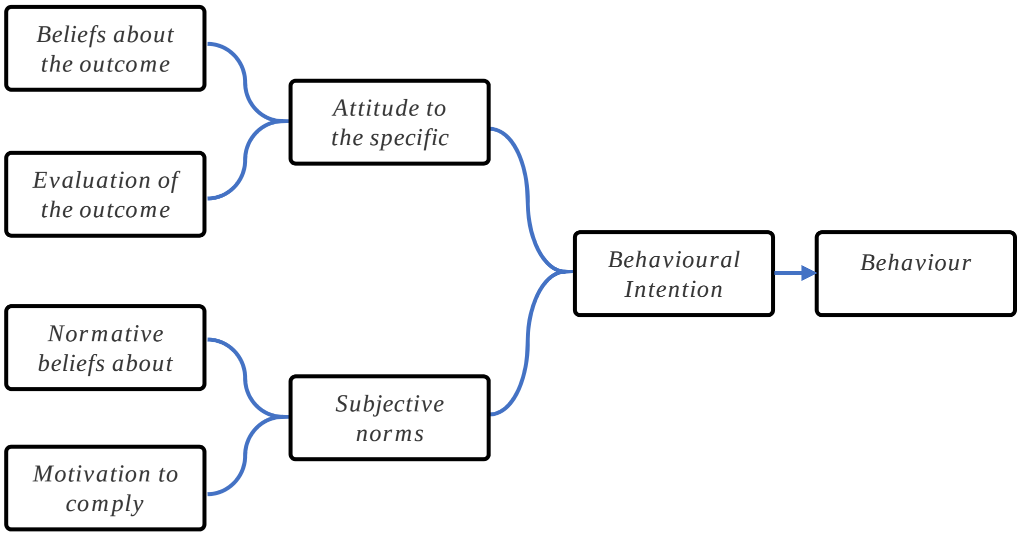
2.5.1 Theory of reasoned action

According to the theory of reasoned action, a behavior is determined by an individual's intention to perform the behaviour. The theory of reasoned action postulates that attitudes are function of the believe that the individual accumulates over time. Behavioural intentions are the function of an individual's attitude toward the behaviour and his/her subjective norm (Ajzen & Fishbein, 1980).

An individual's attitude to the behaviour which is a judgement of whether or not the behaviour is a good thing to do, is determined by two behavioural beliefs: a belief about the outcome of the behaviour, and evaluations of the expected outcome (i.e whether the outcome is rewarding). For example, a person may have the attitude that "it is good to use technology"; which may have developed from the belief that "technology can help make work easier and less erroneous", and the evaluation that "I want to make my work easier" and "I want to avoid error";

Subjective norms (Figure 2.1) refers to the result of what other people feel about the behaviour and motivations to comply with those opinions. Subjective norm is a person's beliefs about their social world. These are basically the perception of and commitment to social standards regarding the behaviour's acceptability or appropriateness. Subjective norms are based on two normative beliefs: (1) beliefs about others' opinions about the behaviour, and (2) a person's motivation to comply with those opinions (i.e. "what do others think I should do?" and "do I want to do what they want?"). For example, a person may think, "it is appropriate to use technology". This subjective norm may have developed from the belief that "my family and friends think I should use technology" and "I value their opinion and want to follow their advice". Subjective norms, along with attitudes, stimulate the intension to perform a specific behaviour, and whether we carried out a specific behavior or not.

This theory suggests that the two factors highlighted above, (attitude to the behaviour and subjective norms) combine to produce the intention, which leads to performance of the behaviour as illustrated in figure 1. Thus, the attitudes that the person in the examples above has generated from their beliefs are likely to produce the intention to use technology, which will lead them, to in turn, use it. These two factors may be weighted differently in different situations. In some situations, attitudes may be more important determinants of behavioural intentions than subjective norms, but in other situations more weight may be given to behaving in a normative way rather than in a way in line with personal attitudes.



| *Beliefs* | | *Attitude* | | *Intention* | |*Behaviour* |

Figure 2. 1*:* Theory of reasoned action (adapted from Ajzen and Fishbein, 1980)

2.5.2 Theory of planned behaviour

The theory of planned behavior (TPB) is an extension of the theory of reasoned action proposed by Ajzen (1991) by including perceived behavioural control as shown in Figure 2. The theory states that: "the attitude toward behaviour, subjective norms, and perceived behavioural control, together shape an individual's behavioral intentions and behaviour" PAGE NO???. Perceived behavioural control can be referred to as self-efficiency (i.e our believe that we can perform effectively and exert control over events that influence our lives). This theory stresses the role of perceived behavioural control as an influence on behavioural intentions as well as the actual behaviour. Ajzen (1991) asserted that control beliefs are fundamental determinants of the perception of behavioural control, and are crucially important for understanding motivation. That means an individual's confidence (or lack of it) in their ability to perform the needed behaviour may critically determine whether they choose to undertake the behaviour or not, and whether they will be successful in its execution. For example, if you think you cannot operate a computer, then you probably will not try.

The perceived behavioural control of an individual who is uncertain of their ability to perform a behaviour may be influenced by their perception of their personal resources, such as their own abilities, self-esteem and confidence, and the time and money that are required to succeed in executing the behavior. Perceived control can have a direct effect on behaviour, evading behavioural intentions. For example, people may fail to adapt technology possibly because there is a doubt in their mind over their own behavioural control, and their ability to stick to using it simply because of lack of regularly access or technical support. Past behaviour also provided an important role here; if a person tried to adapt technology several times in the past, they are less likely to believe that they can successfully adapt in the future and therefore less likely to intend to try.
The theory has been used in various studies of the relationships among beliefs, attitudes, behavioral intentions and behaviors (Boulton, Hardcastle, Down, Fowles, & Simmonds, 2014; De Leeuw, Valois, Ajzen, & Schmidt, 2015; Fayolle & Gailly, 2015; Greaves, Zibarras, & Stride, 2013; Kreijns, Van Acker, Vermeulen, & Van Buuren, 2013; Kreijns, Vermeulen, Kirschner, Buuren, & Acker, 2013; Valtonen et al., 2015). Mummery and Wankel (1999) claimed that swimmers who held positive attitudes towards training, believed that significant others (people they considered important in their lives such as family, friends, spouses etc) wanted them to train hard (subjective norm) and held positive perceptions about their swimming ability (perceived behavioural control), formed stronger intentions to train and actually stuck to the training programme significantly more than those who did not hold these attitudes and perceptions.

| *Beliefs* | | *Attitude* | | *Intention* | | *Behaviour* |

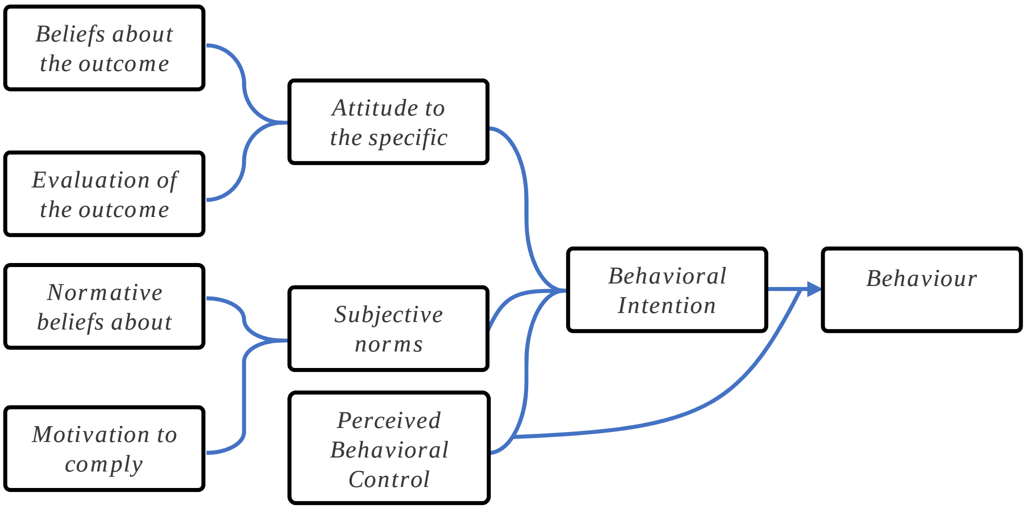


Figure 2. 2: Theory of planned behaviour (adapted from Ajzen , 1991)

2.5.3 Technology acceptance model

Technology acceptance model (TAM) is an information system theory that presents how individuals come to accept and use a technology. According to the theory, when users are presented with a new technology, a number of factors will influence their decision about how and when they will use it. Behavioural intention is influenced by attitude toward usage, as well as direct and indirect effects of perceived usefulness and perceived ease of use. Both perceived usefulness and perceived ease of use together affect attitude toward usage, while perceived ease of use has a direct impact on perceived usefulness (Davis, 1989).

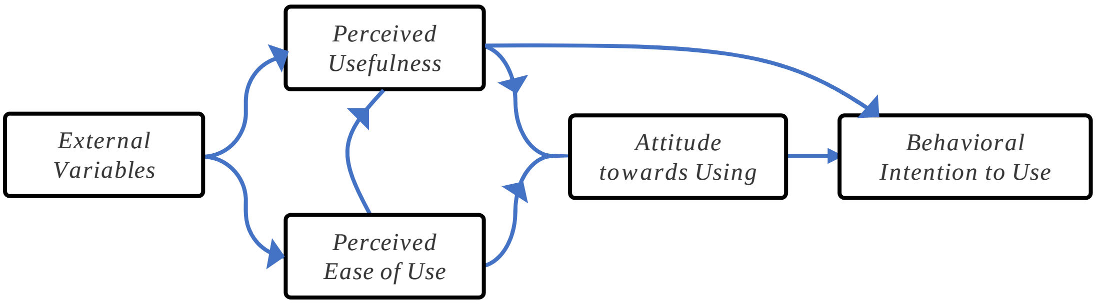


Figure 2. 3: Technology acceptance model (TAM)

TAM suggests that perceived usefulness and perceived ease of use determine an individual's intention to use a technology with intention to use being a mediator of actual technology use. Perceived usefulness is also seen as being directly influenced by perceived ease of use.

The model assume that when someone forms an intention to act, that they will be free to act without limitation. But in practice, constraints such as limited ability, time, environmental or organisational limits, and unconscious habits will limit the freedom to act.

2.5.4 Unified theory of acceptance and use of technology

The unified theory of acceptance and use (figure 4 below) was developed to reinforce technology acceptance model, the model aims to explain individual's behavior to use technology and consequent usage behavior. There are four key constructs to the theory viz: performance expectancy; effort expectancy; social influence; and facilitating conditions which are determinants of usage intention and behavior (Venkatesh, Morris, Davis, & Davis, 2003; Venkatesh & Zhang, 2010). Additionally, gender, age, experience, and voluntariness of use are expected to impact one's intent to use technology. Behavioral intention is anticipated to have a positive correlation to use behavior; if one intends to use technology, they will probably use it.

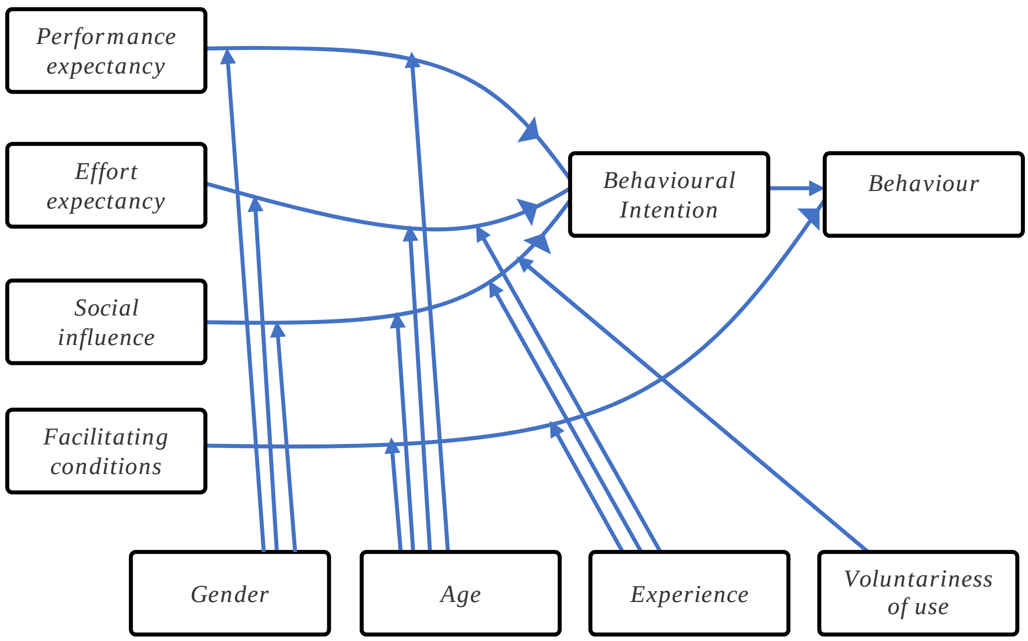


Figure 2. 4: Unified theory of acceptance and use of technology (UTAUT) model

2.5.4.1 Performance expectancy

Effort expectancy is the extent to which a person expects the use of the technology to improve their performance (Venkatesh et al., 2003). The relationship between performance expectancy and the behavioral intention to use technology is likely to be positive; if a person expects the technology to improve his performance, his intent to use it will be higher.

2.5.4.2 Effort expectancy

Effort expectancy is defined as the degree of ease or amount of effort associated with the use of a particular technology (Venkatesh et al., 2003). The relationship between effort expectancy and behavioral intention is likely to be negative. The easier a person expects use of a technology to be (lower effort expectancy), the greater will be their intent to use it.

2.5.4.3 Social influence

Social influence is the extent to which a person perceives others think he or she should use technology (Venkatesh et al., 2003). Social influence is likely to have a positive relationship with behavioral intention; the more a person perceives others think he or she should use the technology, the greater will be his or her intent to use it.

2.5.4.4 Facilitating conditions

Facilitating conditions are defined as the perceived available support for the use of the technology that is new. A person who perceives that they will be able to receive assistance or support in the use of the technology is more likely to use it. Hence, the expected relationship between facilitating conditions and actual use of the technology is a positive one.

2.5.4.5 Gender, age, experience and voluntariness of use

Gender, age, experience and voluntariness of use of a system by an individual influence the dependent variable via the four main concepts (performance expectancy, effort expectancy, social influence and facilitating conditions).

The theories were outlined here as the framework for this research method and data collection tool. The components of the instrument such as affect, behavioral intention and perceived behavioral control were obtained from the theory of planned behavior and theory of reasoned action. While perceived usefulness was obtained from TAM, the influence of gender, age and technology experience were obtained from UTAM

CHAPTER III – Methodology

3.1 Research design

Descriptive type of quantitative research method was employed in this study. According to Aggarwal (2008) descriptive research is devoted to the gathering of information about prevailing conditions or situations for the purpose of description and interpretation. This type of research method is not simply gathering and tabulating facts but includes proper analyses, interpretation, comparisons, identification of trends and relationships.

Descriptive method of descriptive research is based on fact-finding with adequate and accurate interpretation of the findings (Kothari, 2004). It describes what actually exist such as current conditions, practices, or situations. Since this study or investigation is concerned with the present status of the attitudes of tertiary engineering education trainee-teachers, the descriptive method of research was found to be the most appropriate method to use.

3.2 Research field

The research was conducted on trainee-teachers with specialization in engineering in two universities in Bangladesh, namely: Islamic University of Technology and Technical Teachers Training College under Dhaka University.

3.3 Population and sample

The population for this research comprise of trainee-teacher from Islamic University of Technology and Technical Teachers Training College, under Dhaka University. The researcher selected participants from the two institutions in Bangladesh who are trainee-teachers that completed at least one year of their degree program. These participants were selected from within four different specializations of engineering education programmes, such as Computer Science and Engineering; Civil Engineering; Electrical and Electronic Engineering; and Mechanical and Chemical Engineering.

The selected institutions were the only institutions in Bangladesh that offer teacher training programmes in engineering education. Moreover, the programmes are limited to four specializations (*Computer Science and Engineering; Civil Engineering; Electrical and Electronic Engineering; and Mechanical and Chemical Engineering.*

3.4 Research tool

A survey questionnaire was used in this study, with sections on participants' demographic background, technology experience and perceived confidence. The questionnaire was formulated following two frameworks such as:

i. Computer Attitude Scale (CAS)
ii. Social Influence (SI)

The Computer Attitude Scale (CAS), was developed by Selwyn (1997), validated by Bear, Richards, and Lancaster (1987) and adopted by (Teo, 2008). It has been reported by Sexton, King, Aldridge, and Goodstadt-Killoran (1999) in a study of 131 undergraduate trainee-teachers to be a reliable instrument for measuring trainee-teachers' attitudes towards technology.

