

Technology and its Impact, Looking Towards the Future

A thesis presented for the Bachelor of Science Degree

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Foreword

Before you lies the thesis “Technology and its Impact, Looking Towards the Future”. The research into the opinion of students towards the Technology Impact Cycle Tool (TICT) has been carried out within the Fontys Institute for ICT (FHICT). This thesis has been written as part of my graduation from Applied Psychology at the Fontys University of Applied Science HRM&P. The thesis is the result of my personal interest between the inseparable interaction between the human psyche and technological developments. Especially digital technology plays an ever-increasing part in the day-to-day lives of citizens in every walk of life.

My gratitude goes out to my lecturers, Tanja Stöver and Ilse van Beljouw, for answering my questions and the constant guidance during this process. Additionally, I would like to thank my organisational mentor, Danny Bloks, for supporting me through my research at FHICT. The members of the Fontys TICT Research Group also deserve recognition, as their continues critical perspective and support have stimulated me to do my utmost. I would like to recognize the invaluable assistance that the lectorate People & Technology provided during my study.

I would also like to thank my friends and family who have supported me throughout writing this thesis. Special thanks are in place for Yvette – my wonderful and lovely partner – it is whole-heartedly appreciated that your great advice for my study proved monumental towards the success of this study. Finally, I wish to express my deepest gratitude to Frank, who proofread my thesis to check for inconsistencies.

I hope you enjoy your reading.

Ruben van Ess

Abstract

Technology has an ever-increasing role in the day to day lives of individuals and societies. To provoke critical thought about the impact of new digital technology, the Technology Impact Cycle Tool (TICT) has been developed. In this paper, three psychological constructs: Performance Expectancy, Effort Expectancy, and Attitude towards using technology are researched to better understand the perception of students at the Fontys University of Applied science institute for ICT (FHICT). The following research question is constructed to research the perception of FHICT students: ‘To which degree do Performance Expectancy, Attitude and Effort Expectancy contribute to the intent to use the TICT for FHICT students?’.

To research FHICT students perception of the TICT a survey was distributed among third- and fourth-year students of the IT & software engineering, and IT & technology profiles of FHICT. Attitude towards using technology got the lowest score, Performance Expectancy got an average rating, while Effort Expectancy got the highest score. Which could mean that while the TICT was perceived as easy-to-use, the perceived utility and the evaluation of the tool could be improved. Additionally, Attitude towards using technology showed the highest relationship with the intent to use the TICT, with Performance Expectancy having the second-highest relation. The relationships could indicate that the evaluation and perceived utility of the TICT influence the intent to use.

The results indicate that to increase the intent to use the TICT, FHICT students should be made aware of the personal relevance of, and the task accomplished with the TICT. If the personal relevance and task accomplishments are not made aware or improved upon, a failure of the Fontys vision of providing reflective practitioners onto the labour market could be imminent.

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List of abbreviations

Abbreviation	Definition
AI	Artificial Intelligence
BI	Behavioural Intent
EE	Effort Expectancy
FC	Facilitating Conditions
FHICT	Fontys university of applied science for ICT (<i>Dutch: Fontys Hogeschool voor de ICT</i>)
FTRG	Fontys TICT Research Group
GDPR	General Data Protection Regulation
HBO	University of Applied Science (<i>Dutch: Hoger Beroeps Onderwijs</i>)
IS	Information System
PBC	Perceived Behavioural Control
PE	Performance Expectancy
SI	Social Influence
SN	Subjective Norm
TICT	Technology Impact Cycle Tool
TPB	Theory of Planned Behaviour
TRA	Theory of Reasoned Action
UB	Use Behaviour
UTAUT	Unified Theory of Acceptance and Use of Technology

Glossary

Term	Definition
Artificial intelligence	“The ability of a digital computer or computer-controlled robot to perform tasks commonly associated with intelligent beings.” (Copeland, 2019).
Deepfake	“An AI-based technology used to produce or alter video content so that it presents something that didn’t, in fact, occur.” (Rouse, 2018).
Digital technology	“Electronic tools, systems, devices and resources that generate, store or process data.” (Victoria State Government, 2019).
Effort Expectancy	“The degree of ease associated with the use of the system.” (Venkatesh, Morris, Davis, & Davis, 2003).
Ethics	“Moral principles that govern a person’s behaviour or the conducting of an activity.” (Lexico Oxford, 2019).
Facilitating Conditions	“The degree to which an individual believes that an organizational and technical infrastructure exists to support the use of the information system.” (Venkatesh, Morris, Davis, & Davis, 2003).
Information System	“A formal, sociotechnical, organizational system designed to collect, process, store, and distribute information.” (Piccoli & Pigni, 2016).
Performance Expectancy	“The degree to which an individual believes that using the system will help him or her to [sic] attain gains in job performance.” (Venkatesh, Morris, Davis, & Davis, 2003).
Salience	“The way in which people are more likely to respond to stimuli that are novel, simple and accessible.” (Institute for Government, 2015).
Smartphone	“A mobile phone that can be used as a small computer and that connects to the internet.” (Cambridge Dictionary, 2019).
Social Influence	“The degree to which an individual perceives that important others believe he or she should use the new system.” (Venkatesh, Morris, Davis, & Davis, 2003).
Stakeholder	“A person such as an employee, customer, or citizen who is involved with an organization, society, etc. and therefore has responsibilities towards it and an interest in its success.” (Cambridge Dictionary, 2019).

Introduction

“Escaping digital technology is impossible,” according to Stöve (2018) in the newspaper *Het Parool*. Additionally, Ritchie and Roser (2019) also found that digital technology has an ever-increasing role in our day-to-day lives, as the average person cannot imagine a world without digital technologies such as social media, (online) videogames, smartphones and apps for the smartphone (Ritchie & Roser, 2019).

Some forms of digital technology might be beneficial on a societal level, as Facebook and WhatsApp allow for quick and accessible communication in present-day society (Mieczakowski, Goldhaber, & Clarkson, 2011). However, digital technology might also have a negative effect on one-on-one communication, as research has found that the mere presence of a smartphone during a face-to-face conversation between two people leads to diminishing feelings of trust (Przybylski & Weinstein, 2012). Additionally, notifications on the smartphone are deliberately designed to attract as much attention as possible, as research has shown that the combination of images and text draw people’s attention more than text alone (Levy, Rafaeli, & Ariel, 2016). Other research has found that tasks performed on a smartphone can take up to four times longer than originally intended, because of ‘distractors’ originating from the smartphone (Leiva, Böhmer, Gehring, & Krüger, 2012).

The direction of digital technology is determined by its designers and developers - humans. We need to ask ourselves the question if we only want to develop digital technology that solves the needs of the client, or whether we want digital technology that not only looks at the needs of the client but the societal- and personal effects as well?

Fontys University of Applied Sciences is presupposing a certain responsibility, as it is one of the educational institutions training future developers, specifically the Fontys institute for ICT (Fontys HBO-ICT, 2019). Wanting to meet these responsibilities, Fontys has set their own bar of producing so-called “reflective practitioners” for the labour market (Fontys Hogescholen, 2017). According to Fontys Hogescholen (2017), a reflective practitioner is characterized by a professional that systematically reflects on his or her own professional conduct. The will to create reflective practitioners ties in with ethical decision-making during the design and development of new technology, as the ability to reflect upon one's behaviour is also a fundamental premise for ethical decision-making (Ametrano, 2010). The vision of Fontys for producing reflective practitioners has implications for every institute within the organization. Students at the Fontys institute for ICT need to adopt new methods for the current design and developmental process for digital technology due to the greater focus on ethical considerations within this process (Lancee, Prüst, & Kamp, 2019).

The Fontys institute for ICT (FHICT) sees it as a moral obligation to contribute to educating a reflective practitioner. Therefore, they compel students to contemplate ethical problems during the entire design- and developmental process (Lancee, Prüst, & Kamp, 2019). Wanting to know what is needed to encourage students to take ethical considerations into account when developing digital technology, a research group called the Fontys TICT Research Group (FTRG) was established. The problem statement was formulated as a result of several meetings, in addition to explorative interviews with members of the FTRG. Furthermore, the goal of the research and research question were established, with the latter being supported by sub-questions.

Problem statement

Students of the FHICT currently design and develop new digital technologies that only adhere to the demands of the client. Ethical issues are barely, if ever, considered during this process. The TICT is primarily designed to provoke critical thought about the impact of new technology from the developers. However, owing to the TICT being a prototype, it is not known how students of FHICT perceive the TICT.

Research objective

The objective of the FTRG for the current research is to gather knowledge from students of FHICT to motivate them to use the TICT in an engaging manner during the entire design and development process of new technology.

Organisational context & Target group

FHICT is an educational institution that prides itself for the innovative approach in preparing its students for the labour market, especially for the third- and fourth-year courses. Students who attend third- or fourth-year courses work in groups of five to six students for an entire semester. All assignments are incorporated into a real-world business case that originated from one of the affiliated partners in education of FHICT. Additionally, FHICT simulates real-world business practices by organising their study spaces to mimic genuine office spaces.

The target group of the current research consists of full-time students currently following an educational program at the Fontys Institute for ICT (FHICT). The full-time students incorporated into the current study attend courses in the third and fourth year of their study, as experience with the design and development of new technology is needed before one can reflect

upon the choices that were made. According to the HBO-council, the majority (67%) of the target group (full-time students) will be within the age range of 20 – 24 years and the national average age of acquiring a bachelor degree is 25 years (HBO raad, 2009).

Research question

The combination of an explorative study of the literature, the attendance of multiple meetings of the FTRG and additional interviews with members of the FTRG resulted in the following research question:

‘To which degree do Performance Expectancy, Attitude and Effort Expectancy contribute to the intent to use the TICT for FHICT students?’.

Supporting the main research question, the following sub-questions were drafted:

Sub-question 1: ‘what are the current levels of Performance Expectancy, Effort Expectancy and attitude towards using the TICT of FHICT students?’

Sub-question 2: ‘which of the following factors - Performance Expectancy, Effort Expectancy, and Attitude towards using the TICT - has the highest predictive value for the intent to use the TICT?’

Sub-question 3: ‘which of the following factors - Performance Expectancy, Effort Expectancy, and Attitude towards using the TICT - need to be improved to enhance the intent to use the TICT?’

Theoretical Framework

Ethics helps society determine how individuals and groups ought to act in an array of situations as it provides a set of behavioural standards (Bonde, et al., 2013). At the moment of writing, there are various frameworks that aim to help individuals make the best possible ethical choice in different circumstances. Brown university has produced one such ethical framework for students; the framework consists of seven consecutive phases (Bonde, et al., 2013). Figure 1 is a schematic illustration of the framework of Bonde, et al. (2013).

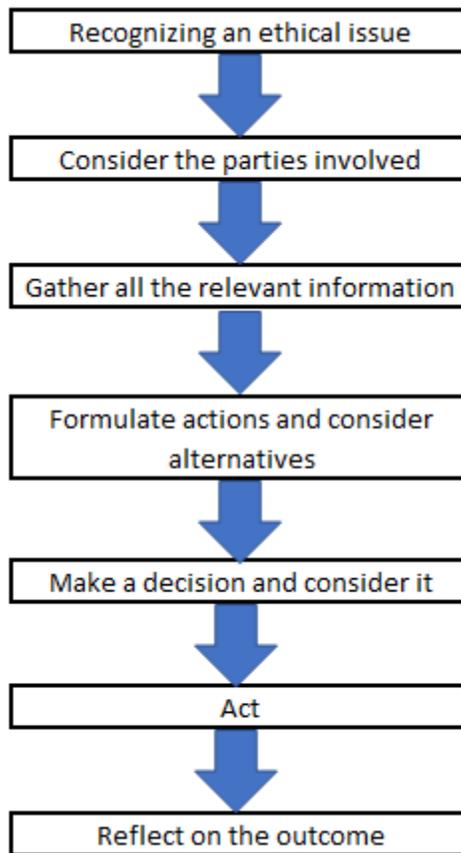


Figure 1: Schematic illustration of Brown university ethical framework

Phase one consists of recognizing an ethical issue, which serves to differentiate the main issue within the ethical dilemma. The second phase is about considering the parties, individuals,

or groups that are involved in the ethical case (Bonde, et al., 2013). Considering who might be harmed or who might benefit from the outcome of the ethical decisions is a beneficial question in the second phase (Bonde, et al., 2013). The third phase consists of gathering all the relevant information concerning the ethical dilemma. The fourth phase is composed of formulating actions and considering alternatives; the alternative options are essential as there is rarely only one approach to a problem (Bonde, et al., 2013). Phase five consists of consideration and decision; “which potential action best addresses the ethical dilemma?” is a viable supporting question. Phase six involves executing the decision (Bonde, et al., 2013). Finally, phase seven serves for the basis of reflecting on the decisions, which may have brought about unintended consequences (Bonde, et al., 2013).

In addition to the choice of an ethical framework, it is important to consider the presentation of information (Mason, 2018). Researching Behavioural Science Models applicable to the presentation of information within the Technology Impact Cycle Tool (TICT) found several beneficial theories and models. Firstly, a definition of what the TICT is must be constructed. In the current research, the TICT is considered an Information System (IS). Information Systems are “a formal, sociotechnical, organizational system designed to collect, process, store, and distribute information” (Piccoli & Pigni, 2016). The TICT collects information in the form of user input through questions, after which the information is processed and stored on the system that runs the TICT. Subsequently, the information is distributed in the form of a digitally available printout of all the user input (TICT research group, 2019).

Theory of Planned Behaviour

According to the Theory of Planned Behaviour (TPB), Behavioural Intentions are the best predictor for actual behaviour (Ajzen, 1991). Ajzen (1991) proposed the Theory of Planned Behaviour to further increase the predictive power of the Theory of Reasoned Action (TRA) (Fishbein & Ajzen, 1975), by adding the factor Perceived Behavioural Control to the TRA. In addition to Perceived Behavioural Control, Behavioural Intention is influenced by an individual's Attitude and Subjective Norm (Ajzen, 1991).

Perceived Behavioural Control is described as "One's perception of how difficult it would be to perform the behaviour." (Kenrick, Neuberg, & Cialdini, 2014), e.g. an individual wants to go to a wedding but cannot because of time constraints. Perceived Behavioural Control differs from the perceived locus of control (Rotter, 1966), with Perceived Behavioural Control applying to behaviour in a specific situation and perceived locus of control of Rotter (1966) being generally stable across situations and types of behaviour (Ajzen, 1991). Subjective Norm is described as "One's perception that important others will approve of the behaviour." (Kenrick, Neuberg, & Cialdini, 2014), e.g. an individual would not demonstrate for more liberal abortion legislation when he thinks the important people in his life would disapprove.

Attitude is the final construct to influence an individual's behavioural intentions, attitude is described as "A favourable or unfavourable evaluation of a particular thing." (Kenrick, Neuberg, & Cialdini, 2014), e.g. somebody is afraid of dogs because he was once bitten by a dog. The aforementioned example exemplifies an attitude acquired through Classical Conditioning, which can either form positive (Manis, Cornell, & Moore, 1974) or negative attitudes (Griffitt, 1970). Classical conditioning can even form an attitude of which an individual

was not aware, as found in various studies (Gibson, 2008; Olson & Fazio, 2002; Krosnick, Betz, Jussim, & Lynn, 1992).

Additionally, other forms of attitude formation - which can be influenced - are Operant Conditioning and Observational Learning. Operant Conditioning is described as a “Learning procedure in which the consequences of a particular behaviour increase or decrease the probability of the behaviour occurring again” (Kolb & Whishaw, 2014). An attitude can be formed through operant conditioning, with (Insko, 1965) or without awareness (Pessiglione, et al., 2008) of the individual that would form the attitude.

Finally, people often learn through merely observing others getting punished or rewarded for certain behaviour, a process called Observational Learning (Bandura, 1986). Seeing that, Observational Learning is another method through which an individual can accumulate an attitude (Kenrick, Neuberg, & Cialdini, 2014). An example of attitude formation through Observational Learning is children who were frightened of dogs who formed a significantly more positive attitude towards dogs by merely watching video material of other kids playing with dogs (Bandura & Menlove, 1968).

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Attitudes influence on behaviour

Strong attitudes can accurately predict behaviour and therefore, an important part when behavioural change is desirable (Kenrick, Neuberg, & Cialdini, 2014). The benefit of a strong attitude is twofold. Firstly, a strong attitude is more stable than a weak attitude and is more likely to remain unchanged over time (Kenrick, Neuberg, & Cialdini, 2014). Secondly, a strong attitude is less likely to be influenced by a persuasive attack directed at the attitude (Kenrick, Neuberg, & Cialdini, 2014). However, a strong attitude alone does not guarantee the so-called Attitude-Behaviour Consistency. For an attitude to be consistent with visible behaviour three factors are important, namely: knowledge, personal relevance, and attitude accessibility.

Knowledge. The more knowledge one has on a particular subject, the more likely it is that an attitude is consistent with actual behaviour (Wyer, 2008). Additional to the amount of knowledge that influences the attitudinal consistency, the nature of the knowledge is also of importance (Davidson, Yantis, Norwood, & Montano, 1985). Nature can either be direct or indirect, a direct nature of knowledge means a first-hand experience, an indirect nature means that knowledge was gathered through a second-hand experience (Glasman & Albarracin, 2006). The consistency between an attitude and behaviour regarding racism, for example, would be much stronger if an individual received racist treatment him- or herself, as the opposite of only hearing about racist experiences second-hand (Glasman & Albarracin, 2006).

Personal Relevance. The more effect something has on the life of an individual, the higher the attitude-behaviour consistency will be (Lehman & Crano, 2002). A person who is directly affected by, for example, a decrease in the legal age to obtain a drivers license would be

much more inclined to demonstrate for a change in the law than somebody to whom the decrease in the legal age would not matter.

Attitude Accessibility. Accessibility of and attitude is the speed at which an attitude springs to mind. The higher the accessibility of an attitude is, the more likely an attitude is with behaviour (Glasman & Albarracin, 2006). Research shows consistency of attitude accessibility on the short-term (Descheemaeker, Spruyt, Fazio, & Hermans, 2016) and in the long term (Fazio & Williams, 1986). In other words, the faster an individual shares his or her attitude (opinion) about a certain topic, the higher the consistency between attitude and behaviour (Kenrick, Neuberg, & Cialdini, 2014). However, a difference between positive and negative attitudes has been discovered regarding the accessibility. Research has found that positive attitudes are more accessible than negative attitudes, as positive attitudes are more readily available in memory than negative attitudes (McCartan & Elliott, 2018).

Unified Theory of Acceptance and Use of Technology

Research in the field of social and behavioural sciences has found several applicable theories and models to the current situation. For the current research, the Unified Theory of Acceptance and Use of Technology (UTAUT) was chosen as the UTAUT accounts for 70% of the variance in Behavioural Intentions (BI) and accounts for around 50% of Use Behaviour (UB) (Venkatesh, Morris, Davis, & Davis, 2003). The UTAUT is a scientific model, partially founded upon the TPB, that attempts to clarify what influences the adoption of information systems (IS) and why some other IS are disposed (Venkatesh, Morris, Davis, & Davis, 2003). According to Venkatesh et al. (2003), four constructs play a significant role as behavioural determinants of user acceptance and usage behaviour: performance expectancy, effort expectancy, social

influence, and facilitating conditions. Additionally, Venkatesh et al. (2003) also defined four key moderators: gender, age, voluntariness, and experience.

The construct Performance Expectancy (PE) is defined as “the degree to which an individual believes that using the system will help him or her to attain gains in job performance” (Venkatesh, Morris, Davis, & Davis, 2003). Furthermore, according to Venkatesh et al. (2003), PE is moderated by gender and age, such that the effect will be stronger for younger men. Secondly, the construct Effort Expectancy (EE) is defined as “the degree of ease associated with the use of the system.” EE is moderated by gender, age, and experience (Venkatesh, Morris, Davis, & Davis, 2003). According to Venkatesh et al. (2003), EE has the strongest effect on young women in the earlier stages of their careers. Thirdly, the construct Social Influence (SI) is defined as “the degree to which an individual perceives that important others believe he or she should use the new system” (Venkatesh, Morris, Davis, & Davis, 2003). SI is moderated by gender, age, voluntariness, and experience; it has the strongest effect on older women in mandatory settings (i.e. when a particular task is imposed from a manager or supervisor) at the start of their careers (Venkatesh, Morris, Davis, & Davis, 2003). The fourth and final determinant for user acceptance is Facilitating Conditions (FC) which are defined as “the degree to which an individual believes that an organizational and technical infrastructure exists to support the use of the information system” (Venkatesh, Morris, Davis, & Davis, 2003). Facilitating Conditions are moderated by age and experience, meaning that the effect of FC is the strongest for older and more experienced employees (Venkatesh, Morris, Davis, & Davis, 2003).

EAST-method

Applying the UTAUT model of Venkatesh et al. (2003) in a manner that is practical for policymakers results in two models. The first result is the MINDSPACE-model consisting of nine different behavioural determinants for the desired behaviour (Institute for Government, 2015). However, the nine different factors of the MINDSPACE-model were found to be too arduous to keep in mind for individuals who do not have a thorough enough understanding of behavioural science (the Behavioural Insights Team, 2018). This spurred researchers to come up with a new, more practically applicable model that was easy to keep in mind when a new policy is drawn up (the Behavioural Insights Team, 2018). The research found that the EAST-method, with its four behavioural determinants - Easy, Attractive, Social, Timely - was easier to keep in mind for policymakers (the Behavioural Insights Team, 2018).

Make it Easy. The Easy principle stems from the fact that most individuals maintain the default option in most circumstances (privacy settings on social media are on the lowest setting “by default”) (Madrian & Shea, 2001), avoiding the effort to perform an action (Bettinger, Long, Oreopoulos, & Sanbonmatsu, 2012), and avoiding difficult to understand messages (Jack, et al., 2009). This is further endorsed by research about the effectiveness of chunking messages (Gobet, et al., 2001).

Make it Attractive. The principle of making a service or product more attractive is supported by two factors: the salience of said service or product and the magnitude of the reward and/or punishment (the Behavioural Insights Team, 2018).

Make it Social. The principle of making a service or product social stems from mankind its desire to make social connections with others (Kenrick, Neuberg, & Cialdini, 2014). The

social norms of a particular group often strengthen the motivation to execute certain behaviour (Elster, 1989). In practice, desirable behaviour can be reinforced by showing people performing particular behaviour and by encouraging individuals to make a commitment to each other (the Behavioural Insights Team, 2018).

Make it Timely. The principle of making a service or product timely stems from the fact that a change of habit is more likely during a period of transition, like migrating, marrying, becoming a parent, or losing somebody close (Institute for Government, 2015). Individuals should be incited when most likely to be receptive when a behavioural change is coveted (the Behavioural Insights Team, 2018). For example, presenting a message to wash the hands with soap immediately after toilet use increased the number of people that washed their hands (Judah, et al., 2009).

Theoretical summary

There are various factors that are of great importance when people need to be motivated to use technology, such as the TICT. The UTAUT has four dimensions that need to be considered, namely: Performance Expectancy (PE), Effort Expectancy (EE), Social Influence (SI), and Facilitating Conditions (FC). For the current research, only PE and EE are deemed important. PE is deemed important because it has a major influence on young men, and the largest part of the research sample fall within this category. Even though EE has a stronger effect on women than on men, it is still deemed important because the effect of EE is also the strongest for younger, inexperienced individuals. SI and FC will not be a focal point for the current research because FC has the strongest effect on older individuals, with extensive experience in their field of study or work. Furthermore, SI shares some of the influences of FC, as FC too has

the strongest effect on older individuals. Additionally, both SI and FC questions are focused on situations where Information Systems (IS) are already embedded in an organization, while the TICT is not.

Additionally, the TPB adds attitude as an important psychological construct for Behavioural Intention. Although the TPB also includes Subjective Norm (SN) and Perceived Behavioural Control (PBC), SN and PBC are not seen as focus-points for the current research. SN and PBC are considered a sub-topic of SI and FC respectively, the two factors of the UTAUT that will not be included. According to the EAST-method introducing a reward for the participant can stimulate said participant to perform desirable behaviour, also known as an extrinsic motivator.

Fout! Verwijzingsbron niet gevonden. shows the conceptual model used in the current research, with the independent variables shown in blue and the moderating variables shown in green. The variables presented in yellow are the mediating variable (lighter yellow) and the

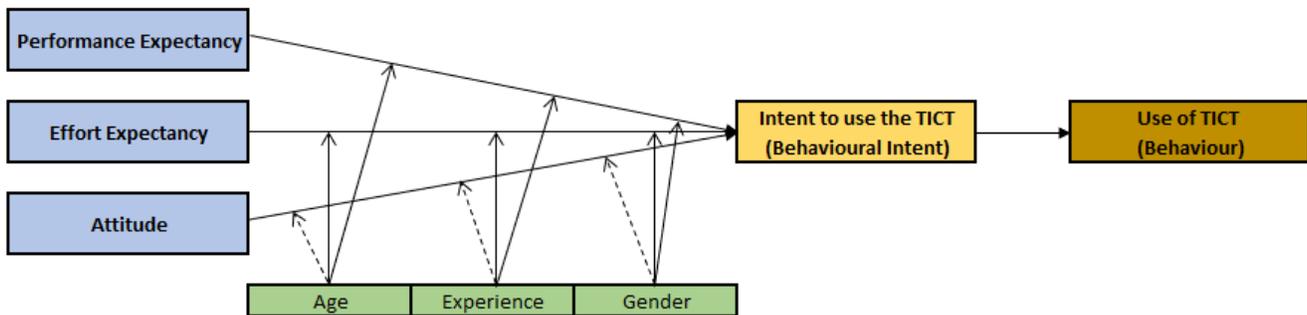


Figure 2: Conceptual Research Model

dependent variable (darker yellow).

Method

Literature- and preliminary research

The current research has used a mixed research design. Firstly, literature was gathered from various databases such as biep.nu, Google Scholar, and PubMed. Relevant literature was found by means of two search strategies. The first search strategy is called the snowball method, which uses cited literature from scientific articles to find new relevant sources. Though the snowball method found literature quickly, the downside was that this search method returned mainly older literature. Alongside the snowball method, a second strategy analysed citations that were found in scientific articles, as analysing citations predominantly looks at recent literature. Combining the two search strategies contributed to the reliability of the current research, as it resulted in older and more recent literature discovered and applied to the research.

In addition to the literature review, a preliminary research round was organised to analyse if additional items needed to be added to the survey, the instrument for the current research. For the preliminary research, two groups of students of the health-TEC minor were introduced to the TICT by the researcher. The students of both groups were asked to fill in the TICT for a group-project - designing and developing new technology for the healthcare industry. After each round respondents were asked to state and explain the feedback, which was subsequently documented (Appendix 11).

Population Sample and Recruitment of Respondents

Respondents of the current study are students who are enrolled at Fontys, specifically at the institute for ICT. The respondents were in the undergraduate phase of their study, meaning that the participants predominantly attended courses in the third or fourth year of their study. The

respondents had either chosen the profile 'IT and software engineering' or 'IT and technology'. FHICT conducts education for undergraduates in an innovative manner, meaning that undergraduate students work in teams of five to six on a project for an entire semester. During the second semester of the academic year 2019-2020, undergraduate students attended various presentations on a range of topics. On February the 19th the respondents were introduced to the TICT by a lecturer of FHICT. After the introduction of the TICT, the respondents had three weeks to fill out the TICT as an assignment.