Technology experience was measured by asking the participants "How many years on average have you used technology?" Perceived confidence was measured by asking the participants "How confident are you in using technology?" in which the participants responded on a five point scale from 1=not confident to 5=very confident.

CAS was used to measure the trainee-teachers' attitudes towards the technology adoption and use. It is of four components with at least 3 items in each component. The first component 'Affect' comprised six items that are intended to measure the feelings of participant towards technology. Second component 'Perceived Usefulness' comprise five items that measure the individual beliefs about the usefulness of technology in their job life. The third component 'Perceived Control' is of six items that measure the individual's perceived ease of use or difficulty in using technology. The fourth component, 'behavioural Intention' comprised of four items that measure behavioural intentions of the participants to use technology.

However, CAS does not contain one of the component assumed to have greater influence on the behaviour towards technology use; known as 'Social Influence' (Venkatesh, & Davis, 2000). Social influence which is the extent to which a person perceives others think he or she should use technology, is likely to have a positive relationship with behavioral intention of a person towards technology. The researcher therefore include Social Influence component in addition to the four components of the CAS.

The Social Influence component comprise three items to measure the degree at which an individual perceives the view of others who are close to him with regard to technology use. It is therefore about whether the individual expect others such as friends, relatives, partners, coworkers, spouse or neighbors to appreciate using technology.

The extended CAS therefore contain 05 components with 24 items, and were respond to, by the participants using five-point scale as follows;

Strongly disagree (1), Disagree (2) Neutral (3) Agree (4) Strongly agree (5) as shown in Table 3.1

Table 3. 1 *Interpretation of weighted average based on five point scale*

SA(5)	A(4)	N(3)	D(2)	SD(1)
4.15 – 5.00	3.25 – 4.10	2.35 – 3.20	1.45 – 2.30	1.00 – 1.40

3.5 Data collection procedure

A closed ended questionnaire was used during data collection in this study with sections on participants' demographic background, technology experience and perceived confidence. Each participant was allowed to freely and voluntarily participate and respond to the questionnaire. Participants were also informed that they are free to withdraw their participation at any time.

3.6 Data analysis procedure

The scores from the items on each component were aggregated to provide corresponding scores for each component. The negative items were reverse coded so that meaningful analysis could be conducted. Statistical methods used in this study for the purpose of data analysis included: descriptive statistics such as frequency, percentage, means, and standard deviation. Reliability coefficient (Cronbach's Alpha) was calculated to check the internal consistency of the instrument. To compute the overall attitude of the participants, a one way analysis of variance (MANOVA) analysis was performed for the five constructs. In addition, a one way analysis of variance (ANOVA) was performed to investigate the significant differences found between participants in terms of associated dependent variables such as age, gender and subject specialization during MANOVA analysis of the five constructs. A bivariate correlation analysis was also conducted between pairs of the scale variables to investigate whether significant correlation exits. Another bivariate correlation analysis was performed between years of technology use, technology confidence and overall attitude towards technology. Data analysis was performed using Statistical Package for Social Sciences software (IBM SPSS version 24).

3.7 Validity and reliability

The items of the questionnaire were adopted from the computer attitude scale validated by Bear et al. (1987) and adopted by (Teo, 2008). The items of the instrument were validated again by Asil, Teo, and Noyes (2014).

To ensure reliability of the questionnaire, a pilot study was conducted on a sample of 30 participants, and a good reliability coefficient (*Cronbach's Alpha*) of 8.3 was obtained.

3. 8 Ethical consideration

The selection process of the participants and their participation in this study was conducted with the approval of their respective institutions. Besides, all information related to the participant was kept confidential and remains anonymous without any direct link to the respondent.

CHAPTER IV – Results

4.0 Data analysis and interpretation

This chapter deals with the analysis and interpretation of data collected from the respondents. The analysis was divided into three major sections. The first section discuss the demographic data of the participants. The second section involves analysis of data related to the first research question, which is the *overall attitude of the trainee-teachers towards technology adoption and use*. In this section, the computed data collected from the respondents was computed and aggregated based on the five independent variables of the scale, and tabulated in form of frequencies and percentages. Chi-square test was conducted by testing the components at .05 significant level. Pearson correlation coefficients, weighted average, mean and standard deviations were also calculated. In the last section, data analysis related to the second research question which is the *similarities and differences of the attitudes towards technology among the trainee teachers, with respect to age, gender and subject specialization* was conducted. These include MANOVA analysis, ANOVA analysis and bivariate correlation between participants' profiles.

4.1 Demographic data

Data was collected from 110 trainee-teachers from two universities in Bangladesh. The questionnaire was administered to the sampled participants physically, with the researcher available for giving further clarifications regarding the required responses. 98% of the questionnaires were returned. The sample was categorized in terms of age, gender, subject specialization, years of technology use and experience. Sixty participants were selected from Dhaka University, while fifty were from Islamic University of Technology. Among the all, 66 were participants were males, while 44 participants were females as in Figure (4.1 & 4.2).

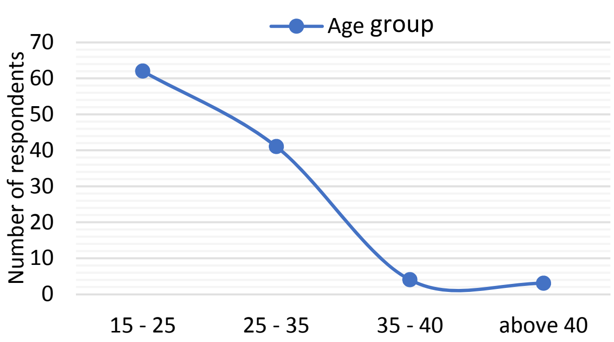


Figure 4. 1 Sample distribution by age groups

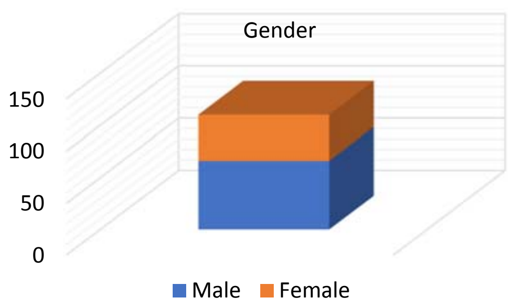


Figure 4. 2 Sample distribution by gender

4.2 Research question I: Overall attitude of trainee-teachers towards technology

The data analysis for the computed components of the scale with respect to research question one "*what is the overall attribute of the trainee-teachers' attitudes towards technology?*" was described below, with the summary indicated in Table 4.1.

4.2.1 Affective component:

From the *Chi-Squire* test statistics, it was discovered that 20 percent of the respondents strongly agree that they liked technology, 48.2 percent agree, 6.3 percent disagree, 0.9 percent strongly disagree while 27 percent of the respondent remain neutral on whether they liked or disliked technology (Figure 4.3). The weighted average was 3.90 ($3.25 \leq 3.90 \leq 4.10$), which agree that the participants liked technology and that they were comfortable and will not hesitate to use it when given the opportunity. *Chi-square* test was conducted at *df* = 7 with significant value of 0.000, which is less than 0.05 level of significance and *Chi-square observed* χ^2 o (117.78) was greater than *Chi-square critical* χ^2 c (14.07), that is χ^2 o (117.78) > χ^2 c(14.07) of which the null hypothesis, responses on this component are not statistically significant, is rejected. Therefore the researcher concluded that it was statistically significant and agreed that the respondents liked technology and that they are feel comfortable while using technology.

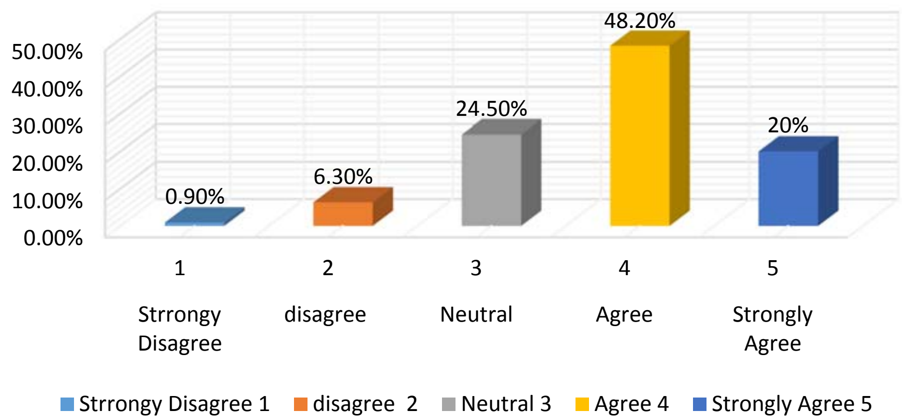


Figure 4. 3 Percentage distribution for affect component

4.2.2 Perceived usefulness:

From the responses received on perceived usefulness, it was observed that 42.7 percent were strongly agree, 53.6 percent were agree, 3.6 percent were neutral, while 0.0

percent were disagree and 0.0 percent were strongly disagree that they perceived technology as being useful to them, can enhance their work and improve their productivity (Figure 4.4). The weighted average was 4.40 ($4.15 \leq 4.40 \leq 5.00$), which strongly agree that the participants perceived technology as useful component that can enhance their work and improve their productivity. *Chi-square* test was conducted at *df* = 3 with significant value of 0.000, which is less than 0.05 level of significance and *Chi-square observed* χ^2 o (93.27) was greater than *Chi-square critical* χ^2 c (7.81), that is χ^2 o (93.27) > χ^2 c(7.81) of which the null hypothesis, responses on this component are not statistically significant, is rejected. The researcher therefore concluded that the respondents perceived technology as a useful component that can simplify their teaching activities and improve their productivity.

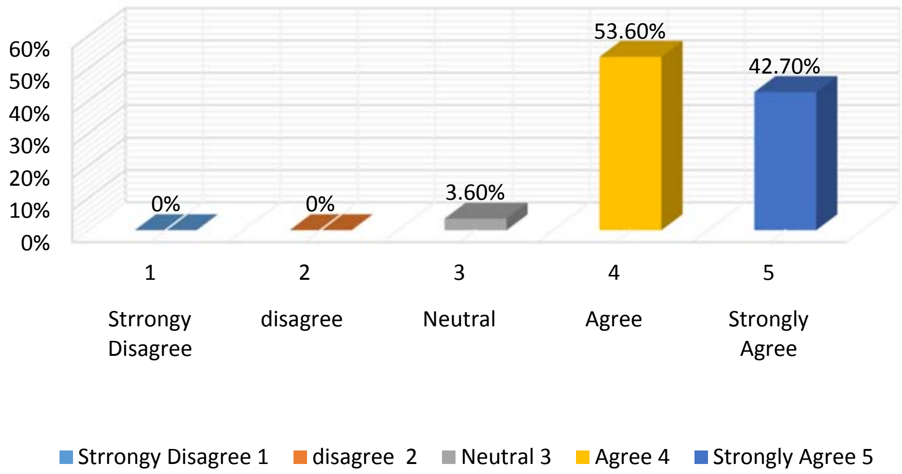


Figure 4. 4 Percentage distribution for perceived usefulness

4.2.3 Perceived control:

The responses on perceived control of technology shows that, 9.1 percent were strongly agree, 39.1 percent were agree, 37.2 percent were neutral, 13.7 percent disagree, while 0.9 percent were strongly disagree that they have control over technology and that they do not necessarily need someone to support them while using technology to accomplish their work (Figure 4.5). The weighted average was 3.60 ($3.25 \leq 3.60 \leq 4.10$) which is agree that the respondents perceived that they have control over technology and that they does not need support while using technology. *Chi-square* test was conducted at *df* = 7 with significant value of 0.000, which is less than 0.05 level of significance and *Chi-square observed* χ^2 o (72.12) was greater than *Chi-square critical* χ^2 c (14.07), that is χ^2 o (72.12) > χ^2 c (14.07) of which the null hypothesis, responses on this component are not statistically significant, is rejected. Therefore the researcher concluded that the respondents perceived that they have control over technology while doing their work and that they do not necessarily need support to accomplish their tasks using technology.

Figure 4.5: Percenttage distribution for Perceived Control

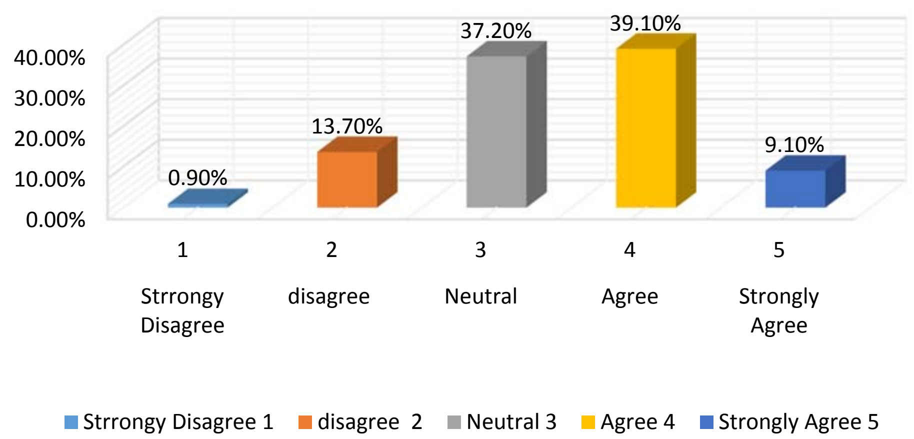


Figure 4. 5 Percentage distribution for perceived control

4.2.4 Behavioral intention:

The responses on behavioral intention component revealed that 17.3 percent were strongly agree, 40.9 percent were agree, 25.5 percent were neutral, 16.4 percent were disagree and 7.2 percent were strongly disagree that they intend to use technology regularly throughout in their institutions and that they are ready to take jobs that involves technology use (Figure 4.6). The weighted average was 3.66 ($3.25 \leq 3.66 \leq 4.10$) which is agree that that respondents intent to use technology regularly throughout in their institutions and they are ready to take jobs that involves using technology. *Chi-square* test was conducted at *df* = 8 with significant value of 0.000, which is less than 0.05 level of significance and *Chi-square observed* χ^2 o (36.62) was greater than *Chi-square critical* χ^2 c (15.51), that is χ^2 o (36.62) > χ^2 c (15.51) of which the null hypothesis, responses on this component are not statistically significant, is rejected. Therefore the researcher concluded that the respondents intent to use technology regularly throughout in their institutions and that they also intent to take jobs that involved technology use.

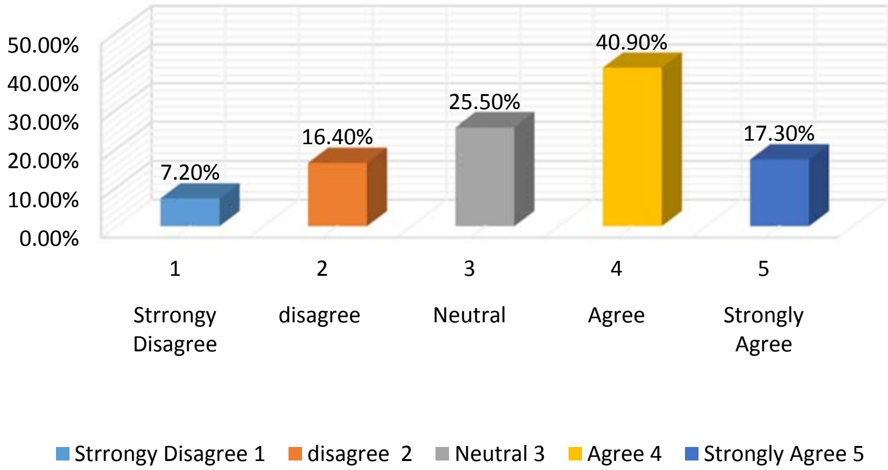


Figure 4. 6 Percentage distribution for behavioral intention

4.2.5 Social influence:

Responses on the social influence component shows that 9.1 percent were strongly agree, 36.4 percent were agree, 43.5 percent were neutral, 16.4 percent were disagree and 2.7 percent were strongly disagree that they use technology because it is widely used in their community and that their families, friends and colleagues are using it and encourage them to use technology as well (Figure 4.7). The weighted average was 3.33 ($3.25 \leq 3.33 \leq 4.10$) which is agree that the respondents use technology because it is widely used in their community and that their facilities, friends and colleagues are using it and encourage them to use technology as well. *Chi-square* test was conducted at *df* = 5 with significant value of 0.000, which is less than 0.05 level of significance and *Chi-square observed* χ^2 o (79.71) was greater than *Chi-square critical* χ^2 c (11.07), that is χ^2 o (79.71) > χ^2 c (11.07) of which the null hypothesis, responses on this component are not statistically significant, is rejected. Therefore the researcher concluded that the respondents use because it is widely used in their community and that their families and associates encourage them to use it as well.

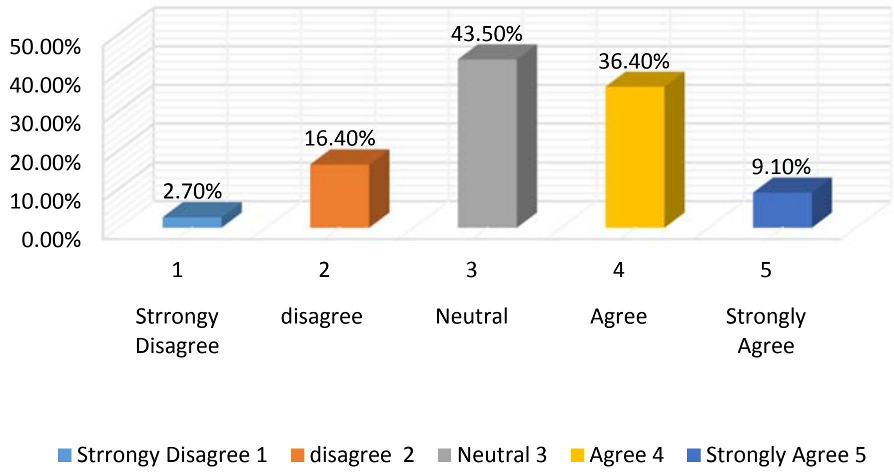


Figure 4. 7 Percentage distribution for social influence

4.4.6 Overall technology attitude

The overall aggregate of the responses computed based on the five constructs used to measure the attitudes of the participants towards technology adoption and use, revealed that 14.5 percent were strongly agree, 55.5 percent were agree, 28.2 percent were neutral, 1.8 percent were disagree, while 0.0 percent were strongly disagree that their attitude towards technology use adoption and use was positive (Figure 4.8). The weighted average was 3.95 ($3.25 \leq 3.95 \leq 4.10$) which is agree that the respondents' attitudes towards technology adoption and use was positive. *Chi-square* test was conducted at $df = 5$ with significant value of 0.000, which is less than 0.05 level of significance and *chi-square observed* χ^2 o (82.55) was greater than *Chi-square critical* χ^2 c (11.07), that is χ^2 o (82.55) > χ^2 c (11.07) of which the null hypothesis, responses on these components are not statistically significant, is rejected. The researcher therefore concluded that the respondents' attitudes towards technology adoption and use were positive.

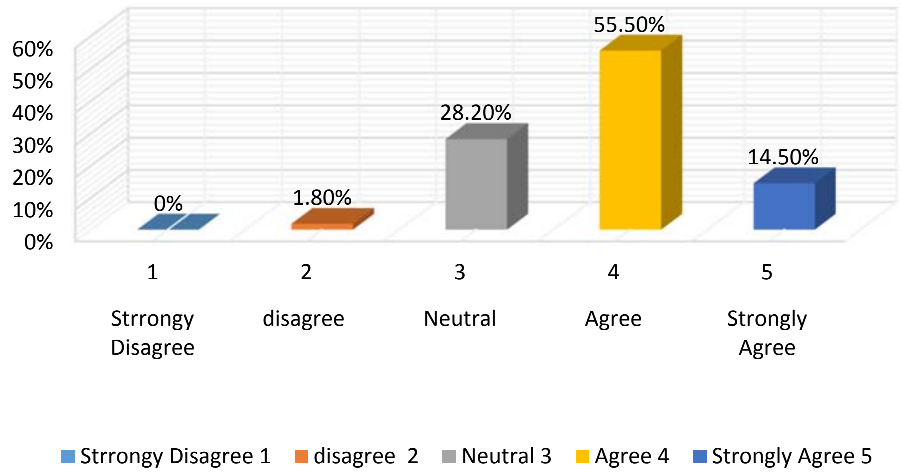


Figure 4. 8 Percentage distribution for overall technology attitude

Table 4. 1 *Test Statistics for five components measuring technology attitudes and the overall attitude*

	Affective	Perceived usefulness	Perceived control	Behavioral intention	Social influence	Overall technology attitude
Strongly Disagree	1 0.9%	0 0%	1 0.9%	8 7.2%	3 2.7%	0 0%
Disagree	7 6.3%	0 0%	15 13.7%	18 16.4%	18 16.4%	2 1.8%
Neutral	27 24.5%	4 3.6%	41 37.2%	20 25.5%	39 43.5%	31 28.2%
Agreed	53 48.2%	59 53.6%	43 39.1%	45 40.9%	40 36.4%	61 55.5%
Strongly Agree	22 20%	47 42.7%	10 9.1%	19 17.3%	10 9.1%	16 14.5%
W-Average	3.90	4.40	3.60	3.66	3.33	3.95
Chi-Square	117.782	93.273	72.109	36.618	79.709	82.545
df	7	3	7	8	5	5
Asymp. Sig.	.000	.000	.000	.000	.000	.000

4.2.7 Summary of the results based on research question I

The attitude towards the technology acceptance and use was measured in terms of *affective*, *perceived usefulness*, *perceived control* and *behavioural intention* components in Computer attitude scale (Selwyn, 1997) and *social influence* component of extended technology acceptance model (Malhotra & Galletta, 1999). All participants responded to all items of the component with no missing data recorded. The participants means score and standard deviations of the five sub-scales are presented in Table 4.2. The participants scored highest on the *perceived usefulness* (mean = 4.40) followed by *affective* sub-scale (mean = 3.90). The scores for *behavioural intention* and *perceived control are* nearly the same (mean = 3.66 & 3.60) while *social influence* sub-scale has the lowest mean score (mean = 3.33). The means suggested that, the participants were more positive about their perception of the usefulness than their control and behavioural intention to use the technology

The result, also revealed that the participants liked (affective) and intent to use technology to a lesser degree than they thought it was useful to them. However, in social influence sub-scale, the participants appears to be least positive compared to their affect, intention to use, as well as their perception of usefulness and control of the technology. In general, the overall attitude towards technology is far above the midpoint of the scale (3.00) which indicated that the participants held a positive attitude towards the technology. The reliability coefficient (*Cronbach's alpha*) ranges from moderate (.52) to high (.89). The overall reliability coefficient (*Cronbach's alpha*) is (.83) Table 1, which signified that the internal consistency of the instrument is good enough to measure the variables of interest.

Table 4. 2 *Descriptive Statistics* and reliability coefficient (*Cronbach's alpha)* for each sub-scale

	N	Minimum	Maximum	Mean	Std. Deviation	Alpha
Affective	110	1.50	5.00	3.90	.802	.62
Perceived use	110	3.00	5.00	4.40	.559	.52
Perceived control	110	1.50	5.00	3.60	.784	.56
Behavioral intention	110	1.00	5.00	3.66	1.13	.89
Social influence	110	1.00	5.00	3.33	.949	.55
Overall technology attitude	110	2.50	5.00	3.95	.611	.83

4.3 Correlation among the five sub-scales

Pearson correlation analysis between each pair of the five sub-scales was performed to observe their interrelationships of the components. The summary of the correlation coefficients were shown in Table 4.3. All sub-scales correlates significantly at the $p < .01$ significant level, with the Pearson coefficients ranging from positive (.41) to (.09). This means that the five components were fairly independent to be used as independent variables in examining the attitudes towards technology use among the trainee-teachers (Figure 4.9 – 4.23).

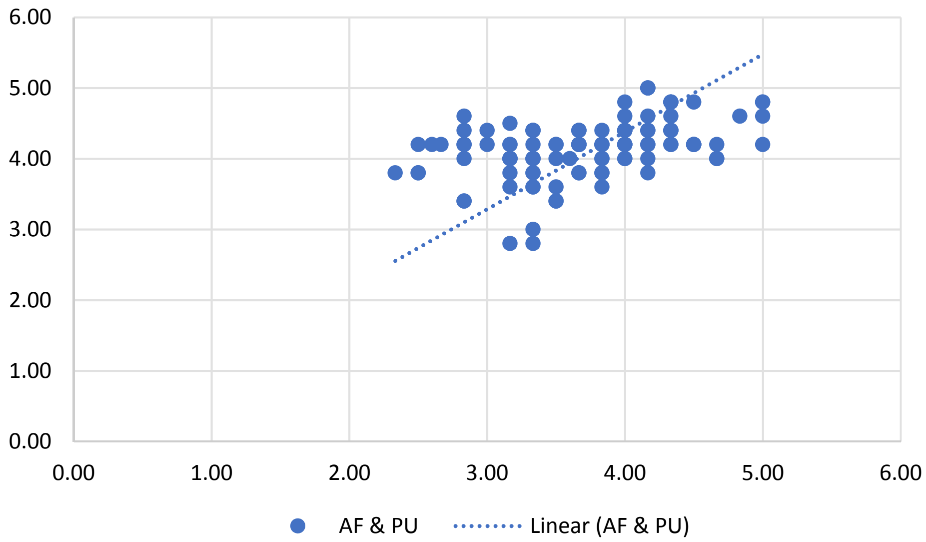


Figure 4. 9 Pearson correlation between affect and perceived usefulness

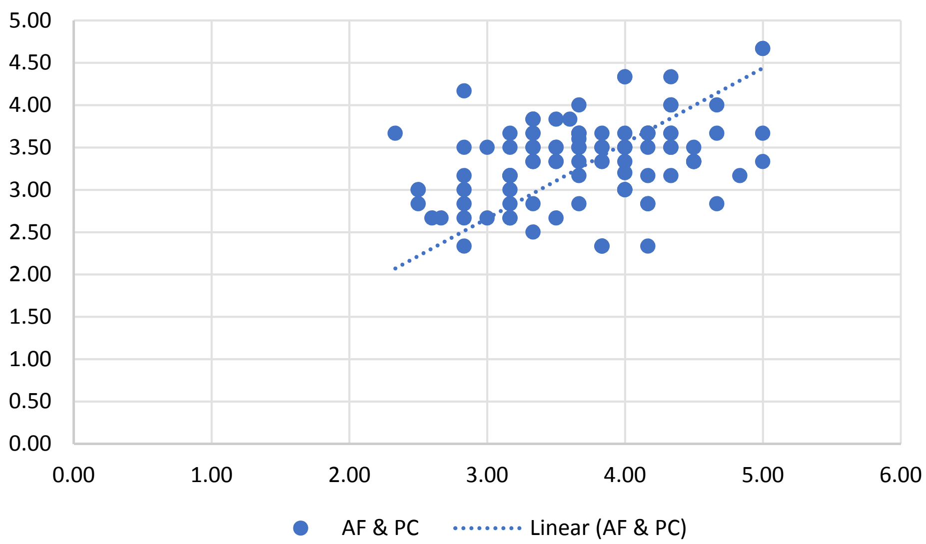


Figure 4. 10 Pearson correlation between affect and perceived control

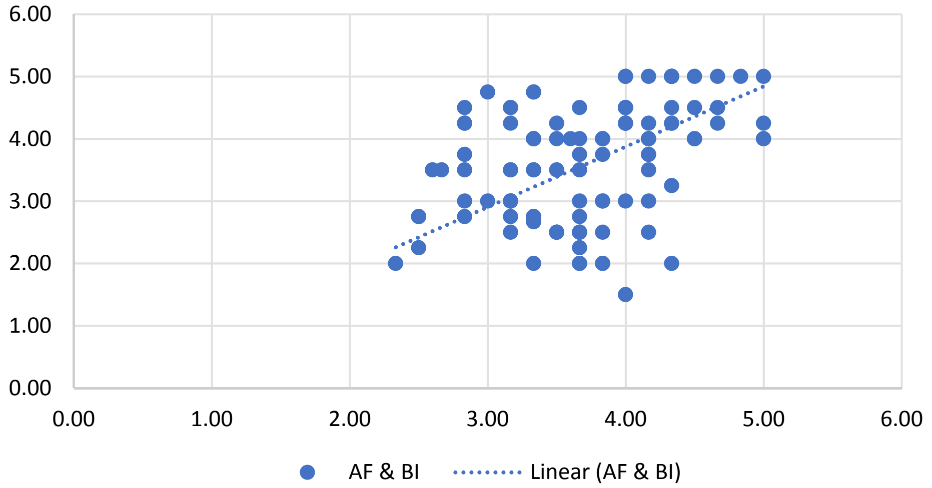


Figure 4. 13 Pearson correlation between affect and behavioral intention

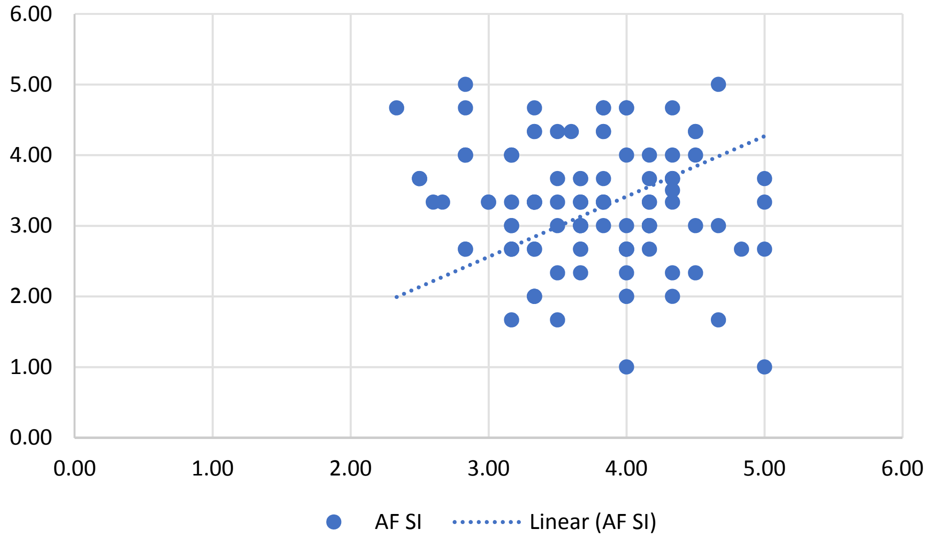


Figure 4. 12 Pearson correlation between affect and social influence

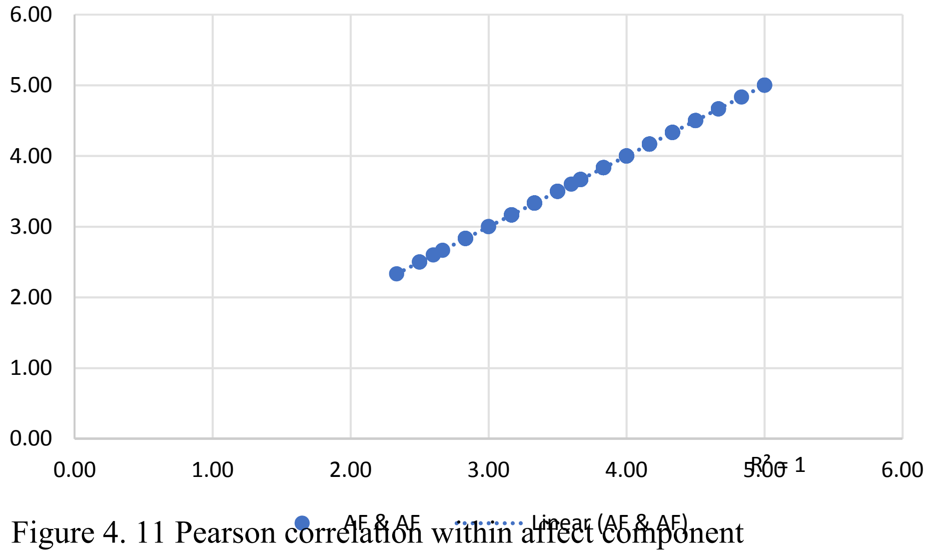


Figure 4. 11 Pearson correlation within affect component

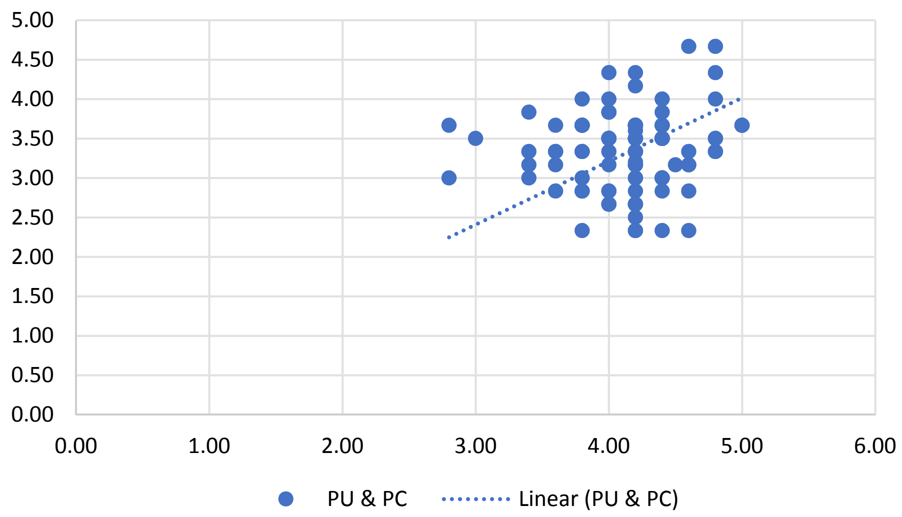


Figure 4. 16 Pearson correlation between perceived usefulness and Perceived control