After the initial presentation of the FHICT lecturer on February the 19th, the researcher introduced himself and the purpose of the current research to the students. Additionally, the researcher explained that he would return on March the 3rd to request the students' participation with the research. The introduction and explanation of the research-purpose were done one additional time for the second group of undergraduate students. After February the 19th, an information letter was sent to the appropriate lecturer of FHICT and was concurrently made available to the undergraduate students (Appendix 5)

After the first round of testing, only 22 respondents filled out the survey. To recruit more respondents for the current study, an email was sent to the supervising professor to inform him of the shortage of respondents. The email contained an updated version of the letter, which included a weblink to the instrument of the current study (Appendix 6). The second attempt to recruit additional participants yielded zero new respondents.

The third attempt to recruit additional respondents promised a reward when a respondent completed the survey – a €10,- gift certificate for the gaming platform Steam. The reward was communicated to the undergraduate students of FHICT in an updated version of the initial

information letter (Appendix 7). The third attempt to recruit additional respondents yielded zero new participants.

In a fourth attempt to recruit additional respondents, the leading project-manager of the FTRG was contacted. The project manager provided additional potential participants and associated contact information. The relevant individuals were contacted by email and were also promised a reward of a gift card of ten Euros. However, after several attempts to contact the potential respondents, no additional respondents were recruited.

In a fifth and final attempt to recruit additional respondents, another member of the FRTG was contacted and asked if he knew potential respondents to conduct the survey with. The fifth attempt has not resulted in new participants of the current research, as the COVID-19 virus shifted the focus towards digitalizing education.

Instrument

The instrument of the current research was a survey with 59 questions to determine the perspective respondents had towards the TICT ($N = 54$), what the participants would improve about the TICT ($N = 1$), and information about the respondents themselves ($N = 4$). The questions that determined the perspective of the respondents towards the TICT were scored on a seven-point Likert-scale, with a minimum corresponding with “Strongly Disagree” and a maximum representing “Strongly Agree” (Figure 3: Likert-scale answering options. Figure 3).

Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
<input type="radio"/>						

Figure 3: Likert-scale answering options.

The questions about the perspective of the respondents were divided into the topics of Performance Expectancy, Effort Expectancy and Attitude toward using technology. The three topics were subsequently subdivided (Table 1, 2, and 3). To find out if participants really understood a question, various questions were asked twice. Once the question was positively worded, the other time the question was negatively worded. These questions needed to be reverse-scored afterwards and can be recognized with the “(reverse scored)” after a question.

Table 1. Performance Expectancy: sub-topics, definition and questions

Sub-topic	Definition	Questions
Perceived Usefulness (Davis, Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology, 1989)	The degree to which a person believes that using a particular system would enhance his or her job performance (Davis, Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology, 1989).	<ol style="list-style-type: none"> 1. Using the system for my study would enable me to accomplish tasks/projects more quickly. 2. Using the system would improve my study performance. 3. Using the system for my study job would increase my productivity. 4. Using the system would enhance my effectiveness for my study. 5. Using the system would make it easier to do my study. 6. I would find the system useful for my study.
Extrinsic Motivation (Davis, Bagozzi, & Warshaw, 1992)	The perception that users will want to perform an activity because it is perceived to be instrumental in achieving valued outcomes that are distinct from the activity itself, such as improved job performance, pay, or promotions (Davis,	Same questions as “perceived usefulness”

	Bagozzi, & Warshaw, 1992).	
Job-fit (Thompson, Higgins, & Howell, 1991)	How the capabilities of a system enhance an individual's job performance (Thompson, Higgins, & Howell, 1991).	<ol style="list-style-type: none"> 1. Use of the system will have no effect on the performance of my study. (reverse-scored) 2. Use of the system can decrease the time needed for my important study responsibilities. 3. Use of the system can significantly increase the quality of output for my study. 4. Use of the system can increase the effectiveness of performing study tasks/projects. 5. Use can increase the quantity of output for the same amount of effort.
Relative Advantage (Moore & Benbasat, 1991)	The degree to which using an innovation is perceived as being better than using its precursor (Moore & Benbasat, 1991).	<ol style="list-style-type: none"> 1. Using the system enables me to accomplish tasks/projects more quickly. 2. Using the system improves the quality of the work I do. 3. Using the system makes it easier to do my study. 4. Using the system enhances my effectiveness for the study. 5. Using the system increases my productivity.
Outcome Expectations (Compeau & Higgins, 1995)	Outcome expectations relate to the consequences of the behaviour. Based on empirical evidence, they were separated into performance expectations (job-related) and personal expectations (individual goals) (Compeau & Higgins, 1995).	<p>If I use the system...</p> <ol style="list-style-type: none"> 1. I will increase my effectiveness in my study. 2. I will spend less time on routine study tasks. 3. I will increase the quality of output of my study. 4. I will increase the quantity of output for the same amount of effort. 5. My fellow students will perceive me as competent. 6. I will increase my chances of obtaining a high grade.

Performance Expectancy was divided into five sub-topics, namely: Perceived Usefulness, Extrinsic Motivation, Job-fit, Relative Advantage, and Outcome Expectations. Extrinsic Motivation and Perceived Usefulness were measured through the use of the same questions, as the definition of both constructs meant the same in the current study (Table 1).

Table 2. Effort Expectancy: sub-topics, definition and questions

Sub-topic	Definition	Questions
Perceived Ease of Use (Davis, 1989)	The degree to which a person believes that using a system would be free of effort (Davis, 1989).	<ol style="list-style-type: none"> 1. Learning to operate the system would be easy for me. 2. I would find it easy to get the system to do what I want it to do. 3. My interaction with the system would be clear and understandable. 4. It would be easy for me to become skilful at using the system. 5. I would find the system easy to use.
Complexity (Thompson, Higgins, & Howell, 1991)	The degree to which a system is perceived as relatively difficult to understand and use (Thompson, Higgins, & Howell, 1991).	<ol style="list-style-type: none"> 1. Using the system takes too much time from my normal duties. (reverse-scored) 2. Working with the system is so complicated, it is difficult to understand what is going on. (reverse-scored) 3. Using the system involves too much time doing mechanical operations (e.g., data input). (reverse-scored) 4. It takes too long to learn how to use the system to make it worth the effort. (reverse-scored)
Ease of Use (Moore & Benbasat, 1991)	The degree to which using an innovation is perceived as being difficult to use (Moore & Benbasat, 1991).	<ol style="list-style-type: none"> 1. My interaction with the system is clear and understandable. 2. I believe that it is easy to get the system to do what I want it to do. 3. Overall, I believe that the system is easy to use. 4. Learning to operate the system is easy for me.

Effort Expectancy was divided into three sub-topics, namely: Perceived Ease of Use, Complexity, and Ease of Use. The reverse-scored questions can be recognized by the addition of the “(reverse-scored)” statement at the end of the question (Table 2).

Table 3. Attitude towards using technology: sub-topics, definition and questions

Sub-topic	Definition	Questions
Affect Toward Use (Thompson, Higgins, & Howell, 1991)	Feelings of joy, elation, or pleasure; or depression, disgust, displeasure, or hate associated by an individual with a particular act (Thompson, Higgins, & Howell, 1991).	<ol style="list-style-type: none"> 1. The system makes work more interesting. 2. Working with the system is fun. 3. The system is okay for some fields of study, but not the field of study I am in. (reverse-scored)
Affect (Compeau & Higgins, 1995)	An individual’s liking of the behaviour (Compeau & Higgins, 1995).	<ol style="list-style-type: none"> 1. I like working with the system. 2. I look forward to those aspects of my study that require me to use the system. 3. Using the system is frustrating for me. (reverse-scored) 4. Once I start working on the system, I find it hard to stop. 5. I get bored quickly when using the system. (reverse-scored)

Table 3 shows that Attitude towards using technology was divided into two sub-topics, namely: Affect Toward Use and Affect. The reverse-scored questions can be recognized through the addition of the “(reverse-scored)” statement at the end of a question (Table 3).

Table 4. Intent to use the TICT (Behavioural Intent): sub-topics, definition and questions

Sub-Topic	Definition	Questions
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<p>Attitude Toward Behaviour (Davis, 1989) (Fishbein & Ajzen, 1975)</p>	<p>An individual’s positive or negative feelings about performing the target behaviour (Davis, 1989) (Fishbein & Ajzen, 1975).</p>	<ol style="list-style-type: none"> 1. Using the system is a bad idea. (reverse-scored) 2. Using the system is a good idea. 3. Using the system is a wise idea. 4. Using the system is a foolish idea. (reverse-scored) 5. I dislike the idea of using the system. (reverse-scored) 6. I like the idea of using the system. 7. Using the system is pleasant. 8. Using the system is unpleasant. (reverse-scored)
<p>Intrinsic Motivation (Davis, Bagozzi, & Warshaw, 1992)</p>	<p>The perception that users will want to perform an activity for no apparent reinforcement other than the process of performing the activity per se (Davis, Bagozzi, & Warshaw, 1992).</p>	<ol style="list-style-type: none"> 1. I find using the system to be enjoyable 2. The actual process of using the system is pleasant. 3. I have fun using the system.

Table 4 shows the sub-topics of intent to use the TICT (Behavioural Intent): Attitude Toward Behaviour and Intrinsic Motivation. The reverse-scored questions can be recognized through the addition of the “(reverse-scored)” statement at the end of a question.

<p>Table 5. Miscellaneous: sub-topics, definition and questions</p>		
<p>Sub-topic</p>	<p>Definition</p>	<p>Questions</p>
<p>TICT improvement</p>		<ol style="list-style-type: none"> 1. If you could improve anything about the TICT, what would it be?
<p>Information about the respondent</p>		<ol style="list-style-type: none"> 1. In which year/phase of your study do you currently reside? <ol style="list-style-type: none"> a. Answer space.

		<ol style="list-style-type: none"> 2. Which minor study program are you currently following? If this question is not applicable for your situation, please leave the answer space blank. <ol style="list-style-type: none"> a. Answer space. 3. What is your age? <ol style="list-style-type: none"> a. Answer space, to fill in with a number 4. Please specify your sex. <ol style="list-style-type: none"> a. Answer possibilities: <ol style="list-style-type: none"> i. Male ii. Female iii. Other
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Table 5 shows which sub-topics the category of miscellaneous were divided into and the corresponding questions. The question concerning which improvements the participant would apply to the TICT was an open question which could be freely answered with both numerical as well as alphabetical signs, up to a maximum of 500 characters. The question regarding which year of their study program the respondents were enrolled in contained four answer options in the form of a dropdown menu – available options were 1, 2, 3, and 4. If the participant made a remark about the fact that they were following subjects of multiple study years they were told that they had to fill in the year the majority of their courses would fall under. Additionally, the participants were asked about the minor program they might be enrolled in. The participants could either leave the answer space empty or fill in the name of the minor they followed with both numerical and alphabetical signs up to a maximum of 500 characters. Furthermore, the participants could state their age only with numerical signs and the answer space was limited to a three-character maximum as age with four numbers or more was not realistic. Lastly, the respondents were asked about their sex and could respond with three pre-determined answer options to include research participants that could not identify themselves with the binary options of either male or female.

Reliability of instrument

To guarantee the reliability of the survey, a test was done to analyse the internal consistency of the items belonging to a specific sub-topic and the survey in general; the results of the reliability test are presented in table 5. A Cronbach's Alpha reliability test was conducted for the whole survey ($N = 54$; $\alpha = .903$) and the general survey questions passed the reliability test. The items that belong to the sub-topic Perceived Usefulness passed the reliability test ($N = 6$; $\alpha = .919$). The items that belong to the sub-topic Job-Fit passed the reliability test ($N = 5$; $\alpha = .864$). The items that belong to the sub-topic Relative Advantage passed the reliability test ($N = 5$; $\alpha = .864$). The items that belong to the sub-topic Outcome Expectations passed the reliability test ($N = 6$; $\alpha = .891$). The items that belong to the sub-topic Perceived Usefulness passed the reliability test ($N = 5$; $\alpha = .901$). The items that belong to the sub-topic Complexity did not pass the reliability test ($N = 4$; $\alpha = .566$). The items that belong to the sub-topic Ease of Use passed the reliability test ($N = 4$; $\alpha = .847$). The items that belong to the sub-topic Attitude towards Behaviour passed the reliability test ($N = 8$; $\alpha = .938$). The items that belong to the sub-topic Intrinsic Motivation passed the reliability test ($N = 3$; $\alpha = .806$). The items that belong to the sub-topic Affect towards Use did not pass the reliability test ($N = 3$; $\alpha = .590$). The items that belong to the sub-topic Affect passed the reliability test ($N = 5$; $\alpha = .783$).

After the items that belonged to a sub-topic scale were tested for internal consistency, the composite scales of Performance Expectancy, Effort Expectancy, Attitude towards using technology and intent to use the TICT (Behavioural Intent) were tested for internal consistency. The items that belonged to the scale Performance Expectancy were tested for internal consistency and passed the reliability test ($N = 22$; $\alpha = .961$). The items that belonged to the scale

intent to use the TICT (Behavioural Intent) were tested for internal consistency and passed the reliability test (N =11; $\alpha = .946$). Furthermore, the items belonging to the scale Effort Expectancy were tested for internal consistency, because the sub-topic of complexity did not pass the reliability test. The items that belonged to the Effort Expectancy scale passed the reliability test (N = 13; $\alpha = .922$). Additionally, the items that belonged to the scale Attitude towards using Technology was tested for additional internal consistency, because Affect towards Use did not pass the first reliability test, Attitude towards using Technology passed the reliability test (N = 8; $\alpha = .850$). After the second reliability test of the Attitude towards using Technology scale, it was decided that the questions would remain within the survey. After the results of the reliability tests, it was decided that all items remained in the survey for final use.