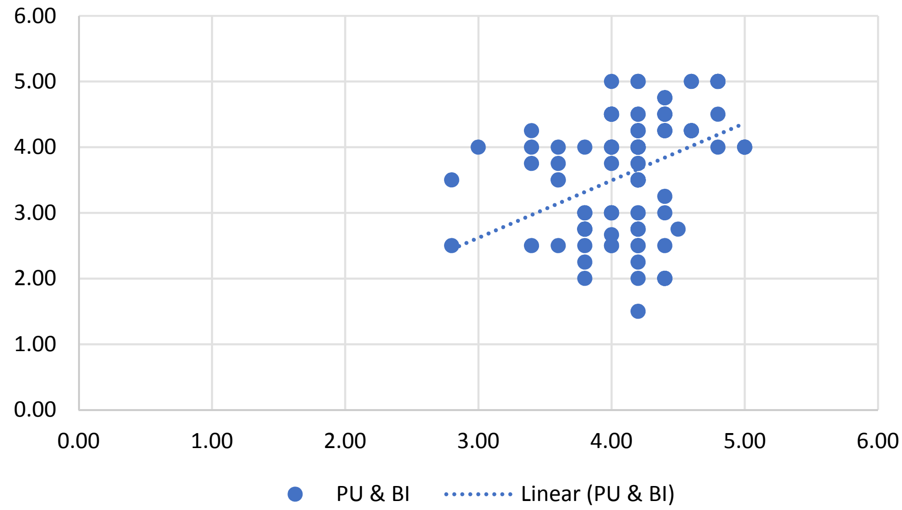


Figure 4. 15 Pearson correlation between perceived usefulness behavioral intentions

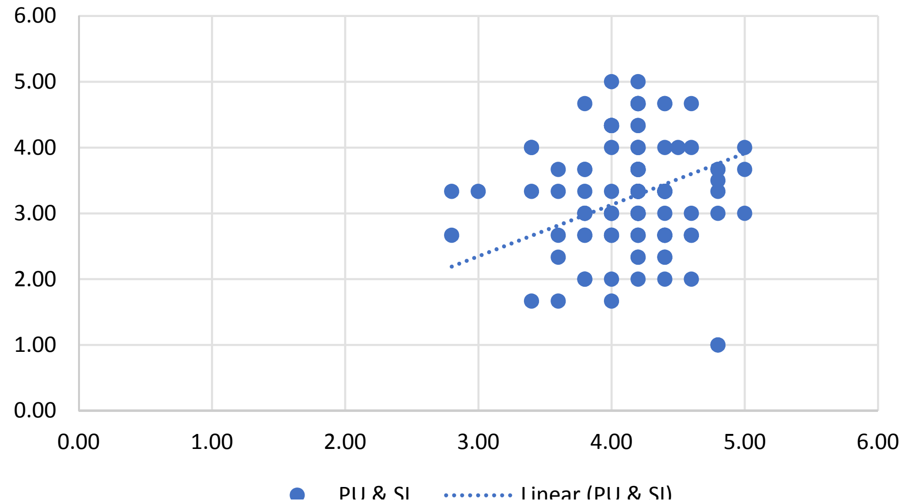


Figure 4. 14 Pearson correlation between perceived usefulness and social influence

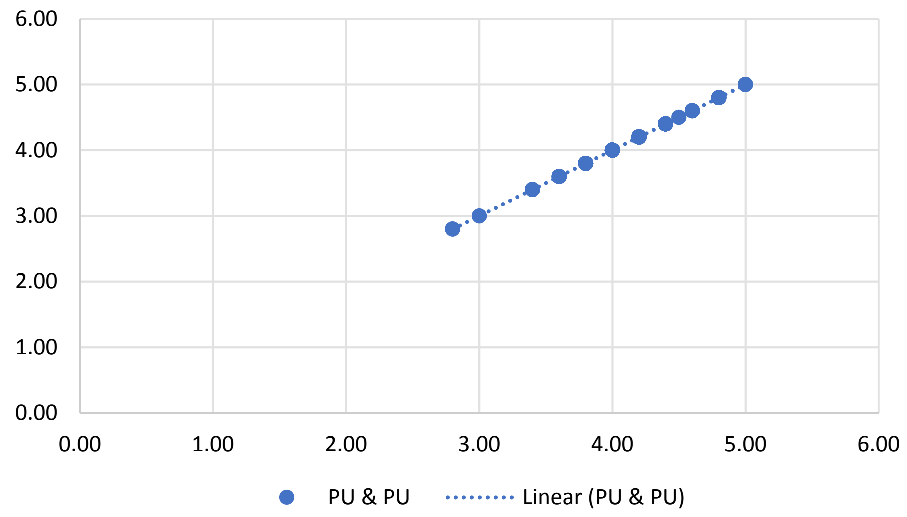


Figure 4. 17 Pearson correlation within perceived usefulness

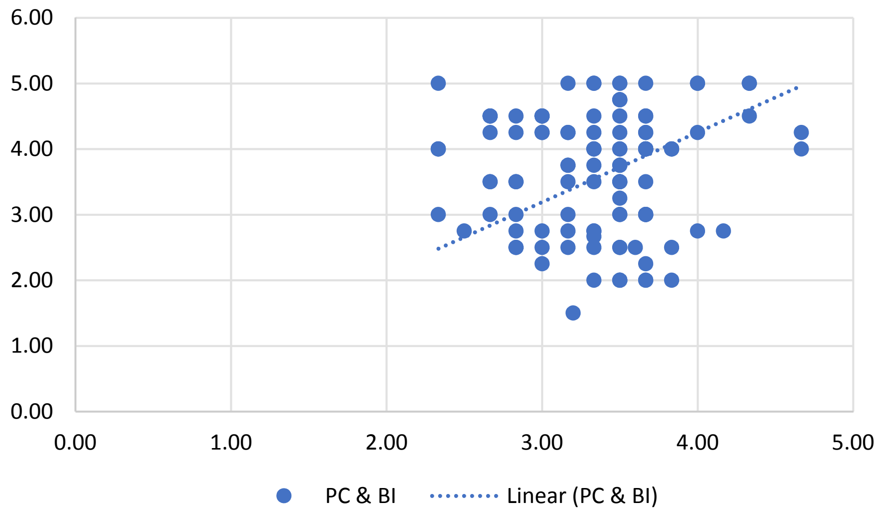


Figure 4. 19 Figure 4.18: Pearson correlation between perceived control and behavioral intention

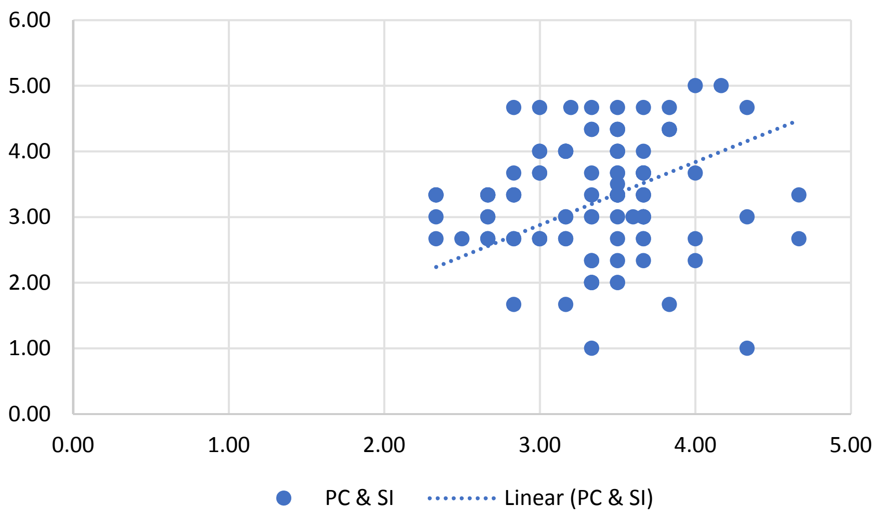


Figure 4. 18 Pearson correlation between perceived control social influence

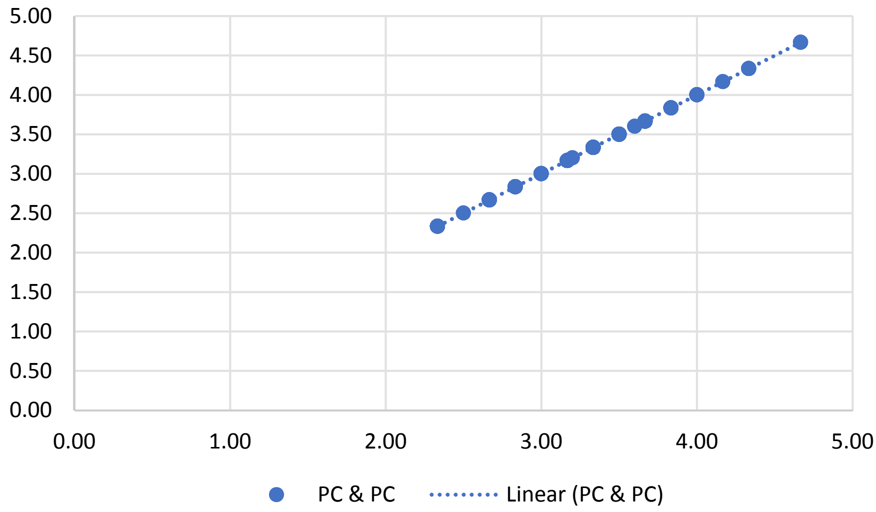


Figure 4. 20 Pearson correlation within perceived control

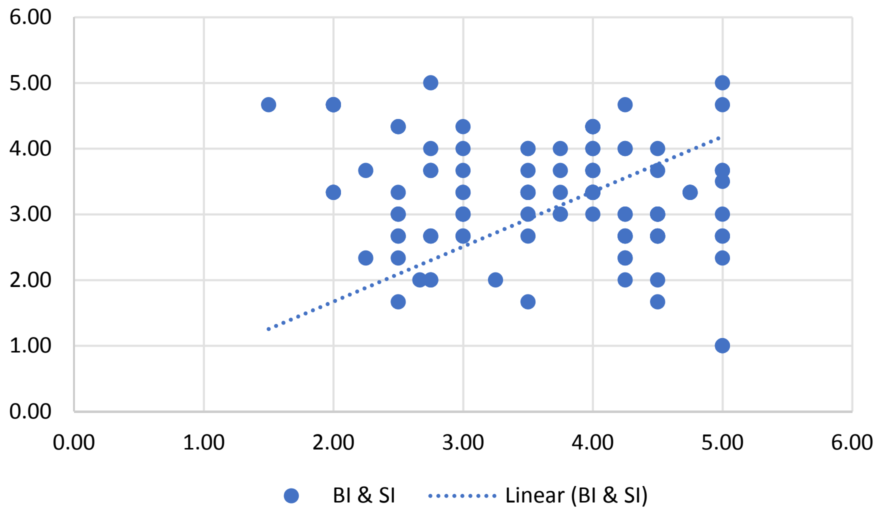


Figure 4. 21 Pearson correlation between behavioral intention and social influence

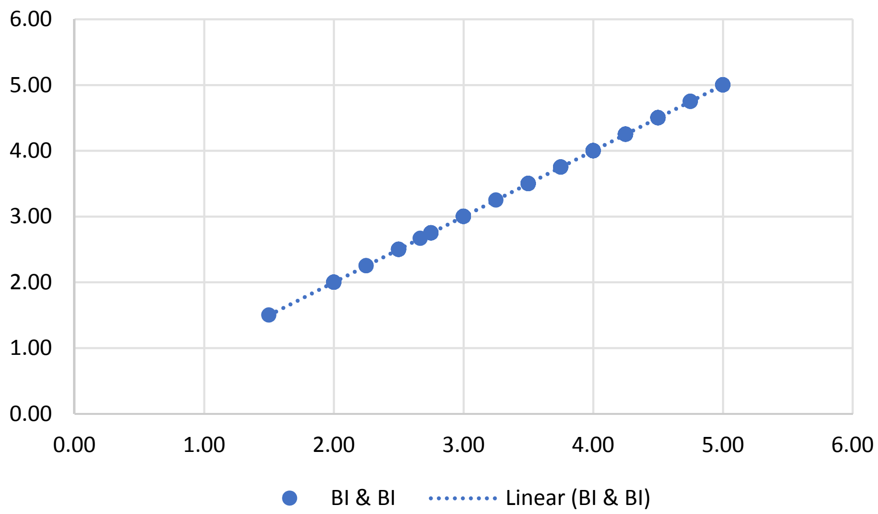


Figure 4. 22 Pearson correlation within behavioral intention

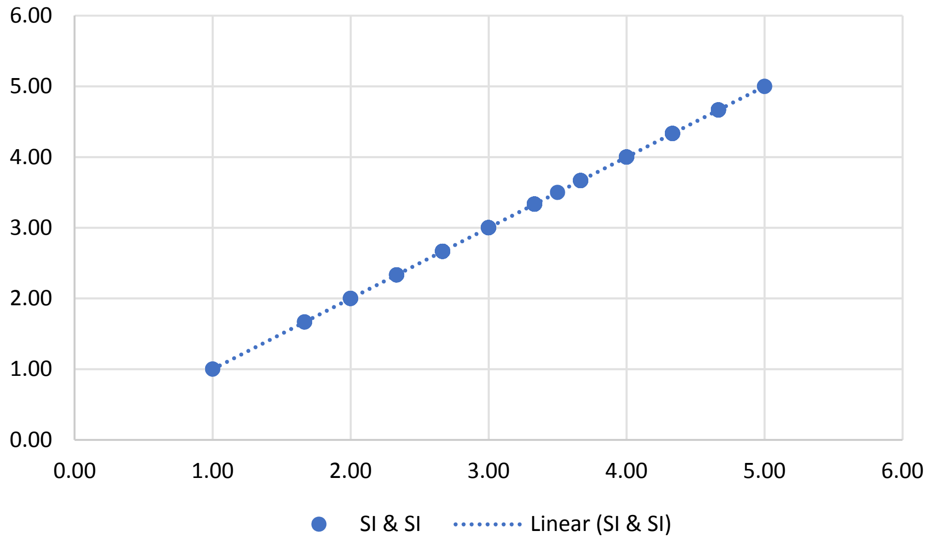


Figure 4. 23 Pearson correlation within social influence

Table 4. 3 *Correlation matrix of the sub-scales**

		AF	PU	PC	BI	SI
	P-Correlation	1	.411**	.433**	.365**	-.099
	Sig. (2-tailed)		.000	.000	.000	.305
	P-Correlation	.411**	1	.250**	.143	.148
	Sig. (2-tailed)	.000		.008	.135	.122
	P-Correlation	.433**	.250**	1	.167	.098
	Sig. (2-tailed)	.000	.008		.082	.309
	P-Correlation	.365**	.143	.167	1	-.113
	Sig. (2-tailed)	.000	.135	.082		.240
	P-Correlation	-.099	.148	.098	-.113	1
	Sig. (2-tailed)	.305	.122	.309	.240	

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

4.4 Attitudes towards technology with respect to age, gender and subject specialization

4.4.1 Introduction

In this section, MANOVA was performed to measure the variations of the attitude of participants towards *Technology* with respect to their *age, gender and subject specialization. Wilk's lamda was reported in the analysis at* significant alpha level of .05. For every dependent variable, that shows significant difference among the participants in MANOVA, we perform an ANOVA analysis to further look at each individual component to see which dependent variable(s) contribute to the statistically significant result. For example to find out in the case of gender, who responded more positively between males and females, which age group have the highest mean score and which subject specialization is more positive than the rest. The major key terms used in MANOVA and ANOVA analysis are defined below.

4.4.1.1 Wilk's lamda(Λ): is the the test statistic that is reported in results from MANOVA, it tests if there is differences between group mean for the combination of the dependent variables. Lamda is the measure of the percent variance by differences in the levels of independent variable. A value of zero means there is no any variance**.**

4.4.1.2 F-value: helps to answer the question "is the variance between the means of two populations significantly different?" The F value was used along with the p-value to decide whether the results are significant enough to reject the null hypothesis. For F value larger than the F-critical found in the F-table, it means that there is significance.

4.4.1.3 p-value: p value is the indicator of whether the result is significant at a stated alpha level. For p value smaller than the alpha level (.05 in this analysis) we reject the null hypothesis and accept the alternate hypothesis that significant variation exist.

4.4.2 MANOVA and ANOVA analysis

4.4.2.1 MANOVA for age group

A one way, multivariate analysis of variance between groups was performed on five dependent variables (affective, perceived usefulness, perceived control, behavioural intention and social influence) for a dependent variable - *age* (Table 4.4). There was a significant difference between the age groups when considered on the combined dependent variable Wilk's lamda(Λ) = .741, $F(15, 281) = 2.161$, $p = .008$, partial eta-squared(η^2) = .095.

Table 4. 4 *MANOVA analysis between age groups and the five sub-scales*

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Intercept	Pillai's Trace	.956	364.015[b]	6.000	101.000	.000	.956
	Wilks' Lambda	.044	364.015[b]	6.000	101.000	.000	.956
	Hotelling's Trace	21.625	364.015[b]	6.000	101.000	.000	.956
	Roy's Largest Root	21.625	364.015[b]	6.000	101.000	.000	.956
Age	Pillai's Trace	.304	1.932	18.000	309.000	.013	.101
	Wilks' Lambda	.714	2.009	18.000	286.156	.010	.106
	Hotelling's Trace	.375	2.079	18.000	299.000	.007	.111
	Roy's Largest Root	.296	5.082[c]	6.000	103.000	.000	.228

4.4.2.2 ANOVA analysis for age groups

To determine which of the component(s) contributed to the statistically significant result, a separate ANOVA was conducted for each dependent variable, with each ANOVA evaluated at an alpha level of .05 (Table 4.5). There was a significant difference between the age groups on perceived usefulness, $F(3, 106) = 4.03$, $p = .009$, partial eta-squared (η^2) = .102 (Figure 4.25) with age group 35-40(*M*=4.75) scoring highest, followed by age groups 25-35(*M*=4.59), 15-25(M=4.27) and the lowest was scored by 40-45(*M*=4.00) (Table 4.6). There was also significant difference between the age groups on behavioural intention to use technology, $F(3, 106) = 4.573$, $p = .005$, partial eta-squared (η^2) = .115 (Figure 4.27) with the corresponding scores of the participants of the age groups following the same fashion as that of perceived usefulness. Age group 35-40(M=4.25) scored highest among all, followed by 25-35(M=4.05), third score goes to 15-25(M=3.44) and the least was scored by 40-45(M=2.33) (Table 4.6). There was no significant difference between the age groups on how much they liked technology (*affective): $F(3, 106) = .422$, $p = .738$*, partial eta-squared (η^2) = .012 (Figure 4.24), how much control they have over technology (*perceived control*): $F(3, 106) = .496$, $p = .686$, partial eta-squared (η^2) = .014 (Figure 4.26) and how much they were influenced to use technology by the society (*social influence*): $F(3, 106)= .701$, $p = .554$, partial eta-squared (η^2) = .019 (Figure 4.27). However the overall technology attitude of participants of all age groups followed almost the same pattern, except for the age group 15 – 25 (Figure 4.28)

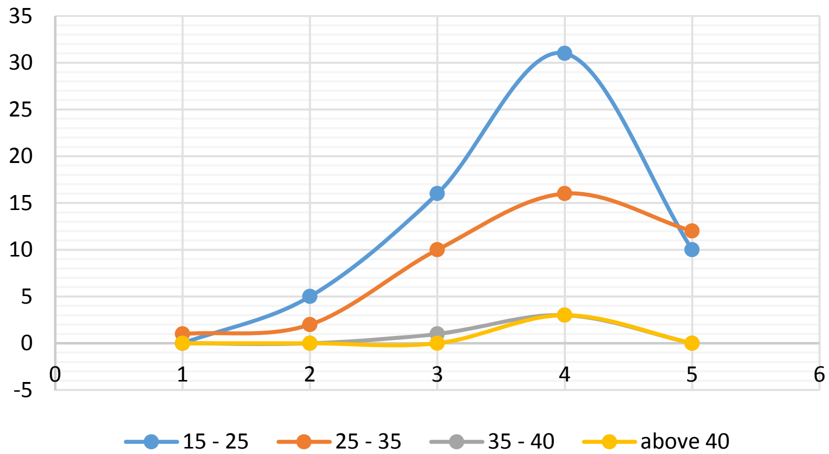


Figure 4. 25 Age * Affect component Crosstabulation

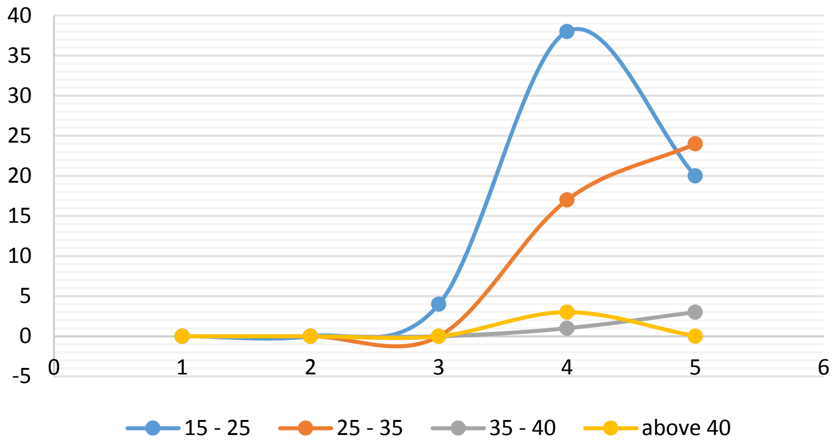


Figure 4. 26 Age * Perceived usefulness Crosstabulation

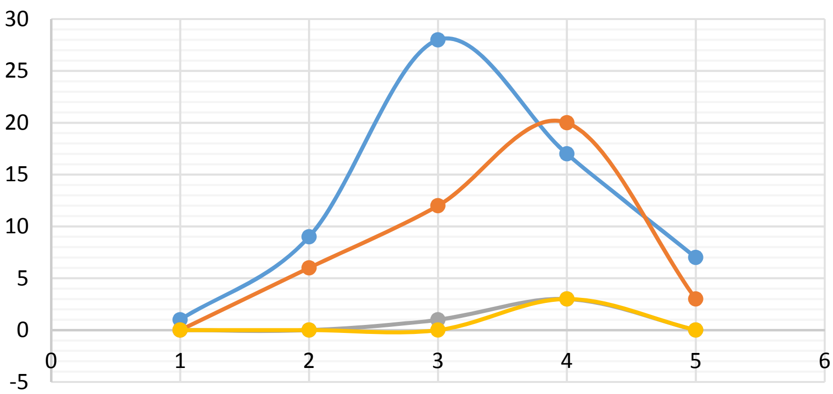


Figure 4. 24 Age * Perceived control Crosstabulation

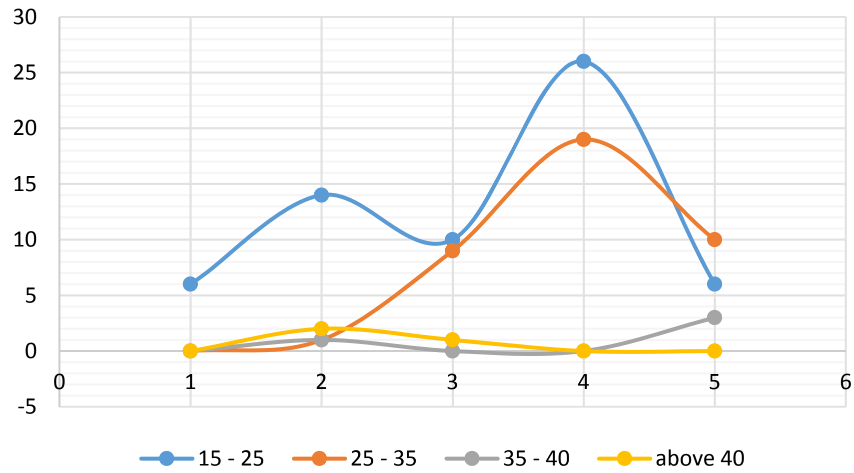


Figure 4. 28 Age * Behavioral intention Crosstabulation

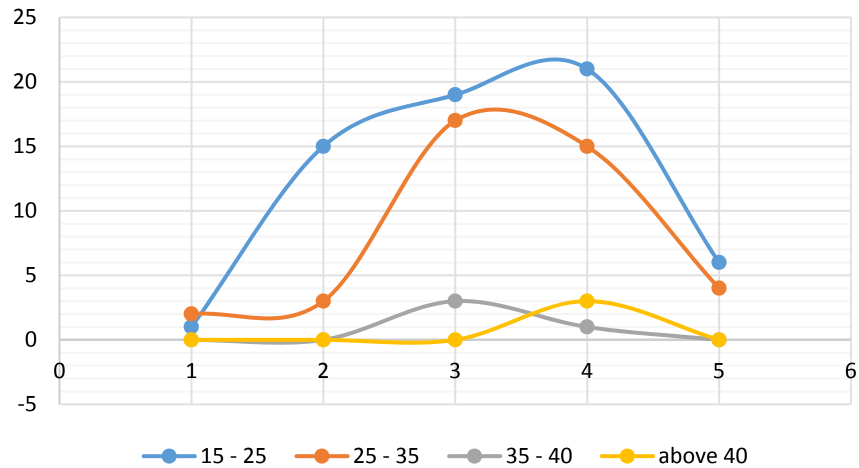


Figure 4. 27 Age * Social influence Crosstabulation

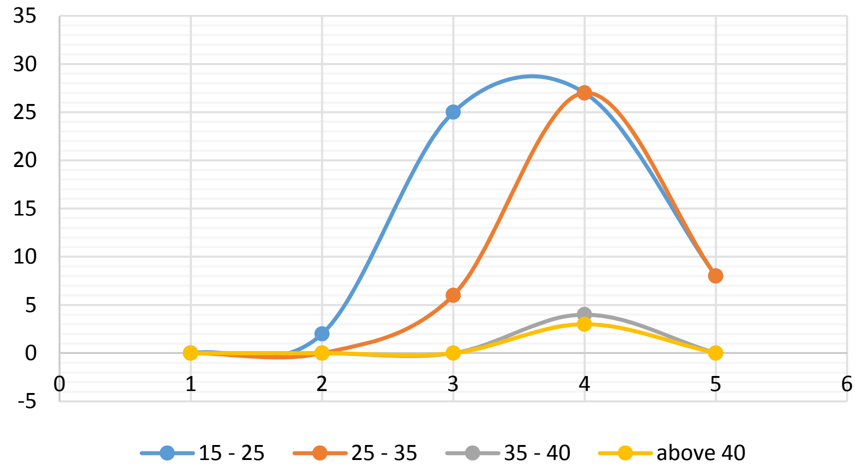


Figure 4. 29 : Age * Overall technology attitude Crosstabulation

Table 4. 5 *ANOVA analysis for each independent variable and age groups*

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	Affect	389.125	1	389.125	595.871	.000	.849
	Perceived use	496.612	1	496.612	1722.53	.000	.942
	Perceived control	358.207	1	358.207	574.269	.000	.844
	Behavioral intention	317.218	1	317.218	272.134	.000	.720
	Social influence	310.173	1	310.173	341.661	.000	.763
	Overall attitude	409.184	1	409.184	1157.17	.000	.916
Age	Affect	.826	3	.275	.422	.738	.012
	Perceived use	3.488	3	1.163	4.032	.009	.102
	Perceived control	.929	3	.310	.496	.686	.014
	Behavioral intention	15.994	3	5.331	4.573	.005	.115
	Social influence	1.908	3	.636	.701	.554	.019
	Overall attitude	3.290	3	1.097	3.102	.030	.081
Error	Affect	69.222	106	.653			
	Perceived use	30.560	106	.288			
	Perceived control	66.119	106	.624			
	Behavioral intention	123.561	106	1.166			
	Social influence	96.231	106	.908			
	Overall attitude	37.482	106	.354			

Table 4. 6 *Estimated marginal means for Age*

				95% Confidence Interval	
				Lower Bound	Upper Bound
Affect	15 - 25	3.831	.103	3.627	4.034
	25 - 35	4.000	.126	3.750	4.250
	35 - 40	3.750	.404	2.949	4.551
	above 40	4.000	.467	3.075	4.925
Perceived usefulness	15 - 25	4.266	.068	4.131	4.401
	25 - 35	4.585	.084	4.419	4.752
	35 - 40	4.750	.268	4.218	5.282
	above 40	4.000	.310	3.385	4.615
Perceived control	15 - 25	3.540	.100	3.341	3.739
	25 - 35	3.659	.123	3.414	3.903
	35 - 40	3.750	.395	2.967	4.533
	above 40	4.000	.456	3.096	4.904
Behavioral intention	15 - 25	3.435	.137	3.164	3.707
	25 - 35	4.049	.169	3.714	4.383
	35 - 40	4.250	.540	3.180	5.320
	above 40	2.333	.623	1.097	3.569
Social influence	15 - 25	3.258	.121	3.018	3.498
	25 - 35	3.402	.149	3.107	3.697
	35 - 40	3.250	.476	2.305	4.195
	above 40	4.000	.550	2.909	5.091
Overall attitude	15 - 25	3.806	.076	3.657	3.956
	25 - 35	4.171	.093	3.987	4.355
	35 - 40	4.000	.297	3.411	4.589
	above 40	4.000	.343	3.319	4.681

MANOVA analysis for gender

In order to ascertain whether variation exits between male and female participants on their attitudes towards technology, a one way multivariate analysis of variance was performed on the five dependent variables (affective, perceived usefulness, perceived control, behavioural intention, social influence) for *gender* (Table 4.7). There was a significant difference between males and females on the combined dependent variable: Wilk's lamda(Λ) = .879 , $F(5, 104)$ = 2.858, p = .018, partial eta-squared(η^2) = .121.

Table 4. 7 *MANOVA analysis between gender and the five sub-scales*

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Intercept	Pillai's Trace	.987	1355.480[b]	6.000	103.000	.000	.987
	Wilks' Lambda	.013	1355.480[b]	6.000	103.000	.000	.987
	Hotelling's Trace	78.960	1355.480[b]	6.000	103.000	.000	.987
	Roy's Largest Root	78.960	1355.480[b]	6.000	103.000	.000	.987
Gender	Pillai's Trace	.121	2.372[b]	6.000	103.000	.035	.121
	Wilks' Lambda	.879	2.372[b]	6.000	103.000	.035	.121
	Hotelling's Trace	.138	2.372[b]	6.000	103.000	.035	.121
	Roy's Largest Root	.138	2.372[b]	6.000	103.000	.035	.121

4.4.2.4 ANOVA analysis for gender

Being that a significant difference exists from the MANOVA result, a separate ANOVA was conducted for each dependent variable at an alpha level of .05 (Table 4.8), estimated marginal means (Table 4.9). There was a significant difference between males and females on social influence: $F(1, 108) = 8.703$, $p = .004$, partial eta-squared(η^2) = .075 (Figure 4.34), with females ($M = 3.608$) scoring higher than males ($M = 3.121$) (Figure 4.42). There was no significant difference between males and females on the *affective*: $F(1, 108) = 1.421$, $p = .236$, partial eta squared(η^2) = .013 (Figure 4.30), perceived usefulness: $F(1, 108) = .697$, $p = .406$, partial eta squared(η^2) = .006 (Figure 4.31), perceived control: $F(1, 108) = .156$, $p = .693$, partial eta squared(η^2) = .001 (Figure 4.32), and behavioural intention: $F(1, 108) = .995$, $p = .321$, partial eta squared(η^2) = .009 (Figure 4.33). In general, there was no significant difference in terms of gender on the overall technology attitude, with both males and females participants following the same pattern (Figure 4.35).