Table 6. Reliability test results (Cronbach's Alpha)

Topic or sub-topic	Quantity (N)	Cronbach's Alpha (α)
Whole survey	54	.903
Perceived Usefulness	6	.919
Job-Fit	5	.864
Relative Advantage	5	.864
Outcome Expectations	6	.891
Perceived Usefulness	5	.901
Complexity	4	.566

Ease of Use	4	.847
Attitude towards Behaviour	8	.938
Intrinsic Motivation	3	.806
Affect towards Use	3	.590
Affect	5	.783
Performance Expectancy	22	.961
Effort Expectancy	19	.954
Attitude towards use of Technology	8	.850
Intent to use the TICT (Behavioural Intent)	11	.946

Procedure

The researcher first visited the responsible lecturer of FHICT at the Fontys TQ5 building, after which the researcher introduced himself to all the participants of the current study together with the responsible lecturer. The choice to introduce the researcher together with a lecturer of FHICT was done to prevent possible confusion among the students of FHICT, in case the participants had forgotten who the researcher was. Additionally, the presence of a FHICT lecturer was intended to add a feeling of authority among the students. It was assumed that an increased feeling of authority among the participants would increase the willingness to participate in the current research. The introduction of the researcher towards the FHICT students occurred between 13:00 and 14:00.

The questionnaire was conducted on March 3rd, among Fontys students that have chosen to either study ICT & Software Engineering, or ICT & Technology. The students were introduced to the research on Wednesday the 19th of February during a presentation about the impact of Technology by a lecturer of Fontys. The researcher personally introduced himself to the participants that were executing group assignments at the Fontys TQ5 location in the city of Eindhoven. The link to the web address of the survey was shared during a second-round past the groups at Fontys TQ5. The weblink was shared with one participant of each group, after which the respondent shared the weblink through various means of group communication. After the initial distribution of the survey, the researcher was present in the same office space as the respondents and asked each group three times if the survey was evident or if the respondents had any questions about the survey. After the three rounds of questioning about the clearness of the test, the researcher walked one final round to ask if every group had succeeded in filling out the complete survey, to which every participant answered positively.

Results

Respondents ($N = 22$) have an average age of 23 years, with 22 being the mode, the youngest respondent was 20 years and the oldest was 29 years old. 9.1% of the respondents ($N = 2$) are excluded from the age calculation because the provided ages are not realistic (1 and -553 years old). When asked about the sex of the respondents 68.2% of the participants identified as “male” ($N = 15$), while 31.8% identified as “other” ($N = 7$). 54.5% of the respondents are predominantly following courses in the third year of their study ($N = 12$), while 45.5% of the participants are predominantly following courses in the fourth year of their study ($N = 10$). Item 55 “If you could improve anything about the TICT, what would it be?” was answered 36.36% of the time ($N = 8$).

Studying the different constructs it is observed that Performance Expectancy has a moderate mean score ($M = 3.95$, $SD = 1.01$), Effort Expectancy has the highest mean score ($M = 4.70$, $SD = 1.01$), Attitude towards using technology has the lowest mean score of ($M = 3.44$, $SD = .916$), and Motivation also has a moderate mean score ($M = 3.91$, $SD = 1.16$) (Figure 5).

There was a statistically significant difference between Effort Expectancy, Performance Expectancy and Attitude towards using technology in relation to the use of the Technology Impact Cycle Tool (TICT), $\chi^2(2) = 24.44$, $p < .000$ (Figure 5). Post-hoc analysis of the Friedman test, to examine what the differences between the independent variables are, was done with the Wilcoxon signed-rank test. The Wilcoxon signed-rank test was chosen because the sample size of the current study is relatively small ($N = 22$), which is too small to analyse the data with an ANOVA with repeated measures. Additionally, the Bonferroni correction was applied to counteract the problem of repeated comparisons which could erroneously declare a significant

result. The application of the Bonferroni correction resulted in a significance level of $p < .017$ for the Wilcoxon signed-rank test.

The Wilcoxon signed-rank test has been performed three times to search for a statistically significant difference between Effort Expectancy and Performance Expectancy, Effort Expectancy and Attitude towards using technology, and Performance Expectancy and Attitude towards using technology (Figure 5). A Wilcoxon signed-rank test indicated that Effort Expectancy ($Mdn = 4.70$) and Performance Expectancy ($Mdn = 3.96$) showed a significant difference $T = 218, Z = -3.563, p < .001$. The Wilcoxon signed-rank test for Effort Expectancy ($Mdn = 4.7$) and Attitude towards using technology ($Mdn = 3.65$) showed a significant difference $T = 189, Z = -3.945, p < .001$. The Wilcoxon signed-rank test for Performance Expectancy ($Mdn = 3.96$) and Attitude towards using technology ($Mdn = 3.65$) showed a significant difference $T = 248, Z = -2.555, p = .011$ (Table 7).

Table 7. Wilcoxon signed-rank test results			
	Performance Expectancy	Effort Expectancy	Attitude towards using technology
Performance Expectancy		$T = 218, Z = -3.563^{**}$	$T = 248, Z = -2.555^*$
Effort Expectancy	$T = 218, Z = -3.563^{**}$		$T = 189, Z = -3.945^{**}$
Attitude towards using technology	$T = 248, Z = -2.555^*$	$T = 189, Z = -3.945^{**}$	
**. Significant at the .001 level *. Significant at the .01 level			

To counteract the problem of multiple comparisons inherent to the Wilcoxon signed-rank test, the Bonferroni correction method can be applied. The Bonferroni correction method states that the significance level of the study needs to be divided by the number of comparisons. As the significance level of the current study is set to .05, the significance criteria for the Wilcoxon signed-rank test after the Bonferroni correction method is set to .017. After the Bonferroni correction method, all results of the Wilcoxon signed-rank test remain significant.

To state the correlation between the independent variables (Effort Expectancy, Performance Expectancy, and Attitude towards using technology) and the dependent variable (Behavioural Intent) a Spearman's rank-order correlation is performed as the sample size is relatively small ($N = 22$) and homoscedasticity of data cannot be assumed through a scatterplot (Figure 4).

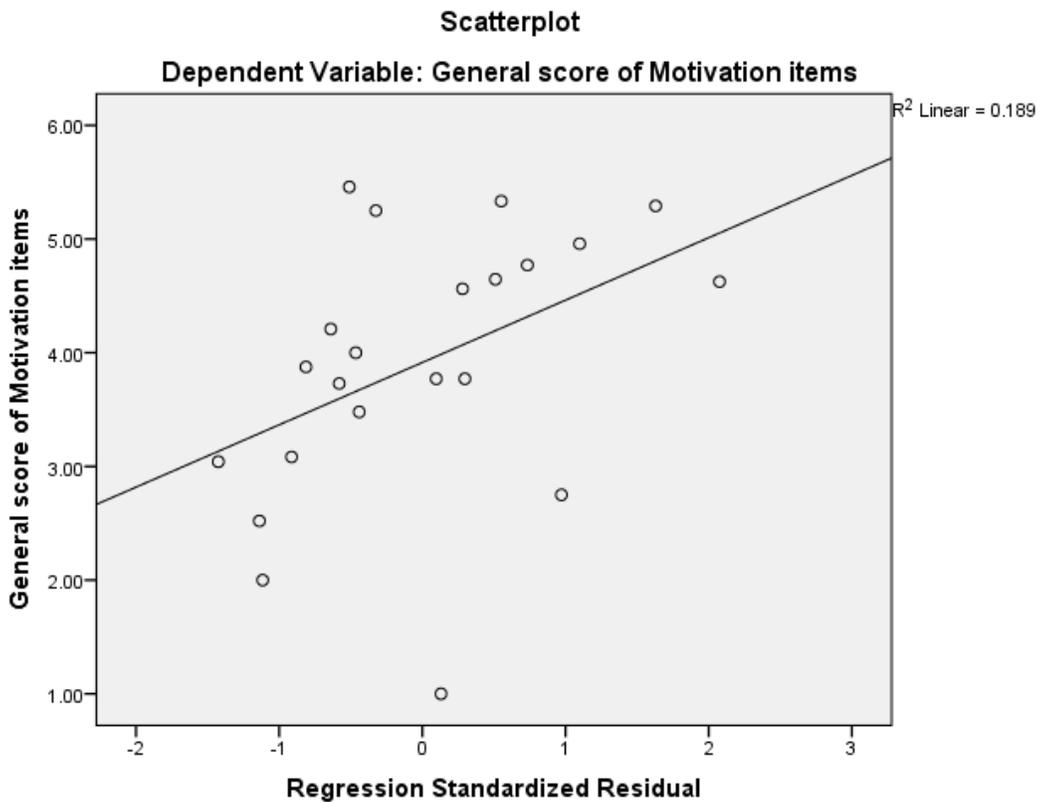


Figure 4: Homoscedasticity scatterplot

Spearman's rank-order correlation was performed to determine the relationship between Effort Expectancy and Behavioural Intent. There was a moderate, positive correlation between Effort Expectancy and Behavioural Intent, which is statistically significant ($r_s(20) = .561, p = .007$) (Figure 5).

Spearman's rank-order correlation was performed to determine the relationship between Performance Expectancy and Behavioural Intent. There was a moderate, positive correlation between Performance Expectancy and Behavioural Intent, which is statistically significant ($r_s(20) = .655, p = .001$) (Figure 5).

Spearman's rank-order correlation was performed to determine the relationship between Attitude towards using technology and Behavioural Intent. There was a strong, positive correlation between Attitude towards using technology and Behavioural Intent, which is statistically significant ($r_s(20) = .827, p < .001$) (Figure 5).

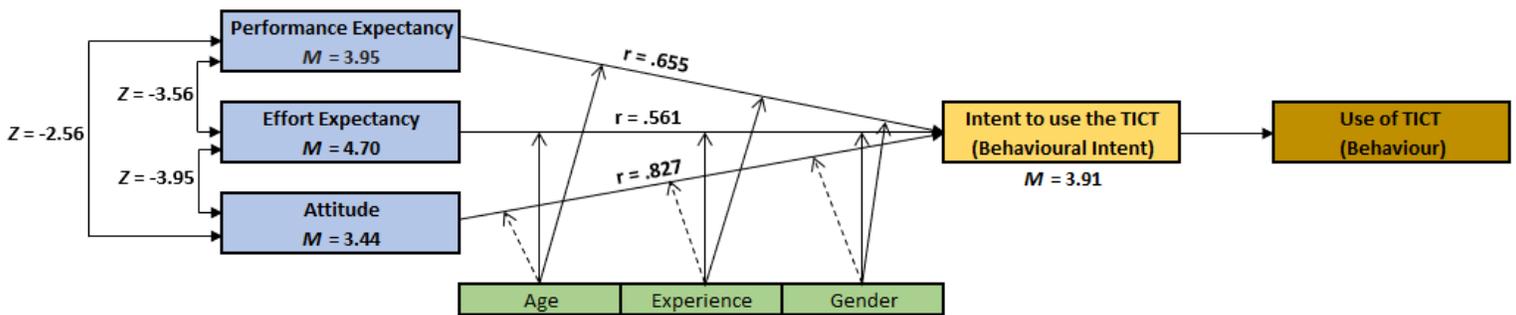


Figure 5: Overview of results in conceptual research model

Conclusion

The research set out to answer the following question: “to which degree do Performance Expectancy, Attitude and Effort Expectancy contribute to the intent to use the TICT for FHICT students?”. In addition to the main research question, three sub-questions were also composed, the first being: “what are the current levels of Performance Expectancy, Effort Expectancy and attitude towards using the TICT of FHICT students?”. The second sub-question was: “which of the following factors - Performance Expectancy, Effort Expectancy, and Attitude towards using the TICT - has the highest predictive value for the intent to use the TICT?”. The final sub-question was: “which of the following factors - Performance Expectancy, Effort Expectancy, and Attitude towards using the TICT - need to be improved to enhance the intent to use the TICT?”.

The results showed that FHICT students had the lowest score on Attitude towards using the TICT, which could mean students giving the TICT a slight negative evaluation. Furthermore, Performance Expectancy received an average rating by FHICT students which could signify that students do not yet perceive the TICT as useful for their academic performance. Finally, Effort Expectancy received the highest rating by the FHICT students, possibly implying that the TICT was perceived as easy to use.

Additional results showed a relationship between the independent variables (Performance Expectancy, Effort Expectancy, and the Attitude towards using technology) and the dependent variable (intent to use the TICT). Effort Expectancy demonstrated the weakest relationship with the intent to use the TICT, which could indicate that an easy-to-use TICT would not necessarily result in a higher intent to use. Subsequently, Performance Expectancy has a somewhat better relationship than Effort Expectancy towards the intent to use the TICT, meaning that perceived utility influences the intent to use more than the TICT being easy to use. Finally, Attitude

towards using the TICT demonstrated the strongest relationship with the intent to use, which may suggest that a more positive evaluation of the TICT would result in a higher intent to use.

To enhance the intent to use the TICT, two aspects should be the focus for improvement. Firstly, the Performance Expectancy of the TICT could be improved upon despite receiving an average rating by FHICT students and a moderate relation with the intent to use the TICT. The reason being that FHICT students are predominantly male and Performance Expectancy is deemed the most influential factor when the intent to use technology needs to be improved among men (Venkatesh, Morris, Davis, & Davis, 2003). Secondly and of even greater importance, the Attitude towards using the TICT is a factor which can be improved upon. Combining the lowest rating by FHICT students of the Attitude towards using the TICT and the strongest relationship with the intent to use, could signify that a change in the Attitude towards using the TICT has the biggest impact on the intent to use the TICT.

Discussion

The current research produced various results that are inconsistent with contemporary literature. The research found a significant relationship between the Attitude towards using technology and the intent to use technology, while the literature found no significant relationship between these two variables (Venkatesh et al., 2003). Furthermore, the relationship between Performance Expectancy and Effort Expectancy with the intent to use the technology are lower than found in literature (Venkatesh et al., 2003). The contrasting results could be the result of a relatively small sample size and the respondents being a homogenous group of predominantly male IT students. Furthermore, the generalisation of the results could also be diminished by the fact that only two out of the six available FHICT profiles were represented within the research sample (IT & software engineering, and IT & technology).