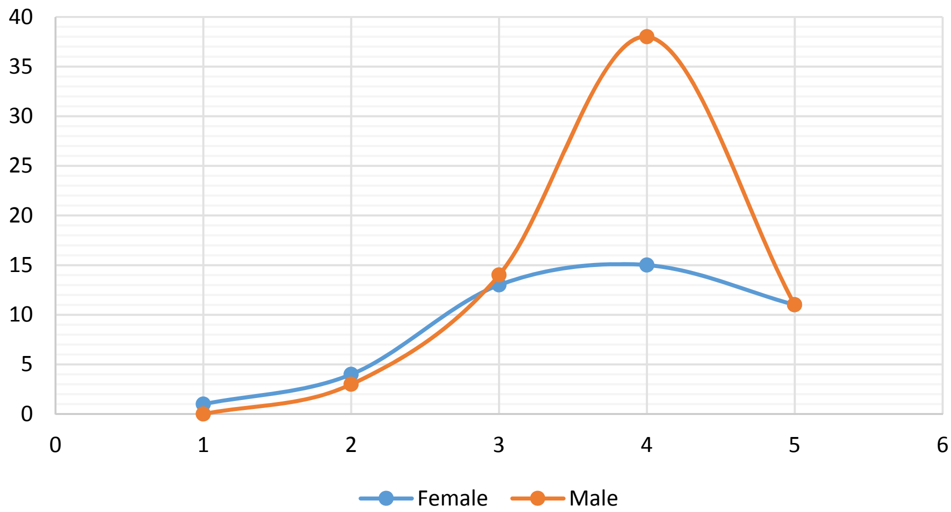


Figure 4. 32 Gender * Affect component Crosstabulation

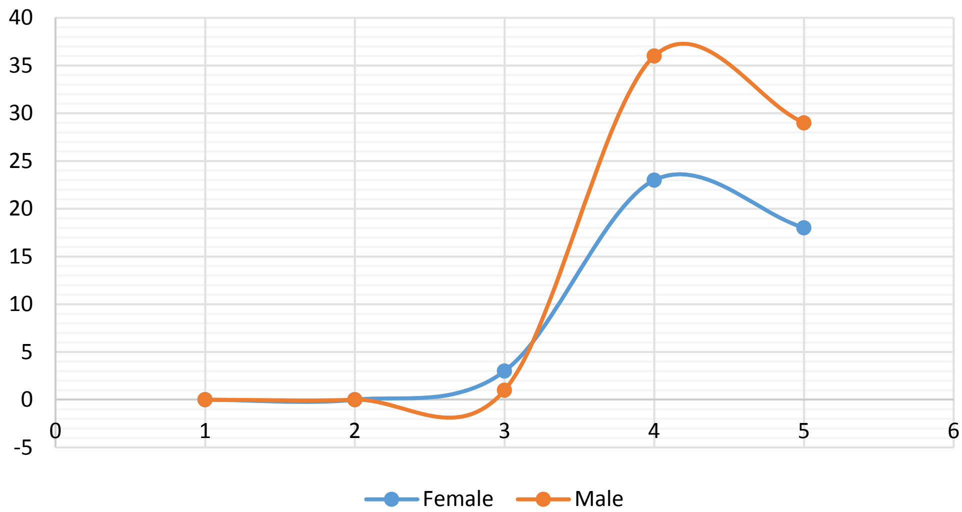


Figure 4. 31 Gender * Perceived usefulness Crosstabulation

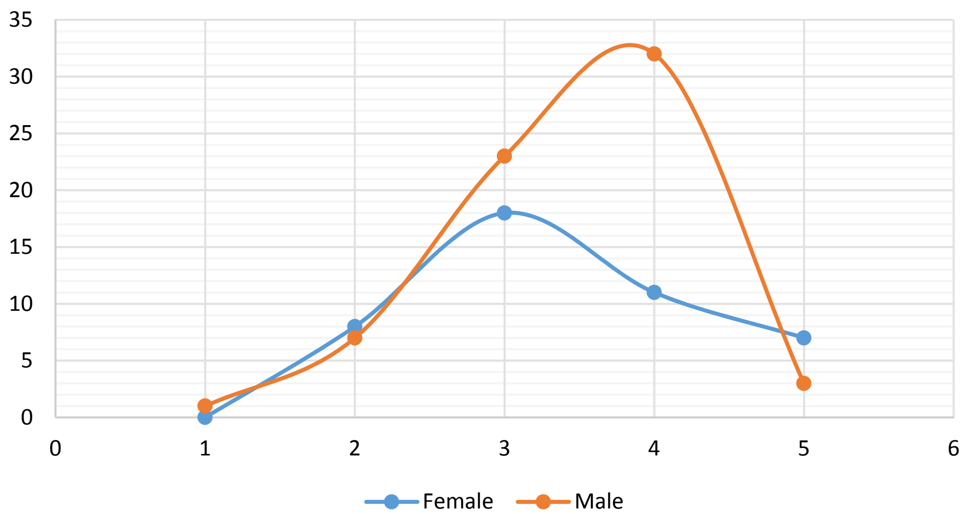


Figure 4. 30 Gender * Perceived control Crosstabulation

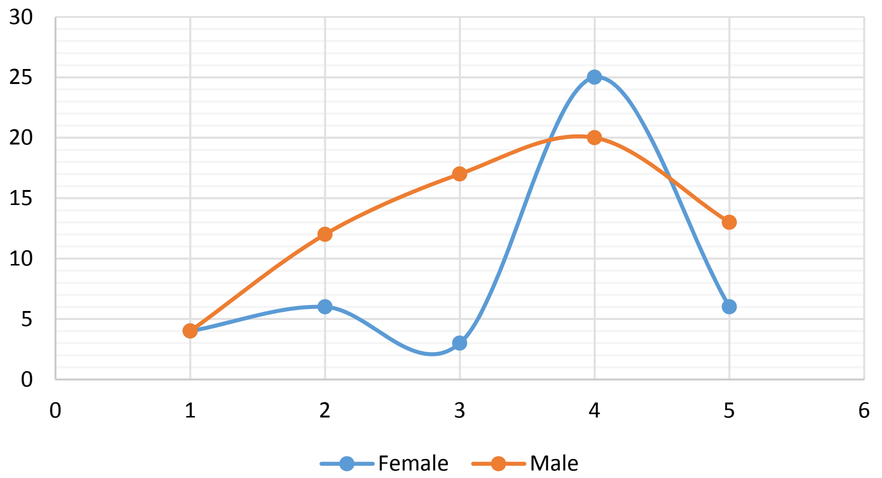


Figure 4. 33 Gender * Behavioral intention Crosstabulation

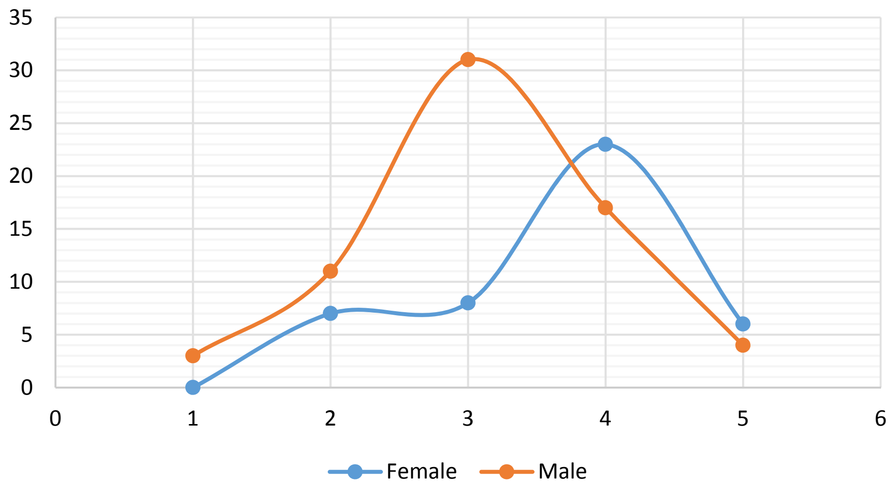


Figure 4. 34 Gender * Social influence Crosstabulation

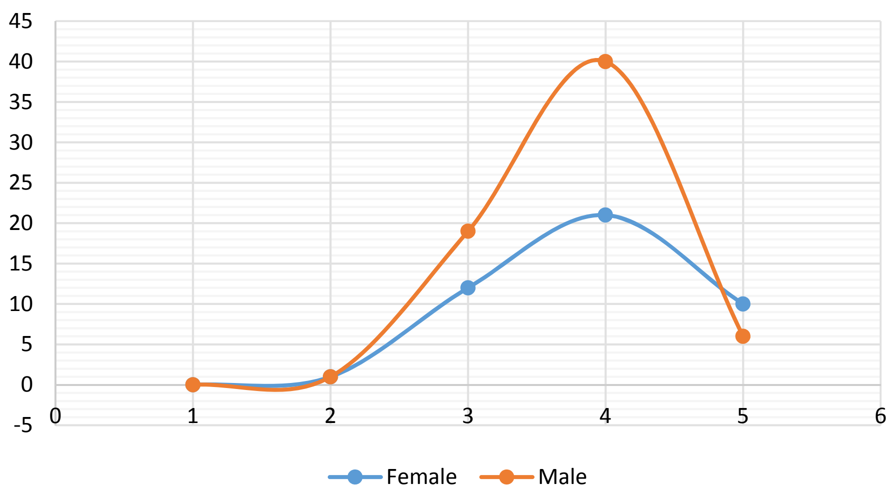


Figure 4. 35 Gender * Overall technology attitude Crosstabulation

Table 4. 8 *ANOVA analysis for each independent variable and gender*

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	Affect	1587.200	1	1587.200	2479.346	.000	.958
	Perceived use	2031.764	1	2031.764	6486.356	.000	.984
	Perceived control	1367.424	1	1367.424	2205.827	.000	.953
	Behavioral intention	1434.438	1	1434.438	1120.328	.000	.912
	Social influence	1209.609	1	1209.609	1438.425	.000	.930
	Overall attitude	1653.000	1	1653.000	4379.533	.000	.976
Gender	Affect	.909	1	.909	1.421	.236	.013
	Perceived use	.218	1	.218	.697	.406	.006
	Perceived control	.097	1	.097	.156	.693	.001
	Behavioral intention	1.274	1	1.274	.995	.321	.009
	Social influence	7.319	1	7.319	8.703	.004	.075
	Overall attitude	.009	1	.009	.025	.874	.000
Error	Affect	69.138	108	.640			
	Perceived_use	33.830	108	.313			
	Perceived control	66.951	108	.620			
	Behavioral intention	138.280	108	1.280			
	Social influence	90.820	108	.841			
	Overall attitude	40.763	108	.377			

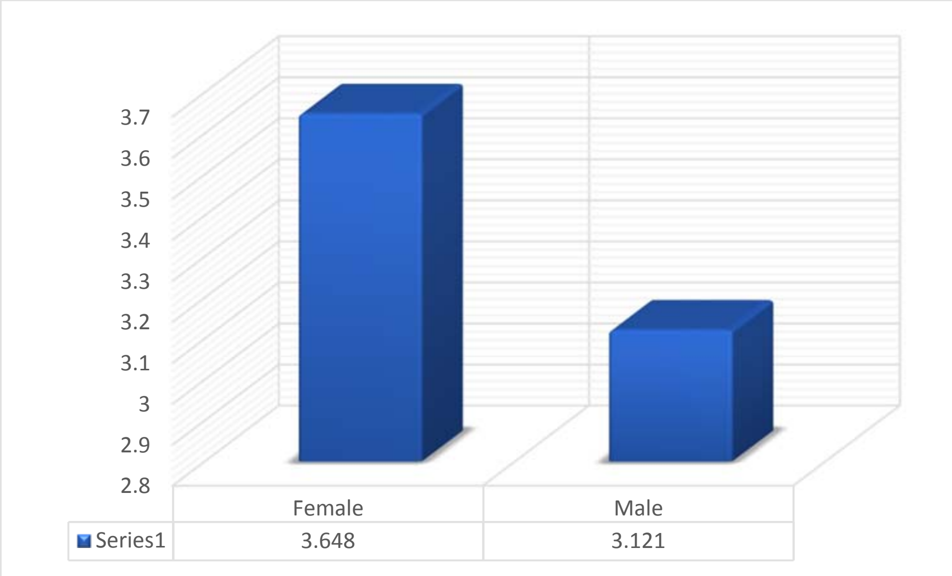


Figure 4. 36 4.42 Estimated marginal means for males and female on Social influence

Table 4. 9 *Estimated marginal means gender*

				95% Confidence Interval	
				Lower Bound	Upper Bound
Affect	Female	3.784	.121	3.545	4.023
	Male	3.970	.098	3.774	4.165
Perceived usefulness	Female	4.341	.084	4.174	4.508
	Male	4.432	.069	4.295	4.568
Perceived control	Female	3.568	.119	3.333	3.803
	Male	3.629	.097	3.437	3.821
Behavioral intention	Female	3.795	.171	3.457	4.134
	Male	3.576	.139	3.300	3.852
Social influence	Female	3.648	.138	3.374	3.922
	Male	3.121	.113	2.897	3.345
Overall attitude	Female	3.966	.093	3.782	4.149
	Male	3.947	.076	3.797	4.097

4.4.2.5 MANOVA for subject specialization

For subject specializations (*Civil Engineering, Computer Science and Engineering, Electrical and Electronic Engineering, Mechanical and Chemical Engineering*) a one way between groups multivariate analysis of variance was performed on the five dependent variables (Table 4.10). There was significant difference found on subject specialization on combined dependent variable attitude towards technology: Wilk's lamda(Λ) = .666, $F(15, 282) = 2.980$, $p < .0001$, partial eta-squared(η^2) = .127.

Table 4. 10 *MANOVA analysis between subject specializations and the five sub-scales*

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Intercept	Pillai's Trace	.985	1127.588	6.000	101.00	.000	.985
	Wilks' Lambda	.015	1127.588	6.000	101.00	.000	.985
	Hotelling's Trace	66.985	1127.588	6.000	101.00	.000	.985
	Roy's Largest Root	66.985	1127.588	6.000	101.00	.000	.985
Specialization	Pillai's Trace	.397	2.621	18.000	309.00	.000	.132
	Wilks' Lambda	.646	2.651	18.000	286.15	.000	.135
	Hotelling's Trace	.481	2.665	18.000	299.00	.000	.138
	Roy's Largest Root	.280	4.805[c]	6.000	103.00	.000	.219

4.4.2.6 ANOVA for subject specialization

A separate ANOVA was conducted for each independent variable, with each ANOVA evaluated at alpha value of .05 (Table 4.11). There was significant difference found between four groups (*subject specializations*) in their perceptions of how much they like technology (*affective*): $F(3, 106) = 4.265$, $p = .007$, partial eta squared(η^2) = .108 (Figure 4.36), in which Civil Engineering trainee-teachers scored highest (M=4.57), Computer Science and Engineering trainees-teachers scored second highest (M=3.90), followed by Mechanical and Chemical engineering trainee-teachers (M=3.83), and then the least scored by Electrical and Electronic Engineering trainee-teachers (M=3.76) (Table 4.12). Similarly there was significant difference on their perception of how useful they found technology (*perceived usefulness*): $F(3, 106) = 4.719$, $p = .004$, partial eta squared(η^2) = .118 (Figure 4.37), with Civil Engineering trainee-teachers having the highest score (M=4.79), followed by Computer Science and Engineering trainee-teachers (M=4.70), then Electrical and Electronic Engineering trainee-teachers (M=2.33) and the least scored by Mechanical and Chemical Engineering trainee-teachers (M=4.25) (Table 4.12). Their perception also differ on how much control they have over technology (*perceived control*): $F(3, 106) = 5.722$, $p = .001$, partial eta squared(η^2) = .139 (Figure 4.38), and the same way, Civil Engineering scored highest (M=4.29), Computer Science and Engineering (M=3.90), Mechanical and Chemical Engineering trainee-teachers (M=3.52) and lastly Electrical and Electronic Engineering trainee-teacher (M=3.43) (Table 4.12). There was no significant difference found between subject specializations on behavioural intention: $F(3, 106) = 1.477$, $p = .225$, partial eta squared(η^2) = .040 (Figure 4.39), and social influence: $F(3, 106) = 2.695$, $p = .050$, partial eta squared(η^2) = .071 (Figure 4.40). The cumulative effects of these significant differences resulted in significant variation on the overall technology attitude in terms of subject specialization (Figure 4.41).

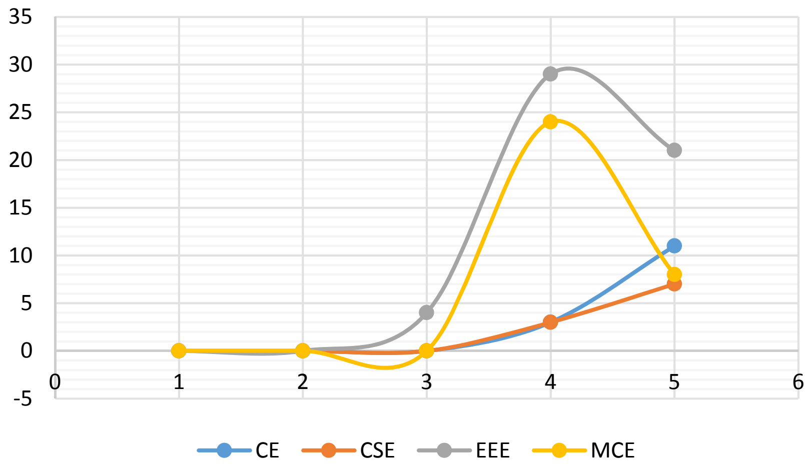


Figure 4. 37 Specialization * Perceived usefulness Crosstabulation

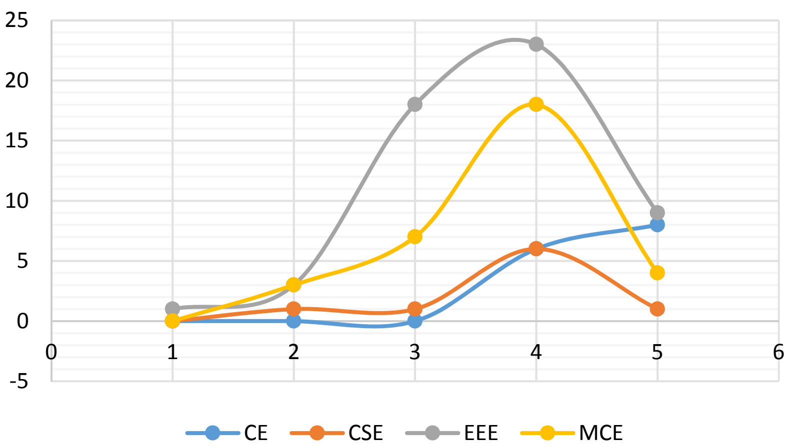


Figure 4. 38 Specialization * Affect component Crosstabulation

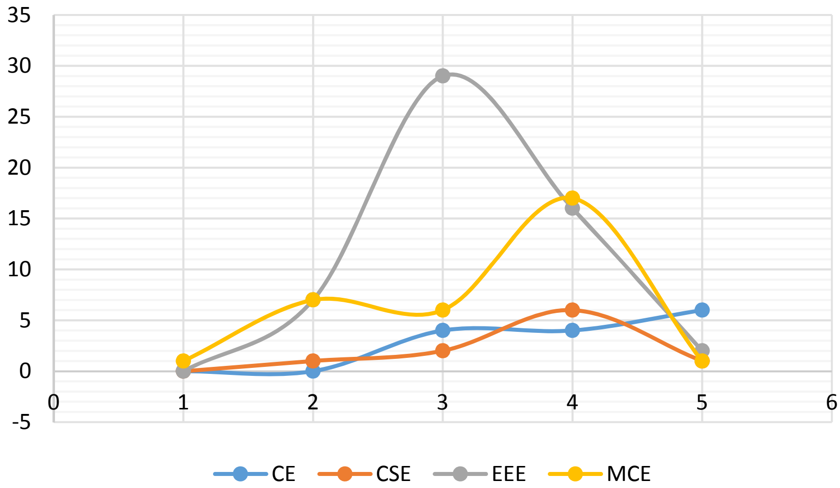


Figure 4. 43 Specialization * Perceived control Crosstabulation

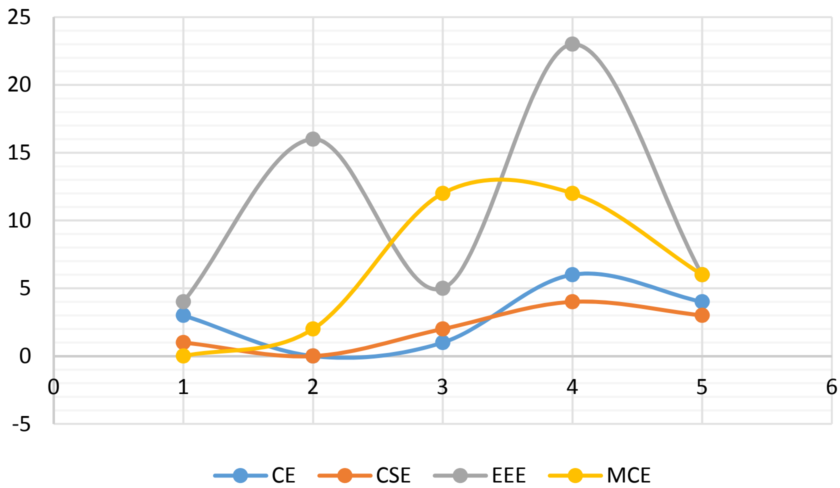


Figure 4. 41 Specialization * Behavioral intention Crosstabulation

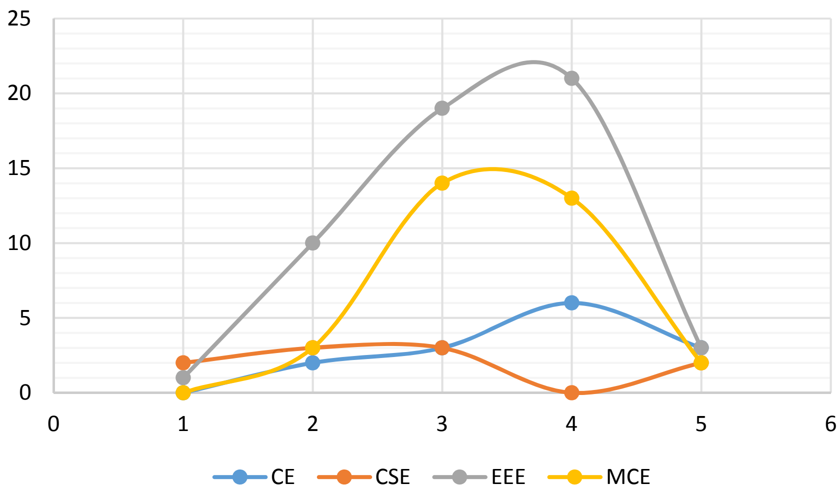


Figure 4. 42 Specialization * Social influence Crosstabulation

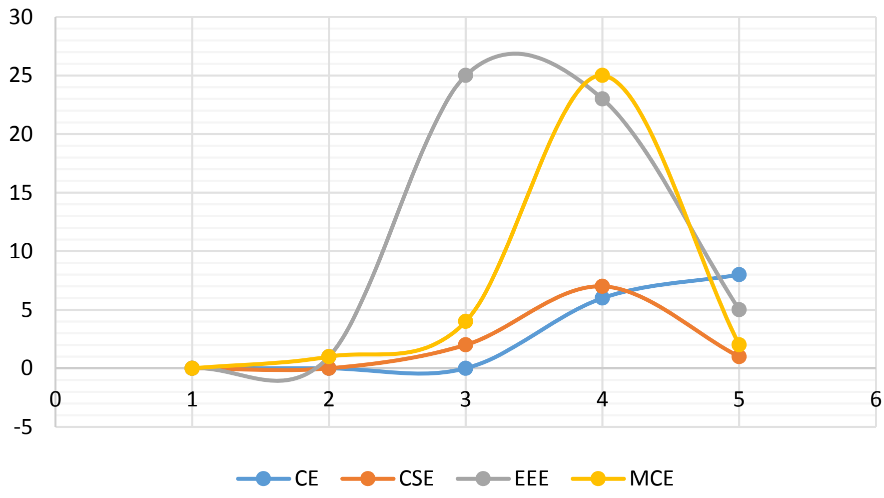


Figure 4. 44 Specialization * Overall technology attitude Crosstabulation

Table 4. 11 *ANOVA analysis for each independent variable and subjection specialization*

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	Affect	1165.863	1	1165.863	1977.18	.000	.949
	Perceived use	1474.504	1	1474.504	5203.69	.000	.980
	Perceived control	1034.526	1	1034.526	1900.41	.000	.947
	Behavioral intention	1035.915	1	1035.915	819.733	.000	.885
	Social influence	783.575	1	783.575	910.901	.000	.896
	Overall attitude	1220.003	1	1220.003	3896.94	.000	.974
Specialization	Affect	7.544	3	2.515	4.265	.007	.108
	Perceived use	4.012	3	1.337	4.719	.004	.118
	Perceived control	9.345	3	3.115	5.722	.001	.139
	Behavioral intention	5.600	3	1.867	1.477	.225	.040
	Social influence	6.955	3	2.318	2.695	.050	.071
	Overall attitude	7.588	3	2.529	8.079	.000	.186
Error	Affective	62.504	106	.590			
	Perceived use	30.036	106	.283			
	Perceived control	57.703	106	.544			
Intercept	Behavioral intention	133.955	106	1.264			
	Social influence	91.183	106	.860			
	Overall attitude	33.185	106	.313			

Table 4. 12 *Estimated marginal* means for *specialization*

				95% Confidence Interval	
				Lower Bound	Upper Bound
Affect	CE	4.571	.205	4.165	4.978
	CSE	3.900	.243	3.419	4.381
	EEE	3.759	.104	3.552	3.966
	MCE	3.828	.136	3.559	4.097
Perceived usefulness	CE	4.786	.142	4.504	5.068
	CSE	4.700	.168	4.366	5.034
	EEE	4.324	.072	4.180	4.468
	MCE	4.250	.094	4.063	4.437
Perceived control	CE	4.286	.197	3.895	4.677
	CSE	3.900	.233	3.437	4.363
	EEE	3.426	.100	3.227	3.625
	MCE	3.516	.130	3.257	3.774
Behavioral intention	CE	3.893	.300	3.297	4.489
	CSE	3.950	.355	3.245	4.655
	EEE	3.435	.153	3.132	3.738
	MCE	3.859	.199	3.465	4.253
Social influence	CE	3.750	.248	3.259	4.241
	CSE	2.700	.293	2.119	3.281
	EEE	3.278	.126	3.028	3.528
	MCE	3.438	.164	3.112	3.763
Overall attitude	CE	4.571	.150	4.275	4.868
	CSE	4.150	.177	3.799	4.501
Affect	EEE	3.769	.076	3.618	3.919
	MCE	3.938	.099	3.741	4.134

4.5 Correlation analysis between years of technology use, perceived confidence and attitude towards technology

To examine the relationship between technology attitude, years of technology use and level of technology confidence, a bivariate correlation was performed (Table 4.13) The result revealed a significant correlation (r = .19, n = 110, *p* = *.43*) between years of technology use and level of technology confidence. There was also significant correlations between the overall technology attitude and years of technology use (r = .240, n = 110, *p* = .11) and level of technology confidence (r = .204, n = 110, *p* = .33) (Table 4.13). The mean years of technology use was years of technology use was (*M* = 7.22, *SD* = 4.16), level of technology confidence (*M* = 3.91, *SD* = .629) and the overall technology attitude (*M*= 3.96, *SD* = .612) (Table 4.14).

Table 4. 13 *Correlation for years of technology use, technology confidence and overall attitude*

		Years of use	Confidence	Overall attitude
	Pearson Correlation	1	.194*	.240*
	Sig. (2-tailed)		.043	.011
	Pearson Correlation	.194*	1	.204*
	Sig. (2-tailed)	.043		.033
	Pearson Correlation	.240*	.204*	1
	Sig. (2-tailed)	.011	.033	

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

Table 4. 14 *Descriptive Statistics for years of technology use, confidence and overall attitude towards technology*

	Mean	Std. Deviation	N
Years of use	7.22	4.158	110
Confidence	3.91	.629	110
Overall technology attitude	3.9545	.61161	110

CHAPTER V - Discussion

5.1 Discussion on findings

This research examined the trainee-teachers attitudes towards technology adoption and use in tertiary engineering education. Trainee-teachers from two universities in Bangladesh participated in the cross-sectional survey. The study highlighted the interaction between these attitudes and variables such as age, gender, subject specialization, years of technology use and confidence. The analysis revealed that the participants showed an overall positive attitude towards technology, as indicated by the mean score for each subscale being above midpoint (*3.3 and above, on 5 point scale*).

The overall positive level of technology attitudes attained by the participants in the study could be attributed to the availability and accessibility to technology at various stages of their education. This may have taken place prior to their enrollment in teacher education program, given the governmental and non-governmental efforts to enhance technology use at various educational level. These efforts constitutes various projects and programs that are geared towards training teachers and trainee-teachers on how to integrate technology into classroom instruction (Pouezevara & Khan, 2007; M. M. Shohel & T. Power, 2010) .

This study found no significant difference for gender and overall attitude towards technology. This contradicts earlier studies which reported significant difference in technology attitudes between males and females (Fisher & Margolis, 2003; Markauskaite, 2006; Tezci, 2011). For example, Jackson et al. (2001) reported that female users of online educational tools were found to be more inclined to hold negative response towards technology than their male counterpart, and that my resulted in gender variation in using technology. Other studies revealed that, males were found to have rated themselves significantly higher than females in technological abilities (Houtz & Gupta, 2001) and perceived the ease of technology use in different ways, with males rated higher than females (Teo, 2014).

Other user variables such as self-efficacy, anxiety, and technological experience were reported to have gender effects. For example, Tømte and Hatlevik (2011) and Rozell and Gardner III (2000) stated that males were reported to have higher technology self-efficacy than females. Females typically shows greater anxiety towards technology than males (McIlroy, Bunting, Tierney, & Gordon, 2001). Todman (2000) suggested that in general, males on average have the tendency to acquire technology self-efficacy much faster than females.

The absence of significant difference in the attitudes towards technology by gender in this study is consistent with studies that reported non-significant difference between males and females in their attitudes towards technology (Bakr, 2011; Jackson et al., 2001; Oyelaran-Oyeyinka & Adeya, 2004; Tezci, 2011). For example, Teo (2008) in a study on pre-service teachers attitude towards technology found non-significant difference by gender. Gender was also reported among several factors that had no statistically significant impact on the acceptance of e-learning by teachers (Hrtoňová et al., 2015).

The positive attitude of females in this study could be spurred by the social influence factor, being that the result in this study shows a significant variation by gender in the way participants feel about societal encouragement on technology use, with females being more influenced to use technology by their social groups than males. This development according to Teo (2008), could be attributed to the fact that females may have been socialized differently in today's generation to be more comfortable while using technology and this may have resulted in lessening the barriers perceived by females in accessing technology

Participants with different subject specializations (*civil engineering, computer science and engineering, electrical and electronic engineering and mechanical engineering)* differed in their perception on how much they like technology (*affective*), how useful they found technology (*perceived usefulness*), and how much control they have over technology (*perceived control*). Among all specializations, participants from civil engineering and computer science and engineering liked and perceived technology as useful for their daily tasks more than participants from mechanical engineering and electrical and electronic engineering. The result also shows that, participants from civil engineering and computer science engineering have control over technology more than participants from mechanical engineering and electrical and electronic engineering. The differences found among students in different subject specializations in this study are consistent with previous literature. For example, Teo (2008) found a significant difference in technology attitudes among pre-service teachers with different subject domain in Singapore survey. It could be possible that their perceptions were shaped by their job expectations (Teo, 2008). Trainee-teachers who expect to use technology more frequently in their future carrier may hold different perceptions of usefulness and control, relative to those who expect less encounter with technology in their teaching profession. In general, participants from all subject specializations liked and perceived the technology to be useful in their work. Their responses also shows that they have control over technology while using.

The findings in this research indicated that years of technology use and level of technology confidence are positively correlated with positive attitudes towards technology. The higher the number of years of technology use, the higher the level of confidence of the user. This signifies that technology use over time increases the level of confidence of the user, and thereby resulted in more positive attitude towards the technology. This result was consistent with previous research findings. For example, (Teo, 2008) claimed that one's more frequent use of technology and developing variety of technology related skills and techniques increases one's overall knowledge of technology. This widens one's learning potential and prospect, which will consequently promote a positive feeling towards technology.

The secondary purpose of this study was to investigate the effect of social factor on the attitude of trainee-teachers on technology, which was not included in previous studied that used CAS, such as (Abedalaziz, Jamaluddin, & Chin, 2013; Grover, 2016; Teo, 2008). Social influence was found to be an important construct, in addition to the four variables of the computer attitude scale (CAS) that affects the acceptability and intention to use technology.

5.2 Implication

To successfully achieve technology integration into the engineering curriculum, concrete foundation of technology acceptance has to be laid at the teachers' training level. This is one of the fundamental steps through which future engineering education teachers can be fully equipped with necessary abilities, capabilities and expertise required for the next task ahead (Teo, 2008). This will enable them to map-out and design their instructional strategies in conformity with the current information age. More so, identifying the trainee-teachers attitudes in engineering education towards technology use and value may provide cognizance for policy and practices related to technology use and skills. It also said to provide a blueprint for course design and support, trainee-teachers training and development (Tabata & Johnsrud, 2008).

5.3 Contribution:

1. **Theory:** This study provides new influential factor (social) which could be merged with other four major components (affect, perceived usefulness, perceived control and behavioral intention) of CAS.
2. **Practice:** The findings of this study may serve as an insight to the progress made so far, against the goals related to technology integration especially in tertiary engineering education of Bangladesh. This study may provide cognizance necessary for the design of educational policy related to technology integration
3. This study may also provide a blueprint for course design, trainee-teachers training and support as well as professional development
4. **Existing literature:** The study provides an insight into a new segment of trainee teachers' attitudes towards technology (Engineering Education) which has not been reported in prior literature

5.4 Limitation

There are three basic limitations to the current study. Firstly, the data was collected through self-reports from trainee-teachers, such that there is the potential for self-response bias that may sway the true associations between variables, though this is common in all survey research. To limit this potential bias, a combination of positive and negative items were used in the instrument to ensure that true responses are received. The negative items were then reverse corded during data analysis.