Future research should focus on the effects of various aspects. Increasing the sample size when analysing the TICT could improve the generalisability of the results and increase the accuracy of the predictive capabilities of the survey. Additionally, the inclusion of the other FHICT profiles when researching the intent to use the TICT could also increase the generalisability of the results for FHICT students. Finally, first- and second-year FHICT students should be included in future research to analyse a possible difference in perceiving the TICT.

The internal validity of the current research was secured through systemically exposing the participants of the research to the survey. Every group of students was approached in the same way and were all asked three times if they understood the survey or if there were any questions. Additionally, all questions were statistically and systematically analysed without any missing values. However, 31.8% of the survey respondents identified as “other” when asked about their gender. The relatively large size of the group “other” was assumed to be a form of a

“joke” by the respondents. Consequently, the results of the current study showed a generally lower scoring of the TICT by the group that identified as “other”.

To increase the intent to use the TICT, FHICT students should first be introduced and familiarized with the tool. During the introduction and familiarization process, an emphasis should be given to positively increasing the Attitude towards using the TICT and the perceived utility of the tool by the FHICT students. The change in Attitude can best be done through demonstrating the personal relevance of using the TICT, as personal relevance is a strong predictor for an Attitude to predict behaviour (Lehman & Crano, 2002). In case the use of the TICT is not deemed personal relevant by FHICT students, the TICT could possibly be made mandatory to increase the personal relevancy. Additionally, the perceived utility of the TICT could be increased through an emphasize on the tasks accomplished through the use of the TICT (Venkatesh et al., 2003). While affirmation on the task accomplishments will increase the perceived utility of the TICT for all genders, male students will experience the strongest effect because they are decidedly task-oriented (Venkatesh et al., 2003).

Conversely, if the personal relevance and the task accomplishments of the TICT are not clear enough for FHICT students, there is a considerable chance that the students will merely use the tool as a “checklist”. Using the TICT as a mere checklist neglects the fundamental intention of the TICT: provoking critical thought about ethical dilemmas of new digital technology. To neglect the fundamental intentions of the TICT is to withhold FHICT students an essential reflective tool within their grasp. To withhold FHICT students an essential reflective tool could lead to a failure of the Fontys vision to provide reflective practitioners onto the labour market, this could have undesirable effects on the direction technology development could go on a societal level.

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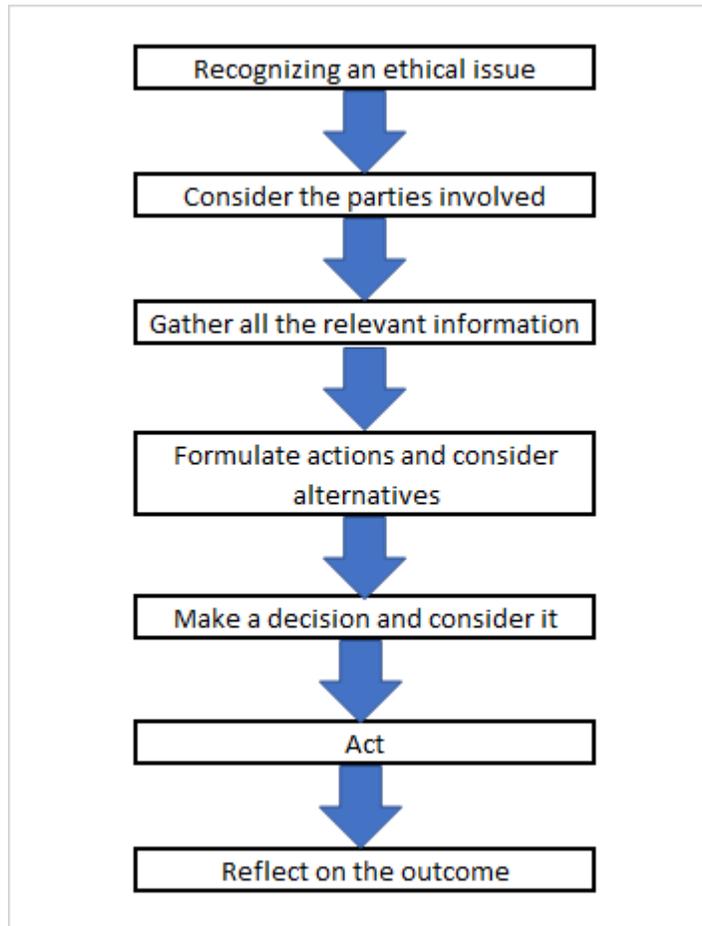
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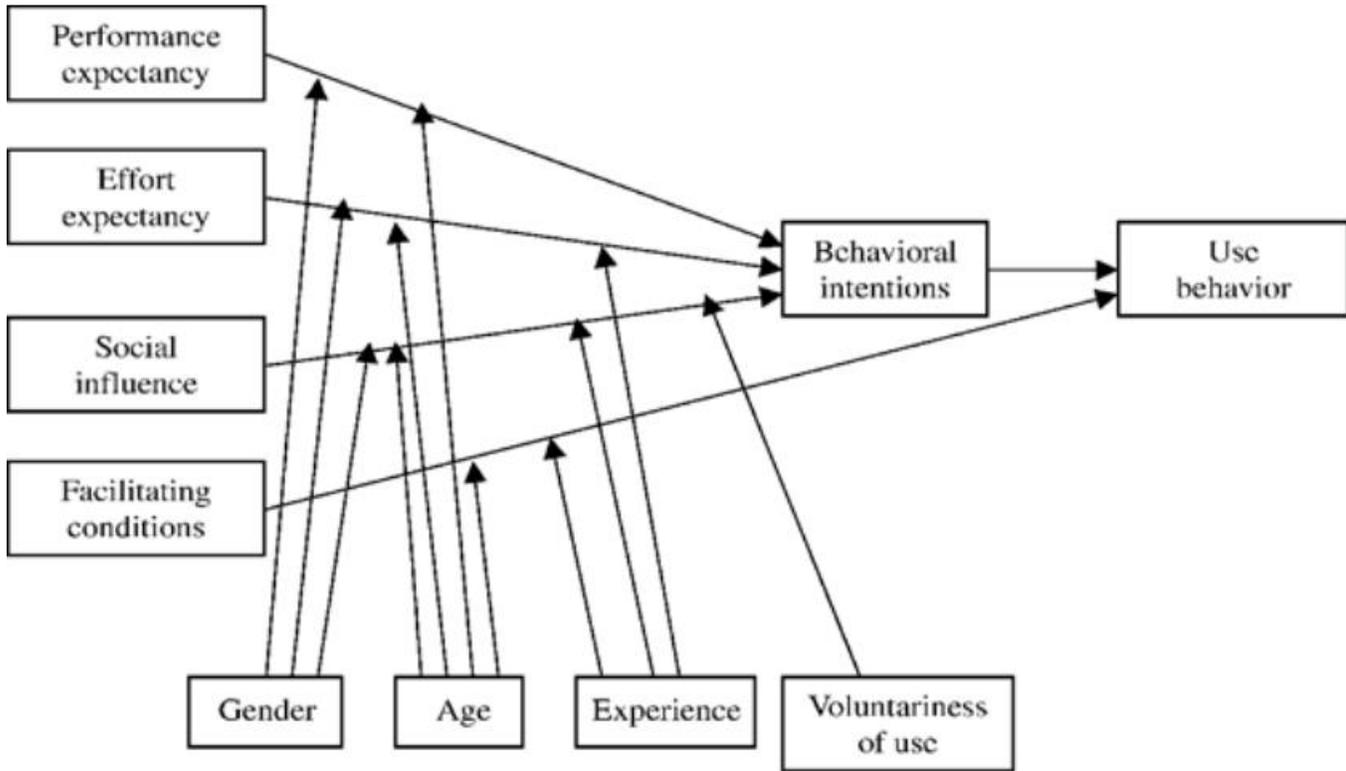
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Appendices

Appendix 1: Ethical framework



Appendix 2: UTAUT



Appendix 3: Information letter for research participants

Introduction

Through this letter, we humbly ask your participation in our research. The part of the research you are engaging in is part of my thesis for my bachelor's degree of the study “applied psychology”. We would like to inform you that your consent is voluntarily and can be withdrawn at any moment, without the need to supplement a reason.

Purpose

The current research wants to look at how we can stimulate students that develop any kind of digital technology (i.e. software applications) to better understand the consequences of their form of technology. The Technology Impact Cycle Tool (TICT) has been developed for precisely that purpose. With the intent to develop the TICT further, we would like to get your input about what you think about the TICT. You will get a better insight into the actual impact of your (health) technology in return, while we gather valuable research data to better the TICT.

If you have any questions, either before, or after the research is conducted, please contact me through the information given below.

Contact information

Name: Ruben van Ess

Institute: Fontys university of applied science, institute for HRM and Psychology

E-mail: r.vaness@student.fontys.nl

Appendix 4: TICT-research survey

Topic	Sub-topic	Questions
Performance Expectancy	Perceived Usefulness	<ol style="list-style-type: none"> 1. Using the system for my study would enable me to accomplish tasks/projects more quickly. 2. Using the system would improve my study performance. 3. Using the system for my study job would increase my productivity. 4. Using the system would enhance my effectiveness for my study. 5. Using the system would make it easier to do my study. 6. I would find the system useful for my study.
	Extrinsic Motivation	Same questions as “perceived usefulness”
	Job-fit	1. Use of the system will have no effect on the performance of my study. (reverse-scored)

		<p>2. Use of the system can decrease the time needed for my important study responsibilities.</p> <p>3. Use of the system can significantly increase the quality of output for my study.</p> <p>4. Use of the system can increase the effectiveness of performing study tasks/projects.</p> <p>5. Use can increase the quantity of output for the same amount of effort.</p>
	<p>Relative Advantage</p>	<p>1. Using the system enables me to accomplish tasks/projects more quickly.</p> <p>2. Using the system improves the quality of the work I do.</p> <p>3. Using the system makes it easier to do my study.</p> <p>4. Using the system enhances my effectiveness for the study.</p> <p>5. Using the system increases my productivity.</p>
	<p>Outcome Expectations</p>	<p>If I use the system...</p>

		<ol style="list-style-type: none"> 1. I will increase my effectiveness in my study. 2. I will spend less time on routine study tasks. 3. I will increase the quality of output of my study. 4. I will increase the quantity of output for the same amount of effort. 5. My fellow students will perceive me as competent. 6. I will increase my chances of obtaining a high grade.
<p>Effort Expectancy</p>	<p>Perceived Ease of Use</p>	<ol style="list-style-type: none"> 1. Learning to operate the system would be easy for me. 2. I would find it easy to get the system to do what I want it to do. 3. My interaction with the system would be clear and understandable. 4. It would be easy for me to become skilful at using the system. 5. I would find the system easy to use.

	Complexity	<ol style="list-style-type: none"> 1. Using the system takes too much time from my normal duties. 2. Working with the system is so complicated, it is difficult to understand what is going on. 3. Using the system involves too much time doing mechanical operations (e.g., data input). 4. It takes too long to learn how to use the system to make it worth the effort.
	Ease of Use	<ol style="list-style-type: none"> 1. My interaction with the system is clear and understandable. 2. I believe that it is easy to get the system to do what I want it to do. 3. Overall, I believe that the system is easy to use. 4. Learning to operate the system is easy for me.
Attitude Towards Using Technology	Affect Toward Use	<ol style="list-style-type: none"> 1. The system makes work more interesting. 2. Working with the system is fun. 3. The system is okay for some fields of study, but not the field of study I am in.

	Affect	<ol style="list-style-type: none"> 1. I like working with the system. 2. I look forward to those aspects of my study that require me to use the system. 3. Using the system is frustrating for me. 4. Once I start working on the system, I find it hard to stop. 5. I get bored quickly when using the system.
Intent to use the TICT (Behavioural Intent)	Attitude Toward Behaviour	<ol style="list-style-type: none"> 1. Using the system is a bad idea. 2. Using the system is a good idea. 3. Using the system is a wise idea. 4. Using the system is a foolish idea. 5. I dislike the idea of using the system. 6. I like the idea of using the system. 7. Using the system is pleasant. 8. Using the system is unpleasant.
	Intrinsic Motivation	<ol style="list-style-type: none"> 9. I find using the system to be enjoyable 10. The actual process of using the system is pleasant. 11. I have fun using the system.

Miscellaneous	Information about the respondent	<ol style="list-style-type: none">1. In which year/phase of your study do you currently reside?<ol style="list-style-type: none">a. Answer space2. Which minor study program are you currently following? If this question is not applicable for your situation, please leave the answer space blank.<ol style="list-style-type: none">a. Answer space.3. What is your age?<ol style="list-style-type: none">a. Answer space, to fill in with a number4. Please specify your sex.<ol style="list-style-type: none">a. Answer possibilities:<ol style="list-style-type: none">i. Maleii. Femalei. Other
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Appendix 5: Information letter one

Beste studenten,

Hopelijk hebben jullie allemaal een fijne vakantie achter de rug. Voor de vakantie hebben jullie kennis gemaakt met de Technology Impact Cycle Tool (TICT) en zijn jullie hiermee aan de slag gegaan voor jullie huidige project. Nu ben ik en de rest van het onderzoeksteam benieuwd naar jullie ervaring met de TICT en wat jullie er eventueel aan zouden willen verbeteren.

Om jullie ervaring met de TICT te evalueren zal ik, Ruben van Ess, op 3 maart langskomen op Fontys TQ. Het onderzoek zal ongeveer 10 á 15 minuten in beslag nemen en helpt mij met mijn afstudeeronderzoek en zal helpen om de TICT in de toekomst te verbeteren. Naast de tijd op 3 maart hoeven jullie geen voorbereidingen te treffen voor het onderzoek.

Mochten jullie nog vragen of opmerkingen hebben, dan hoor ik het uiteraard graag. Jullie kunnen mij bereiken via r.vaness@student.fontys.nl

Met vriendelijke groet,

Ruben van Ess

Appendix 6: Information letter two

Beste studenten,

Hopelijk hebben jullie allemaal een fijne vakantie achter de rug. Voor de vakantie hebben jullie kennis gemaakt met de Technology Impact Cycle Tool (TICT) en zijn jullie hiermee aan de slag gegaan voor jullie huidige project. Nu ben ik en de rest van het onderzoeksteam benieuwd naar jullie ervaring met de TICT en wat jullie er eventueel aan zouden willen verbeteren.

Om jullie ervaring met de TICT te evalueren ben ik, Ruben van Ess, op 3 maart langs geweest op Fontys TQ. Het onderzoek heeft ongeveer 10 á 15 minuten in beslag genomen per persoon en heeft mij goed met mijn afstudeeronderzoek geholpen en zal jullie helpen om in de toekomst beter gebruik te maken van de TICT, aangezien jullie er waarschijnlijk vaker mee in aanraking gaan komen tijdens jullie studie. Mochten jullie op 3 maart niet in staat zijn geweest om het onderzoek in te vullen en zou je dat wel willen doen? Dan kan je alsnog deelnemen via de volgende link: <https://www.thesistoolspro.com/goto/TICTresearch>

Mochten jullie verder nog vragen of opmerkingen hebben, dan hoor ik het uiteraard graag. Jullie kunnen mij bereiken via r.vaness@student.fontys.nl

Met vriendelijke groet,

Ruben van Ess

Appendix 7: Information letter three

Beste studenten,

Hopelijk hebben jullie allemaal een fijne vakantie achter de rug. Voor de vakantie hebben jullie kennis gemaakt met de Technology Impact Cycle Tool (TICT) en zijn jullie hiermee aan de slag gegaan voor jullie huidige project. Nu ben ik en de rest van het onderzoeksteam benieuwd naar jullie ervaring met de TICT en wat jullie er eventueel aan zouden willen verbeteren.

Om jullie ervaring met de TICT te evalueren ben ik, Ruben van Ess, op 3 maart langs geweest op Fontys TQ. Het onderzoek heeft ongeveer 10 á 15 minuten in beslag genomen per persoon en heeft mij goed met mijn afstudeeronderzoek geholpen en zal jullie helpen om in de toekomst beter gebruik te maken van de TICT, aangezien jullie er waarschijnlijk vaker mee in aanraking gaan komen tijdens jullie studie. Mochten jullie op 3 maart niet in staat zijn geweest om het onderzoek in te vullen en zou je dat wel willen doen? Dan kan je alsnog deelnemen via de volgende link: <https://www.thesistoolspro.com/goto/TICTresearch>.

Voor de deelnemers van de survey verloot ik een Steam-giftcard van €10,-. Om in aanmerking te komen voor deze giftcard moet je een screenshot maken van je antwoord op de vraag “Which minor study program are you currently following?” met als toevoeging “ingevuld vanaf 18 maart 2020” en een screenshot maken van het laatste scherm welke begint met “Thank you for your participation.”. Vervolgens moet je beide screenshots sturen naar onderstaand mailadres. De bekendmaking van wie de giftcard gewonnen heeft zal medio april plaatsvinden.

Mochten jullie verder nog vragen of opmerkingen hebben, dan hoor ik het uiteraard graag. Jullie kunnen mij bereiken via r.vaness@student.fontys.nl

Met vriendelijke groet,

Ruben van Ess

Appendix 8: informed consent TICT-survey

Dear reader,

You are hereby invited to participate in research that is supervised by the Fontys University of Applied Science and executed under the responsibility of Ruben van Ess.

The research that I would like to get your consent for is about the Technology Impact Cycle Tool (TICT) that you just filled in. The questions of the online survey will continually ask about your opinion of the TICT.

The goal of the current research is to get to know what individuals think about the TICT, eventually to improve to use of the TICT for developers of new technology.

You, the respondent, will have the following guarantees during the current research:

1. Complete anonymity of your input. Additionally, your data will not be, under any circumstances, shared with third parties without your explicit permission.
2. You can refuse to participate or withdraw your consent from the current research without the need to supplement a reason. Additionally, the consent of using your answers for the current research can also be withdrawn within reasonable terms.
3. You, the respondent, can request a copy of the research report when desired.

If anything is unclear about the research or if you have any remark about the current research please contact me at the following mailadres: r.vaness@student.fontys.nl

Finally, I would request you to confirm that you have read the above and agree with the content.

Appendix 9: GDPR letter of consent

Ruben van Ess, supervising lecturers, and researchers of Fontys University of Applied Sciences (Henceforth known as “researchers”) research your experiences with the Technology Impact Cycle Tool (TICT), with the intent to improve the TICT.

The current research collects the following data: opinion about the TICT, minor program, study progress, age, and sex.

The data is collected through the following means: an electronic survey.

Any potential personal data that is collected will be anonymized as much as is possible, and appropriately secured when needed. The safe storage of personal data will be ensured by the researchers and will be managed in a confidential manner.

Personal data that is collected during the research will be stored for a maximum of seven years.

The collected data can potentially be used in follow-up studies or in other research about experiences with the TICT.

The results of the current research will be used in future scientific publications however, any form of or reference to personal data will be removed.

The researchers want to ask for your consent to collect, save and use your (personal) data through this form.

Through this form, I give the researchers consent to process my data for the purpose of the TICT evaluation. I grant permission for the following methods of data processing:

- The use of my personal data for the aforementioned research through [the abovementioned methods of data collection.
- The reuse of my personal data in follow-up research or other research within the evaluation of the TICT.

My participation in this research is entirely voluntarily. I can withdraw my consent at any given time without any negative consequences and the need to supplement a reason.

My consent is only applicable for the reasons, methods, personal data and researchers above.

Appendix 11: Feedback of Health TEC students

*The feedback in appendix 7 is translated from Dutch to English. For the Dutch version contact the researcher.

Date:	14-01-2020	14-01-2020
Institute:	FHMG	FHMG
Target group:	Students	Students
Comment:	Round 1	Round 2
Characteristics:	N = 15 Minor Health TEC	N = 15 Minor Health TEC
Case:	Own technology	Own technology
Feedback:	Many closed questions.	Username automatically converted to lowercase, username is case sensitive.
	Multiple questions asked within the same question.	Privacy is experienced as one of the most difficult categories, there is mainly thought of the GDPR.
	Restriction of accounts decreases the participation in groups (it is not possible to collaboratively fill in the same category).	some questions are perceived as vague → the bias-question.
	Merge categories, i.e. sustainability and future.	A lot of overlap in questions of different categories.
	Make the last “reflection-question” of each category mandatory.	Questions are formulated in an unclear manner.
	The TICT is very long.	Not everything of the TICT is relevant, as the technology is not yet finished.
	The English was perceived as difficult.	Timing of the TICT is perceived as important → earlier in the development process.
	What is the intended target group for the TICT? Option to make target group specific versions.	The quantity of the TICT is overwhelming. Ten categories (6 A4 papers of text alone).
	Some questions were difficult to answer because of a lack of experience.	The explanatory text to the right of each question was perceived as a proficient clarification.
	Emphasis of the TICT is on “software technology”.	No new insights because of the timing/place in the development process (TICT was too late).
	It is desirable to use the TICT earlier in the development process, so modifications of the technology can be implemented.	Design of the TICT was perceived as “nice”.
	“Save” & “Back” button are close to each other and no warning is given when you accidentally press the “Back”-button.	Goal of the TICT was not evident from the start.

		Last “reflection-question” was too much of the same. Advice is to “personalize” this question per category.
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Appendix 12: SPSS codebook

Column	Variable name	Measurement level	Variable label	Answer options
1	RespNr	Nominal	Number to identify respondents	Automatically generated
2	PercUse1	Interval	Using the system for my study would enable me to accomplish tasks/projects more quickly.	1 = Strongly Disagree 2 = Disagree 3 = Somewhat Disagree 4 = Neutral 5 = Somewhat Agree 6 = Agree 7 = Strongly Agree
3	PercUse2	Interval	Using the system would improve my study performance.	1 = Strongly Disagree 2 = Disagree 3 = Somewhat Disagree 4 = Neutral 5 = Somewhat Agree 6 = Agree

				7 = Strongly Agree
4	PercUse3	Interval	Using the system for my study would increase my productivity.	1 = Strongly Disagree 2 = Disagree 3 = Somewhat Disagree 4 = Neutral 5 = Somewhat Agree 6 = Agree 7 = Strongly Agree
5	PercUse4	Interval	Using the system would enhance my effectiveness for my study.	1 = Strongly Disagree 2 = Disagree 3 = Somewhat Disagree 4 = Neutral 5 = Somewhat Agree 6 = Agree 7 = Strongly Agree
6	PercUse5	Interval	Using the system would make it easier to do my study.	1 = Strongly Disagree

				<p>2 = Disagree</p> <p>3 = Somewhat Disagree</p> <p>4 = Neutral</p> <p>5 = Somewhat Agree</p> <p>6 = Agree</p> <p>7 = Strongly Agree</p>
7	PercUse6	Interval	I would find the system useful for my study.	<p>1 = Strongly Disagree</p> <p>2 = Disagree</p> <p>3 = Somewhat Disagree</p> <p>4 = Neutral</p> <p>5 = Somewhat Agree</p> <p>6 = Agree</p> <p>7 = Strongly Agree</p>
8	JobFit1	Interval	Use of the system will have no effect on the performance of my study.	<p>1 = Strongly Disagree</p> <p>2 = Disagree</p> <p>3 = Somewhat Disagree</p> <p>4 = Neutral</p>

				<p>5 = Somewhat Agree</p> <p>6 = Agree</p> <p>7 = Strongly Agree</p>
9	JobFit2	Interval	Use of the system can decrease the time needed for my important study responsibilities.	<p>1 = Strongly Disagree</p> <p>2 = Disagree</p> <p>3 = Somewhat Disagree</p> <p>4 = Neutral</p> <p>5 = Somewhat Agree</p> <p>6 = Agree</p> <p>7 = Strongly Agree</p>
10	JobFit3	Interval	Use of the system can significantly increase the quality of output for my study.	<p>1 = Strongly Disagree</p> <p>2 = Disagree</p> <p>3 = Somewhat Disagree</p> <p>4 = Neutral</p> <p>5 = Somewhat Agree</p> <p>6 = Agree</p> <p>7 = Strongly Agree</p>

11	JobFit4	Interval	Use of the system can increase the effectiveness of performing study tasks/projects.	1 = Strongly Disagree 2 = Disagree 3 = Somewhat Disagree 4 = Neutral 5 = Somewhat Agree 6 = Agree 7 = Strongly Agree
12	JobFit5	Interval	Use can increase the quantity of output for the same amount of effort.	1 = Strongly Disagree 2 = Disagree 3 = Somewhat Disagree 4 = Neutral 5 = Somewhat Agree 6 = Agree 7 = Strongly Agree
13	RelAdv1	Interval	Using the system enables me to accomplish tasks/projects more quickly.	1 = Strongly Disagree 2 = Disagree

				<p>3 = Somewhat Disagree</p> <p>4 = Neutral</p> <p>5 = Somewhat Agree</p> <p>6 = Agree</p> <p>7 = Strongly Agree</p>
14	RelAdv2	Interval	Using the system improves the quality of the work I do.	<p>1 = Strongly Disagree</p> <p>2 = Disagree</p> <p>3 = Somewhat Disagree</p> <p>4 = Neutral</p> <p>5 = Somewhat Agree</p> <p>6 = Agree</p> <p>7 = Strongly Agree</p>
15	RelAdv3	Interval	Using the system makes it easier to do my study.	<p>1 = Strongly Disagree</p> <p>2 = Disagree</p> <p>3 = Somewhat Disagree</p> <p>4 = Neutral</p> <p>5 = Somewhat Agree</p>

				6 = Agree 7 = Strongly Agree
16	RelAdv4	Interval	Using the system enhances my effectiveness for the study.	1 = Strongly Disagree 2 = Disagree 3 = Somewhat Disagree 4 = Neutral 5 = Somewhat Agree 6 = Agree 7 = Strongly Agree
17	RelAdv5	Interval	Using the system increases my study productivity.	1 = Strongly Disagree 2 = Disagree 3 = Somewhat Disagree 4 = Neutral 5 = Somewhat Agree 6 = Agree 7 = Strongly Agree

18	OutExp1	Interval	I will increase my effectiveness in my study.	1 = Strongly Disagree 2 = Disagree 3 = Somewhat Disagree 4 = Neutral 5 = Somewhat Agree 6 = Agree 7 = Strongly Agree
19	OutExp2	Interval	I will spend less time on routine study tasks.	1 = Strongly Disagree 2 = Disagree 3 = Somewhat Disagree 4 = Neutral 5 = Somewhat Agree 6 = Agree 7 = Strongly Agree
20	OutExp3	Interval	I will increase the quality of output of my study.	1 = Strongly Disagree 2 = Disagree

				<p>3 = Somewhat Disagree</p> <p>4 = Neutral</p> <p>5 = Somewhat Agree</p> <p>6 = Agree</p> <p>7 = Strongly Agree</p>
21	OutExp4	Interval	I will increase the quantity of output for the same amount of effort.	<p>1 = Strongly Disagree</p> <p>2 = Disagree</p> <p>3 = Somewhat Disagree</p> <p>4 = Neutral</p> <p>5 = Somewhat Agree</p> <p>6 = Agree</p> <p>7 = Strongly Agree</p>
22	OutExp5	Interval	My fellow students will perceive me as competent.	<p>1 = Strongly Disagree</p> <p>2 = Disagree</p> <p>3 = Somewhat Disagree</p> <p>4 = Neutral</p> <p>5 = Somewhat Agree</p>