Secondly, the participants in this study were engineering education trainee-teachers and the sample size is relatively small, thus the extent to which the findings may be generalized is limited.

Thirdly, the variables used in this study were basically determined by the selection of Computer Attitude Scale (CAS) for data collection, though one important variable (s*ocial norms*) was included. Consequently, other significant variables that may influence attitudes towards technology were excluded and, subsequently leading to limited understanding of the trainee-teachers attitude towards technology. For example, (Teo, 2008) suggested that other constructs such as subjective norms, facilitating conditions and technological complexity should be added to examine their impact on attitudes towards technology.

Finally, the data in this research was collected using a cross-sectional, single administration design and thus, it was not possible to establish the stability of the participants' attitudes.

5.5 Conclusion and future research direction

The current study provide a glimpse of trainee-teachers attitudes towards technology acceptance and use in tertiary engineering education and how these attitude are mediated by factors such as age, gender, subject specialization, confidence and years of technology use. The analysis revealed a strong associations of these factors and the way trainee-teacher perceive their ability to control technology and its usefulness in their instructional activities. Their perception of the ease of use, of technology has the tendency to spur their perception of its usefulness and subsequently, stimulate their intention to use. There was no gender variation on the overall positive attitude realized among the participants in this study. However, social influence was found to be an important construct, in addition to the four variables of the computer attitude scale (CAS) that affects the acceptability and intention to use technology by gender. Females' attitudes in this regard were more likely swayed by their societal norms than males. Future research may include comparison of the results in this study with larger sample size using longitudinal design to examine how the trainee-teachers attitudes and experiences changes over time. While the additional variable (*social influence*) could be adopted for conducting other research with computer attitude scale (CAS), other variables such as facilitating conditions and technological complexity may also be explored.

REFERENCES

Abedalaziz, N., Jamaluddin, S., & Chin, H. L. (2013). Measuring attitudes toward computer and internet usage among postgraduate students in Malaysia. *TOJET: The Turkish Online Journal of Educational Technology, 12*(2).

Aggarwal, Y. (2008). Meaning of the term-descriptive survey research method. *International Journal of Transformations in Business Management, Volume*(1).

Ajzen, I. (1991). The theory of planned behavior. *Organizational behavior and human decision processes, 50*(2), 179-211.

Ajzen, I., & Fishbein, M. (1975). Belief, attitude, intention and behavior: An introduction to theory and research: Reading, MA: Addison-Wesley.

Ajzen, I., & Fishbein, M. (1980). Understanding attitudes and predicting social behaviour.

Asil, M., Teo, T., & Noyes, J. (2014). Validation and measurement invariance of the computer attitude measure for young students (CAMYS). *Journal of Educational Computing Research, 51*(1), 49-69.

Aypay, A., Celik, H. C., Aypay, A., & Sever, M. (2012). Technology acceptance in education: A study of pre-service teachers in Turkey. *TOJET: The Turkish Online Journal of Educational Technology, 11*(4).

Bahr, D. L., Shaha, S. H., Farnsworth, B. J. L., Valerie, K., & Benson, L. F. (2004). Preparing tomorrow's teachers to use technology: Attitudinal impacts of technology-supported field experience on pre-service teacher candidates. *Journal of Instructional Psychology, 31*(2), 88-98.

Bakr, S. M. (2011). Attitudes of Egyptian Teachers towards Computers. *Contemporary Educational Technology, 2*(4).

Baturay, M. H., Gökçearslan, Ş., & Ke, F. (2017). The relationship among pre-service teachers' computer competence, attitude towards computer-assisted education, and intention of technology acceptance. *International Journal of Technology Enhanced Learning, 9*(1), 1-13.

Bear, G. G., Richards, H. C., & Lancaster, P. (1987). Attitudes toward computers: Validation of a computer attitudes scale. *Journal of Educational Computing Research, 3*(2), 207-218.

Bliss, T. J. (2003). Attitudinal responses to teacher professional development for the effective integration of educational technology. *Journal of In-Service Education, 29*(1), 81-100.

Boulton, M. J., Hardcastle, K., Down, J., Fowles, J., & Simmonds, J. A. (2014). A comparison of preservice teachers' responses to cyber versus traditional bullying scenarios: Similarities and differences and implications for practice. *Journal of Teacher Education, 65*(2), 145-155.

Brantley, C. L., & Bradshaw, D. (2017). Secondary Teachers' Perceptions and Self-Efficacy Regarding Technology Integration: A Phenomenological Study.

Brzycki, D., & Dudt, K. (2005). Overcoming barriers to technology use in teacher preparation programs. *Journal of technology and Teacher Education, 13*(4), 619.

Chiu, T. K., & Churchill, D. (2016). Adoption of mobile devices in teaching: Changes in teacher beliefs, attitudes and anxiety. *Interactive Learning Environments, 24*(2), 317-327.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS quarterly*, 319-340.

De Leeuw, A., Valois, P., Ajzen, I., & Schmidt, P. (2015). Using the theory of planned behavior to identify key beliefs underlying pro-environmental behavior in high-school students: Implications for educational interventions. *Journal of Environmental Psychology, 42*, 128-138.

Ertmer, P. A. (2005). Teacher pedagogical beliefs: The final frontier in our quest for technology integration? *Educational Technology Research and Development, 53*(4), 25-39.

Fayolle, A., & Gailly, B. (2015). The impact of entrepreneurship education on entrepreneurial attitudes and intention: Hysteresis and persistence. *Journal of Small Business Management, 53*(1), 75-93.

Fisher, A., & Margolis, J. (2003). *Unlocking the clubhouse: women in computing.* Paper presented at the ACM SIGCSE Bulletin.

Galley, R., Conole, G., & Alevizou, P. (2014). Community indicators: a framework for observing and supporting community activity on Cloudworks. *Interactive Learning Environments, 22*(3), 373-395.

González, M. Á., González, M. Á., Martín, M. E., Llamas, C., Martínez, Ó., Vegas, J., . . . Hernández, C. (2017). Teaching and Learning Physics with smartphones *Blended Learning: Concepts, Methodologies, Tools, and Applications* (pp. 866-885): IGI Global.

Greaves, M., Zibarras, L. D., & Stride, C. (2013). Using the theory of planned behavior to explore environmental behavioral intentions in the workplace. *Journal of Environmental Psychology, 34*, 109-120.

Grover, P. (2016). Computer Attitude of prospective teachers in relation to Self-Efficacy. *COMPUTER, 2*(5).

Henderson, M., Selwyn, N., & Aston, R. (2017). What works and why? Student perceptions of 'useful'digital technology in university teaching and learning. *Studies in Higher Education, 42*(8), 1567-1579.

Houtz, L. E., & Gupta, U. G. (2001). Nebraska high school students' computer skills and attitudes. *Journal of Research on Technology in Education, 33*(3), 316.

Hrtoňová, N., Kohout, J., Rohlíková, L., & Zounek, J. (2015). Factors influencing acceptance of e-learning by teachers in the Czech Republic. *Computers in Human Behavior, 51*, 873-879.

Huang, H.-M., & Liaw, S.-S. (2005). Exploring users' attitudes and intentions toward the web as a survey tool. *Computers in Human Behavior, 21*(5), 729-743.

Jackson, L. A., Ervin, K. S., Gardner, P. D., & Schmitt, N. (2001). Gender and the Internet: Women communicating and men searching. *Sex roles, 44*(5), 363-379.

Kafyulilo, A. C. (2012). *The relevance of authentic learning activities in developing competency and confidence of integrating technology in teaching among pre-service teachers in Tanzania.* Paper presented at the The African Symposium.

Keegan, J. (2016). Teacher Preferences On Technology Use Using the iTEaCH Implementation Model: A Case Study In A Tanzanian Private School.

Kothari, C. R. (2004). *Research methodology: Methods and techniques*: New Age International.

Kreijns, K., Van Acker, F., Vermeulen, M., & Van Buuren, H. (2013). What stimulates teachers to integrate ICT in their pedagogical practices? The use of digital learning materials in education. *Computers in Human Behavior, 29*(1), 217-225.

Kreijns, K., Vermeulen, M., Kirschner, P. A., Buuren, H. v., & Acker, F. V. (2013). Adopting the Integrative Model of Behaviour Prediction to explain teachers' willingness to use ICT: a perspective for research on teachers' ICT usage in pedagogical practices. *Technology, Pedagogy and Education, 22*(1), 55-71.

Mahajan, G. (2016). Attitude of Teachers towards the use of Technology in Teaching. *Educational Quest, 7*(2), 141.

Malhotra, Y., & Galletta, D. F. (1999). *Extending the technology acceptance model to account for social influence: Theoretical bases and empirical validation.* Paper presented at the Systems sciences, 1999. HICSS-32. Proceedings of the 32nd annual Hawaii international conference on.

Markauskaite, L. (2006). Gender issues in preservice teachers' training: ICT literacy and online learning. *Australasian Journal of Educational Technology, 22*(1), 1.

Martirosyan, N. M., Kennon, J. L., Saxon, D. P., Edmonson, S. L., & Skidmore, S. T. (2017). Instructional technology practices in developmental education in Texas. *Journal of College Reading and Learning, 47*(1), 3-25.

Mathew Myers, J., & Halpin, R. (2002). Teachers' attitudes and use of multimedia technology in the classroom: Constructivist-based professional development training for school districts. *Journal of computing in teacher education, 18*(4), 133-140.

McIlroy, D., Bunting, B., Tierney, K., & Gordon, M. (2001). The relation of gender and background experience to self-reported computing anxieties and cognitions. *Computers in Human Behavior, 17*(1), 21-33.

McKnight, K., O'Malley, K., Ruzic, R., Horsley, M. K., Franey, J. J., & Bassett, K. (2016). Teaching in a digital age: How educators use technology to improve student learning. *Journal of Research on Technology in Education, 48*(3), 194-211.

Miller, J., Christensen, R., & Knezek, G. (2017). *Effect of a Makerspace Training Series on Elementary and Middle School Educator Confidence Levels Toward Integrating Technology.* Paper presented at the Society for Information Technology & Teacher Education International Conference.

Mummery, W. K., & Wankel, L. M. (1999). Training adherence in adolescent competitive swimmers: An application of the theory of planned behavior. *Journal of Sport and Exercise Psychology, 21*(4), 313-328.

Nikou, S. A., & Economides, A. A. (2017). Mobile-based assessment: Investigating the factors that influence behavioral intention to use. *Computers & Education, 109*, 56-73.

Oyelaran-Oyeyinka, B., & Adeya, C. N. (2004). Internet access in Africa: empirical evidence from Kenya and Nigeria. *Telematics and Informatics, 21*(1), 67-81.

Polly, D., Mims, C., Shepherd, C. E., & Inan, F. (2010). Evidence of impact: Transforming teacher education with preparing tomorrow's teachers to teach with technology (PT3) grants. *Teaching and Teacher Education, 26*(4), 863-870.

Pouezevara, S. L., & Khan, R. (2007). Learning communities enabled by mobile technology: A case study of school-based, in-service secondary teacher training in rural Bangladesh. *Innovative information and communication technology in education and its potential for reducing poverty in the Asia and Pacific region*.

Rozell, E. J., & Gardner III, W. (2000). Cognitive, motivation, and affective processes associated with computer-related performance: a path analysis. *Computers in Human Behavior, 16*(2), 199-222.

Selwyn, N. (1997). Students' attitudes toward computers: Validation of a computer attitude scale for 16–19 education. *Computers & Education, 28*(1), 35-41.

Sexton, D., King, N., Aldridge, J., & Goodstadt-Killoran, I. (1999). Measuring and evaluating early childhood prospective practitioners' attitudes toward computers. *Family Relations*, 277-285.

Shohel, M. M., & Power, T. (2010). Introducing mobile technology for enhancing teaching and learning in Bangladesh: teacher perspectives. *Open Learning: The Journal of Open and Distance Learning, 25*(3), 201-215. doi: 10.1080/02680513.2010.511953

Shohel, M. M. C., & Power, T. (2010). Introducing mobile technology for enhancing teaching and learning in Bangladesh: teacher perspectives. *Open learning, 25*(3), 201-215.

Tabata, L. N., & Johnsrud, L. K. (2008). The impact of faculty attitudes toward technology, distance education, and innovation. *Research in higher education, 49*(7), 625.

Teo, T. (2008). Pre-service teachers' attitudes towards computer use: A Singapore survey. *Australasian Journal of Educational Technology, 24*(4).

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. doi: 10.1016/j.compedu.2014.01.014

Tezci, E. (2011). Factors that influence pre-service teachers' ICT usage in education. *European Journal of Teacher Education, 34*(4), 483-499.

Todman, J. (2000). Gender differences in computer anxiety among university entrants since 1992. *Computers & Education, 34*(1), 27-35.

Tømte, C., & Hatlevik, O. E. (2011). Gender-differences in Self-efficacy ICT related to various ICT-user profiles in Finland and Norway. How do self-efficacy, gender and ICT-user profiles relate to findings from PISA 2006. *Computers & Education, 57*(1), 1416-1424.

Valtonen, T., Kukkonen, J., Kontkanen, S., Sormunen, K., Dillon, P., & Sointu, E. (2015). The impact of authentic learning experiences with ICT on pre-service teachers' intentions to use ICT for teaching and learning. *Computers & Education, 81*, 49-58.

Van der Heijden, H., Geldens, J., Beijaard, D., & Popeijus, H. (2015). Characteristics of teachers as change agents. *Teachers and Teaching, 21*(6), 681-699.

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS quarterly*, 425-478.

Venkatesh, V., & Zhang, X. (2010). Unified theory of acceptance and use of technology: US vs. China. *Journal of Global Information Technology Management, 13*(1), 5-27.

Wedman, J., & Diggs, L. (2001). Identifying barriers to technology-enhanced learning environments in teacher education. *Computers in Human Behavior, 17*(4), 421-430.

Willis, E. M., & de Montes, L. S. (2002). Does requiring a technology course in preservice teacher education affect student teacher's technology use in the classroom? *Journal of computing in teacher education, 18*(3), 76-80.

Zhao, Y., Byers, J., Mishra, P., Topper, A., Chen, H., Enfield, M., . . . Tan, S. H. (2001). What do they know? A comprehensive portrait of exemplary technology-using teachers. *Journal of computing in teacher education, 17*(2), 24-36.

APPENDIX

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)

Department of Technical and Vocational Education

Board Bazar Gazipur - 1704 Dhaka Bangladesh

SURVEY QUESTIONNAIRE

Introduction:

As part of my MScTE thesis at the Islamic University of Technology (iut) Dhaka, I am conducting a survey that investigates the attitudes towards the use of technology among tertiary engineering education trainee-teachers. I will appreciate if you could complete the following sections. Any information obtained herein will remain confidential.

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, Personal Digital Assistant(PDA); Smartboard, Multimedia presentation or any other technology you might have used before in teaching and learning.***

Respondent's Details:

Age: ____________ Gender: _______________ Nationality: _____________________

Study Programme: ________________________ Specialization: ____________________

Part A: Technology Experience and Perceived Confidence

1. How many years on average have you used technology? ______________________
2. How confident are you in using the technology?
   [**1**]Very confident [**2**]Confident [**3**]Neutral [**4**]Timorous [**5**]Very timorous

Part B: 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) about using technology					
4.	Technology make me feel uncomfortable*					
5.	Using technology does not scare me at all					
6.	I hesitate to use technology in front of other people because my lack of experience may make me look stupid*					

No.	Section 2: Perceived Useful Component	1	2	3	4	5
1.	Technology help me improve my work better					
2.	Technology makes it possible for me to work more productively					
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 the presentation of my work to a degree which justifies extra effort needed to learn how to use it.					
No.	**Section 3: Perceived Control Component**	**1**	**2**	**3**	**4**	**5**
1.	I can probably teach myself most of the things I need to know about technology that are related to 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*					
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					
No.	**Section 4: Behavioural Intention Component**	**1**	**2**	**3**	**4**	**5**
1.	I would avoid taking a job if I knew it involved working with technology*					
2.	I avoid coming into contact with technology in school (institution/university)*					
3.	I only use technology at school (institution/university) when I am told to so*					
4.	I will use technology regularly throughout school (institution/university)					
No.	**Section 5: Social influence Component**	**1**	**2**	**3**	**4**	**5**
1.	I use technology because my family/relatives believe that I should do so.					
2.	I am using technology because most of my friends are using it and encourage me to do so.					
3.	Technology is generally being used in my community and so I feel ashamed not to use technology*					

Thank you for your sincere cooperation.

Researcher:
Nafiu Salele
Student No:153604

Supervisor:
Dr. Md. Shahadat Hossain Khan
Assistant Professor
TVE, IUT