				6 = Agree 7 = Strongly Agree
23	OutExp6	Interval	I will increase my chances of obtaining a high grade.	1 = Strongly Disagree 2 = Disagree 3 = Somewhat Disagree 4 = Neutral 5 = Somewhat Agree 6 = Agree 7 = Strongly Agree
24	PercEase1	Interval	Learning to operate the system would be easy for me.	1 = Strongly Disagree 2 = Disagree 3 = Somewhat Disagree 4 = Neutral 5 = Somewhat Agree 6 = Agree 7 = Strongly Agree

25	PercEase2	Interval	I would find it easy to get the system to do what I want it to do.	1 = Strongly Disagree 2 = Disagree 3 = Somewhat Disagree 4 = Neutral 5 = Somewhat Agree 6 = Agree 7 = Strongly Agree
26	PercEase3	Interval	My interaction with the system would be clear and understandable.	1 = Strongly Disagree 2 = Disagree 3 = Somewhat Disagree 4 = Neutral 5 = Somewhat Agree 6 = Agree 7 = Strongly Agree
27	PercEase4	Interval	It would be easy for me to become skilful at using the system.	1 = Strongly Disagree 2 = Disagree

				<p>3 = Somewhat Disagree</p> <p>4 = Neutral</p> <p>5 = Somewhat Agree</p> <p>6 = Agree</p> <p>7 = Strongly Agree</p>
28	PercEase5	Interval	I would find the system easy to use.	<p>1 = Strongly Disagree</p> <p>2 = Disagree</p> <p>3 = Somewhat Disagree</p> <p>4 = Neutral</p> <p>5 = Somewhat Agree</p> <p>6 = Agree</p> <p>7 = Strongly Agree</p>
29	Complexity1	Interval	Using the system takes too much time from my normal duties.	<p>1 = Strongly Disagree</p> <p>2 = Disagree</p> <p>3 = Somewhat Disagree</p> <p>4 = Neutral</p> <p>5 = Somewhat Agree</p>

				6 = Agree 7 = Strongly Agree
30	Complexity2	Interval	Working with the system is so complicated, it is difficult to understand what is going on.	1 = Strongly Disagree 2 = Disagree 3 = Somewhat Disagree 4 = Neutral 5 = Somewhat Agree 6 = Agree 7 = Strongly Agree
31	Complexity3	Interval	Using the system involves too much time doing mechanical operations (e.g., data input).	1 = Strongly Disagree 2 = Disagree 3 = Somewhat Disagree 4 = Neutral 5 = Somewhat Agree 6 = Agree 7 = Strongly Agree

32	Complexity4	Interval	It takes too long to learn how to use the system to make it worth the effort.	1 = Strongly Disagree 2 = Disagree 3 = Somewhat Disagree 4 = Neutral 5 = Somewhat Agree 6 = Agree 7 = Strongly Agree
33	EaseoU1	Interval	My interaction with the system is clear and understandable.	1 = Strongly Disagree 2 = Disagree 3 = Somewhat Disagree 4 = Neutral 5 = Somewhat Agree 6 = Agree 7 = Strongly Agree
34	EaseoU2	Interval	I believe that it is easy to get the system to do what I want it to do.	1 = Strongly Disagree 2 = Disagree

				<p>3 = Somewhat Disagree</p> <p>4 = Neutral</p> <p>5 = Somewhat Agree</p> <p>6 = Agree</p> <p>7 = Strongly Agree</p>
35	EaseoU3	Interval	Overall, I believe that the system is easy to use.	<p>1 = Strongly Disagree</p> <p>2 = Disagree</p> <p>3 = Somewhat Disagree</p> <p>4 = Neutral</p> <p>5 = Somewhat Agree</p> <p>6 = Agree</p> <p>7 = Strongly Agree</p>
36	EaseoU4	Interval	Learning to operate the system is easy for me.	<p>1 = Strongly Disagree</p> <p>2 = Disagree</p> <p>3 = Somewhat Disagree</p> <p>4 = Neutral</p> <p>5 = Somewhat Agree</p>

				<p>6 = Agree</p> <p>7 = Strongly Agree</p>
37	AttBeha1	Interval	Using the system is a bad idea.	<p>1 = Strongly Disagree</p> <p>2 = Disagree</p> <p>3 = Somewhat Disagree</p> <p>4 = Neutral</p> <p>5 = Somewhat Agree</p> <p>6 = Agree</p> <p>7 = Strongly Agree</p>
38	AttBeha2	Interval	Using the system is a good idea.	<p>1 = Strongly Disagree</p> <p>2 = Disagree</p> <p>3 = Somewhat Disagree</p> <p>4 = Neutral</p> <p>5 = Somewhat Agree</p> <p>6 = Agree</p> <p>7 = Strongly Agree</p>

39	AttBeha3	Interval	Using the system is a wise idea.	1 = Strongly Disagree 2 = Disagree 3 = Somewhat Disagree 4 = Neutral 5 = Somewhat Agree 6 = Agree 7 = Strongly Agree
40	AttBeha4	Interval	Using the system is a foolish idea.	1 = Strongly Disagree 2 = Disagree 3 = Somewhat Disagree 4 = Neutral 5 = Somewhat Agree 6 = Agree 7 = Strongly Agree
41	AttBeha5	Interval	I dislike the idea of using the system.	1 = Strongly Disagree 2 = Disagree

				<p>3 = Somewhat Disagree</p> <p>4 = Neutral</p> <p>5 = Somewhat Agree</p> <p>6 = Agree</p> <p>7 = Strongly Agree</p>
42	AttBeha6	Interval	I like the idea of using the system.	<p>1 = Strongly Disagree</p> <p>2 = Disagree</p> <p>3 = Somewhat Disagree</p> <p>4 = Neutral</p> <p>5 = Somewhat Agree</p> <p>6 = Agree</p> <p>7 = Strongly Agree</p>
43	AttBeha7	Interval	Using the system is pleasant.	<p>1 = Strongly Disagree</p> <p>2 = Disagree</p> <p>3 = Somewhat Disagree</p> <p>4 = Neutral</p> <p>5 = Somewhat Agree</p>

				<p>6 = Agree</p> <p>7 = Strongly Agree</p>
44	AttBeha8	Interval	Using the system is unpleasant.	<p>1 = Strongly Disagree</p> <p>2 = Disagree</p> <p>3 = Somewhat Disagree</p> <p>4 = Neutral</p> <p>5 = Somewhat Agree</p> <p>6 = Agree</p> <p>7 = Strongly Agree</p>
45	IntMoti1	Interval	I find using the system to be enjoyable	<p>1 = Strongly Disagree</p> <p>2 = Disagree</p> <p>3 = Somewhat Disagree</p> <p>4 = Neutral</p> <p>5 = Somewhat Agree</p> <p>6 = Agree</p> <p>7 = Strongly Agree</p>

46	IntMoti2	Interval	The actual process of using the system is pleasant.	1 = Strongly Disagree 2 = Disagree 3 = Somewhat Disagree 4 = Neutral 5 = Somewhat Agree 6 = Agree 7 = Strongly Agree
47	IntMoti3	Interval	I have fun using the system.	1 = Strongly Disagree 2 = Disagree 3 = Somewhat Disagree 4 = Neutral 5 = Somewhat Agree 6 = Agree 7 = Strongly Agree
48	AffUse1	Interval	The system makes work more interesting.	1 = Strongly Disagree 2 = Disagree

				<p>3 = Somewhat Disagree</p> <p>4 = Neutral</p> <p>5 = Somewhat Agree</p> <p>6 = Agree</p> <p>7 = Strongly Agree</p>
49	AffUse2	Interval	Working with the system is fun.	<p>1 = Strongly Disagree</p> <p>2 = Disagree</p> <p>3 = Somewhat Disagree</p> <p>4 = Neutral</p> <p>5 = Somewhat Agree</p> <p>6 = Agree</p> <p>7 = Strongly Agree</p>
50	AffUse3	Interval	The system is okay for some fields of study, but not the field of study I am in.	<p>1 = Strongly Disagree</p> <p>2 = Disagree</p> <p>3 = Somewhat Disagree</p> <p>4 = Neutral</p> <p>5 = Somewhat Agree</p>

				6 = Agree 7 = Strongly Agree
51	Affect1	Interval	I like working with the system.	1 = Strongly Disagree 2 = Disagree 3 = Somewhat Disagree 4 = Neutral 5 = Somewhat Agree 6 = Agree 7 = Strongly Agree
52	Affect2	Interval	I look forward to those aspects of my study that require me to use the system.	1 = Strongly Disagree 2 = Disagree 3 = Somewhat Disagree 4 = Neutral 5 = Somewhat Agree 6 = Agree 7 = Strongly Agree

53	Affect3	Interval	Using the system is frustrating for me.	1 = Strongly Disagree 2 = Disagree 3 = Somewhat Disagree 4 = Neutral 5 = Somewhat Agree 6 = Agree 7 = Strongly Agree
54	Affect4	Interval	Once I start working on the system, I find it hard to stop.	1 = Strongly Disagree 2 = Disagree 3 = Somewhat Disagree 4 = Neutral 5 = Somewhat Agree 6 = Agree 7 = Strongly Agree
55	Affect5	Interval	I get bored quickly when using the system.	1 = Strongly Disagree 2 = Disagree

				<p>3 = Somewhat Disagree</p> <p>4 = Neutral</p> <p>5 = Somewhat Agree</p> <p>6 = Agree</p> <p>7 = Strongly Agree</p>
56	Improve1	Nominal	If you could improve anything about the TICT, what would it be?	User input with a maximum of 500 characters.
57	StudyY	Ordinal	In which year of your study do you currently reside?	<p>1 = Year 1</p> <p>2 = year 2</p> <p>3 = Year 3</p> <p>4 = Year 4</p>
58	Age	Ratio	What is your age?	Numerical input of the respondents age in years.
59	Sex	Nominal	Please specify your sex.	<p>1 = Male</p> <p>2 = Female</p> <p>3 = Other</p>

60	JobFit1_rev	Interval	Reverse coded input of question: "JobFit1"	1 = Strongly Agree 2 = Agree 3 = Somewhat Agree 4 = Neutral 5 = Somewhat Disagree 6 = Disagree 7 = Strongly Disagree
61	Complexity1_rev	Interval	Reverse coded input of question: "Complexity1"	1 = Strongly Agree 2 = Agree 3 = Somewhat Agree 4 = Neutral 5 = Somewhat Disagree 6 = Disagree 7 = Strongly Disagree
62	Complexity2_rev	Interval	Reverse coded input of question: "Complexity2"	1 = Strongly Agree 2 = Agree

				<p>3 = Somewhat Agree</p> <p>4 = Neutral</p> <p>5 = Somewhat Disagree</p> <p>6 = Disagree</p> <p>7 = Strongly Disagree</p>
63	Complexity3_rev	Interval	Reverse coded input of question: "Complexity3"	<p>1 = Strongly Agree</p> <p>2 = Agree</p> <p>3 = Somewhat Agree</p> <p>4 = Neutral</p> <p>5 = Somewhat Disagree</p> <p>6 = Disagree</p> <p>7 = Strongly Disagree</p>
64	Complexity4_rev	Interval	Reverse coded input of question: "Complexity4"	<p>1 = Strongly Agree</p> <p>2 = Agree</p> <p>3 = Somewhat Agree</p> <p>4 = Neutral</p> <p>5 = Somewhat Disagree</p>

				6 = Disagree 7 = Strongly Disagree
65	AttBeha1_rev	Interval	Reverse coded input of question: "AttBeha1"	1 = Strongly Agree 2 = Agree 3 = Somewhat Agree 4 = Neutral 5 = Somewhat Disagree 6 = Disagree 7 = Strongly Disagree
66	AttBeha4_rev	Interval	Reverse coded input of question: "AttBeha4"	1 = Strongly Agree 2 = Agree 3 = Somewhat Agree 4 = Neutral 5 = Somewhat Disagree 6 = Disagree 7 = Strongly Disagree

67	AttBeha5_rev	Interval	Reverse coded input of question: "AttBeha5"	1 = Strongly Agree 2 = Agree 3 = Somewhat Agree 4 = Neutral 5 = Somewhat Disagree 6 = Disagree 7 = Strongly Disagree
68	AttBeha8_rev	Interval	Reverse coded input of question: "AttBeha8"	1 = Strongly Agree 2 = Agree 3 = Somewhat Agree 4 = Neutral 5 = Somewhat Disagree 6 = Disagree 7 = Strongly Disagree
69	AffUse3_rev	Interval	Reverse coded input of question: "AffUse3"	1 = Strongly Agree 2 = Agree

				<p>3 = Somewhat Agree</p> <p>4 = Neutral</p> <p>5 = Somewhat Disagree</p> <p>6 = Disagree</p> <p>7 = Strongly Disagree</p>
70	Affect3_rev	Interval	Reverse coded input of question: "Affect3"	<p>1 = Strongly Agree</p> <p>2 = Agree</p> <p>3 = Somewhat Agree</p> <p>4 = Neutral</p> <p>5 = Somewhat Disagree</p> <p>6 = Disagree</p> <p>7 = Strongly Disagree</p>
71	Affect5_rev	Interval	Reverse coded input of question: "Affect5"	<p>1 = Strongly Agree</p> <p>2 = Agree</p> <p>3 = Somewhat Agree</p> <p>4 = Neutral</p> <p>5 = Somewhat Disagree</p>

				6 = Disagree 7 = Strongly Disagree
72	PercUse_comb	Interval	Computed mean of the following variables: “PercUse1, PercUse2, PercUse3, PercUse4, PercUse5, PercUse6”	n/a
73	JobFit_comb	Interval	Computed mean of the following variables: “JobFit1_rev, JobFit2, JobFit3, JobFit4, JobFit5”	n/a
74	RelAdv_comb	Interval	Computed mean of the following variables: “RelAdv1, RelAdv2, RelAdv3, RelAdv4, RelAdv5”	n/a
75	OutExp_comb	Interval	Computed mean of the following variables: “OutExp1, OutExp2, OutExp3, OutExp4, OutExp5, OutExp6”	n/a
76	PercEase_comb	Interval	Computed mean of the following variables: “PercEase1, PercEase2, PercEase3, PercEase4, PercEase5”	n/a
77	Complexity_comb	Interval	Computed mean of the following variables: “Complexity1_rev, Complexity2_rev, Complexity3_rev, Complexity4_rev”	n/a
78	EaseoU_comb	Interval	Computed mean of the following variables: “EaseoU1, EaseoU2, EaseoU3, EaseoU4”	n/a

79	AttBeha_comb	Interval	Computed mean of the following variables: “AttBeha1_rev, AttBeha2, AttBeha3, AttBeha4_rev, AttBeha5_rev, AttBeha6, AttBeha7, AttBeha8_rev”	n/a
80	IntMoti_comb	Interval	Computed mean of the following variables: “IntMoti1, IntMoti2, IntMoti3”	n/a
81	AffUse_comb	Interval	Computed mean of the following variables: “AffUse1, AffUse2, AffUse3_rev”	n/a
82	Affect_comb	Interval	Computed mean of the following variables: “Affect1, Affect2, Affect3_rev, Affect4, Affect5_rev”	n/a
83	PerfExpec_gen	Interval	Computed mean of the following variables: “PercUse_comb, JobFit_comb, RelAdv_comb, OutExp_comb”	n/a
84	EffExpec_gen	Interval	Computed mean of the following variables: “PercEase_comb, Complexity_comb, EaseoU_comb”	n/a
85	AttTech_gen	Interval	Computed mean of the following variables: “AffUse_comb, Affect_comb”	n/a
86	Motivation	Interval	Computed mean of the following variables: “AttBeha_comb, IntMoti_comb”	n/a

Appendix 13: Plan of analysis

The data present in SPSS was analysed for potential errors before any analysis was carried out. To check if all data was without any errors, a check of the frequency of the answers was done. Out of 55 questions checked, two missing values were found within the question asking about the age of the respondents (column 58). The two missing values were excluded in the calculations done for the descriptive statistics about the age of the respondents, all other values of the same respondents were included in the analysis.

Missing values were only set for the question about the age of the respondents (column 58), with a value between -999 up to and including 16 set as the range for SPSS to recognize a value as missing. Further definition of missing values was not deemed necessary, as all other data was within the expected range en frequency of the answer possibilities. The data of the missing value about the age of the respondents can be found in Appendix 10.

After the individual variables were checked for inconsistencies and missing values were set, computed variables were constructed. Before a computed variable can be set, the intended individual variables need to be tested for reliability. The reliability of individual items intended to be scored as a combined scale was tested through the internal consistency analysis called, Cronbach's Alpha. The Cronbach's Alpha will be reported in the method section of the thesis, an overview of the results of the Cronbach's Alpha test can be found in table 6.

Statistical analyses. In the current research two types of statistical analyses were to be performed. Firstly, a test of significant difference between the independent variables of Performance Expectancy, Effort Expectancy and Attitude towards using technology, and a test of significant association between the independent variables and the dependent variable of intent to

use the TICT (Behavioural Intent). The original design was to use a ANOVA with repeated measures to check if there is a statistical difference between the independent variables and a Pearson's correlation to test for the predictive association between the independent variables and the dependent variable. However, multiple requirements need to be met before an ANOVA with repeated measures or a Pearson's correlation can be performed. One of the requirements is a sample size of at least 30. However, the sample size of the current study is 22, therefore the requirement of a large enough sample size was not met. As the sample size requirement was not met, no further assumptions for the ANOVA or Pearson's correlation were tested.

With a sample size of 22, statistical testing needed to be done through non-parametric tests. To test if there is a difference between the independent variables a Friedman test will be performed. The Friedman test has the following assumptions (indented bullet-points describe if the assumption is met or not):

1. One group, measured on at least three different occasions.
 - a. Friedman will test the three variables Performance Expectancy, Effort Expectancy and Attitude towards using technology → Assumption met.
2. Variables are to be measured on at least an ordinal level of measurement
 - a. The test variables are scored on a Likert-scale → Assumption met.

As the assumptions are met, a Friedman test will be performed. However, a Friedman test will only test if there is a significant difference between the test variables. If the Friedman test results display a significant difference, a Wilcoxon signed-rank test will be performed to analyse where the difference is. For the Wilcoxon signed-rank test the following assumptions need to be met (indented bullet-points describe if the assumption is met or not):

1. Test variables need to be measured on at least an ordinal level of measurement.
 - a. The test variables were scored on a Likert-scale → Assumption met.
2. The test variables are paired.
 - a. The same respondents are represented within all three groups of test variables → Assumption met.

As both assumptions of the Wilcoxon signed-rank test are met, the test can be performed. It should be noted that a t-test could also be used instead of the Wilcoxon signed-rank test, but the Wilcoxon signed-rank test is preferred with sample sizes smaller than 25.

To account for multiple comparisons with the Wilcoxon signed-rank test, a Bonferroni correct method needs to be applied. The Bonferroni correction method prescribes that the significance level that is set for the current study needs to be divided by the sum of the measurements; in the current study, the sum of measurements is 3. The Bonferroni correction will result in the following equation: $p_b = p_w / \sum_m$. With the following definition:

p_b = significance level corrected with the Bonferroni correction.

p_w = significance level of Wilcoxon signed-rank test.

\sum_m = Sum of measurements performed in the Wilcoxon signed-rank test.

When filled in, the equation for the significance level of the Wilcoxon signed-rank test will look like this $.0167 = .05 / 3$.

The non-parametric variant to test for a correlation is the Spearman's correlation test. The reason a Spearman's correlation test has been chosen over a Pearson's correlation test is because the sample size of the current research is smaller than 30. Additionally, before a Spearman's

correlation can be performed it is assumed that the test variables are at least measured on an ordinal level of measurement. With the test variables being measured on a Likert-scale, this assumption was met.

Appendix 14: SPSS frequency tables

What is your age?					
	Frequency	Percent	Valid Percent	Cumulative Percent	
Valid	20	2	9.1	10.0	10.0
	21	3	13.6	15.0	25.0
	22	5	22.7	25.0	50.0
	23	2	9.1	10.0	60.0
	24	2	9.1	10.0	70.0
	25	3	13.6	15.0	85.0
	26	1	4.5	5.0	90.0
	28	1	4.5	5.0	95.0
	29	1	4.5	5.0	100.0
	Total	20	90.9	100.0	
Missing	-553	1	4.5		
	1	1	4.5		
	Total	2	9.1		
Total		22	100.0		

Appendix 15: Ethical justification

The ethical justification of the current study is done through a reflection upon the principles composed in the Dutch code of conduct for scientific integrity (Commissie herziening Nederlandse gedragscode wetenschappelijke integriteit, 2018). The Dutch code of conduct for scientific integrity dictates five principles: honesty, scrupulousness, transparency, independence, and responsibility (Commissie herziening Nederlandse gedragscode wetenschappelijke integriteit, 2018).

To justify the ethical aspect of the current research the following subjects are to be reflected upon while considering the Dutch code of conduct for scientific integrity. The reflection is as following:

Objective information gathering. When information was gathered, the information could be from various sources. The sources of information could be an explorative interview, survey results or literature. To uphold a certain level of objectivity, information was triangulated as much as possible. That would mean that information obtained through an interview would also be verified through a literature review. Additionally, all answers to the survey conducted in the field research were anonymously gathered to prevent respondents from giving socially desirable answers. The anonymity of the answers was thoroughly communicated towards the respondents. Furthermore, information that was gotten through the client was never taken “as is”. Information gotten through the client was certified by another source before being considered as objective data. This was not done because of a lack of trust, it was done to uphold the independence of the research and its results.

Responsibility towards respondents. During each phase of the research - the preliminary and field research – participants were informed through various information letters before coming into contact with the researcher. The various information letters were specifically drafted for the target population. Additionally, the respondents were presented two forms before their survey-data could be used. The first form was the so called informed consent, it informed the respondents about the purpose of the research and what would be asked of them. Additionally, it also informed the respondents about their right to withdraw their participation in the current research without any negative consequences for them. Finally, the informed consent also stated the contact information of the responsible researcher and the right to request a copy of the research report. The second form that was presented towards the respondents was a GDPR compliance form. In the GDPR compliance form the respondents were informed of their legal rights regarding GDPR legislation. The GDPR compliance form contained information about the goal of the research, the collected data, which parties have access to research data, and the storage period of research data. Respondents needed to sign both form before their data would be collected and used.

Consultation of committees. Various parties were consulted during the research. Each step of the research was first discussed within the Fontys TICT Research Group (FTRG). During the presentation with the FTRG it became clear that the intended format of 54 quantitative questions and 20 qualitative questions would be an excessive burden on the respondents, as it would take over 30 minutes to complete the survey. After this feedback the survey was adjusted to only contain the 54 quantitative questions and one qualitative question. The format change led to a drastic cut in the time needed to complete the survey, as it now only took between ten to

fifteen minutes. The new time to complete the survey was deemed as a proportional load on the respondents lives.

Additionally, the privacy- and GDPR-counsellor had been consulted about the consequences of the survey on the privacy of the respondents. During the consultation it was concluded that the survey met the requirements set in GDPR legislation. The GDPR compliance letter was also examined by the privacy and GDPR-counsellor of Fontys and passed the requirements.

Anonymity of respondents. The results of the survey can in no way be traced back to specific people. The combination of personal information that was gathered with the survey (age, sex, study year) was general enough to not be retraceable. Furthermore, only the researcher and members of the FTRG could access the cloud storage where the data was kept. The data was protected through a password only known by the researcher. There was one possible risk for participants to share information that could lead to their identification, this was the answer to the qualitative question. The answers of the qualitative questions were analysed by the researcher and no infringement of the respondents privacy were detected, after which the data was uploaded on to the Fontys cloud storage for research data.

Dutch principles for scientific integrity. A justification of the current research is also done through a reflection upon the five guiding principles for scientific integrity (Commissie herziening Nederlandse gedragscode wetenschappelijke integriteit, 2018).

Honesty. Data was collected through honest means and the raw research data can be requested from the researcher. Additionally, respondents were informed thoroughly before their participation in the current research and the purpose of the research.

Scrupulousness. To uphold the scrupulousness of the current research, only peer-reviewed scientific articles were included. There is one exception, the EAST-method, as it is a policy-paper. However, the sources of the EAST-method are of a scientific nature and each claim in the policy-paper were analysed in the original source to uphold the scientific principle of scrupulousness.

Transparency. To uphold the transparency of the current research, every step the researcher made is documented. The method-section of the current research explains the steps taken during the study. Additionally, all data is available to interested parties, as they can contact the researcher if interested.

Independence. The choice of the method and analyses of data were independently chosen by the researcher and only checked through the FRTG. Only one adjustment was made through the input of the FTRG, the length of the survey. The original length of the survey was deemed too long and expose the respondents to a disproportionate load. However, before the adjustments to the survey were implemented, they were proposed to the instructor provided by Fontys. Only after the instructor gave the ‘green light’ for the changes, they were implemented.

Responsibility. The researcher has taken responsibility for the current research by analysing the societal relevance of the study. The reasoning behind the relevance can be read in the introduction of the current research.

An explanation of the Dutch principles can be found in appendix 16

Appendix 16: Dutch principles for scientific integrity

Honesty. “Honesty means, among other things, reporting the research process accurately, taking alternative opinions and counterarguments seriously, being open about margins of uncertainty, refraining from making unfounded claims, refraining from fabricating or falsifying data or sources and refraining from presenting results more favourably or unfavourably than they actually are.” (Commissie herziening Nederlandse gedragscode wetenschappelijke integriteit, 2018).

Scrupulousness. “Scrupulousness means, among other things, using methods that are scientific or scholarly and exercising the best possible care in designing, undertaking, reporting and disseminating research.” (Commissie herziening Nederlandse gedragscode wetenschappelijke integriteit, 2018).

Transparency. “Transparency means, among other things, ensuring that it is clear to others what data the research was based on, how the data were obtained, what and how results were achieved and what role was played by external stakeholders. If parts of the research or data are not to be made public, the researcher must provide a good account of why this is not possible. It must be evident, at least to peers, how the research was conducted and what the various phases of the research process were. At the very least, this means that the line of reasoning must be clear and that the steps in the research process must be verifiable.” (Commissie herziening Nederlandse gedragscode wetenschappelijke integriteit, 2018).

Independence. “Independence means, among other things, not allowing the choice of method, the assessment of data, the weight attributed to alternative statements or the assessment of others’ research or research proposals to be guided by non-scientific or non-scholarly

considerations (e.g., those of a commercial or political nature). In this sense, independence also includes impartiality. Independence is required at all times in the design, conduct and reporting of research, although not necessarily in the choice of research topic and research question.”

(Commissie herziening Nederlandse gedragscode wetenschappelijke integriteit, 2018).

Responsibility. “Responsibility means, among other things, acknowledging the fact that a researcher does not operate in isolation and hence taking into consideration – within reasonable limits – the legitimate interests of human and animal test subjects, as well as those of commissioning parties, funding bodies and the environment. Responsibility also means conducting research that is scientifically and/or societally relevant.” (Commissie herziening Nederlandse gedragscode wetenschappelijke integriteit, 2018).

Appendix 17: HBO-kennisbank consent form

The written consent for the publication of this thesis can be found in the separately uploaded appendix on GradeWork.