The Effect of Individual's Technological Belief and Usage on their Absorptive Capacity towards their Learning Behaviour in the Learning Environment

UTS UNIVERSITY OF TECHNOLOGY SYDNEY

The Effect of Individual's Technological Belief and Usage on their Absorptive Capacity towards their Learning Behaviour in the Learning Environment

by Thomas Dolmark

Thesis submitted in fulfilment of the requirements for the degree of

Masters by Research

under the supervision of Dr Osama Sohaib and Professor Ghassan Beydoun

University of Technology Sydney
Faculty of Engineering and IT

July 2020

Certificate of Original Authorship

I, Thomas Dolmark declare that this thesis, is submitted in fulfilment of the requirements for the award of Masters by Research, in the Information System Modelling School at the Faculty of Engineering and IT at the University of Technology Sydney.

This thesis is wholly my own work unless otherwise referenced or acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

This document has not been submitted for qualifications at any other academic institution.

This research is supported by the Australian Government Research Training Program.

Signature: Production Note:
Signature removed prior to publication.

Date: 21/09/20

Table of Content

Acknowledgement

I dedicate this thesis to my late grandmother Maria Dolmark. She, like many other people, never had the opportunity to study even though her wisdom, love and strength inspired me to pursue knowledge. This work is because of you Nona.

I wish to also thank my father Victor Dolmark. There are many people who are unable to pursue further education. I wouldn't have been able to do this without his continuous and unconditional support.

I would like to thank the University of Technology Sydney (UTS), the teachers, students and friends who supported me whilst writing this thesis, in particular my supervisors Dr Osama Sohaib and Prof. Ghassan Beydoun; my friends at UTS such as Diah Priharsari, Ezwan Shah Abd Majid, and Fatuma Kabuye; the School of Information System Modelling and the Graduate Research School who support and supply students with the resources necessary for them to achieve success; the proof-readers who indicated when this thesis was unreadable; and finally, the admin and other supporting staff who are often forgotten but never-the-less are ever present and helping.

I would not have been able to persist without the support of this community. In these trying times (bush fires, COVID-19, and many other tragic events), I wish to send a message of hope to those who are facing despair. To reach this point, it took a lifelong journey punctuated with struggles. However, there is support and potential. Do not ever let anyone hold you back and stick with those who will stand with you.

List of Publications

Conference Paper

Dolmark, T., Sohaib, O. & Beydon, G. 2019, 'The Effect of Technology Readiness on Individual Absorptive Capacity for Knowledge Transfer', *ISD 2019*, ed. C.B. A. Siarheyeva, M. Lang, H. Linger, & C. Schneider, Information Systems Development: Information Systems Beyond 2020 (ISD2019 Proceedings), Toulon, France: ISEN Yncréa Méditerranée.

https://aisel.aisnet.org/isd2014/proceedings2019/ISDMethodologies/17/

Working Papers

Dolmark, T., Sohaib, O. & Beydon, G. 'The Effect of Tools, Social Networks and Social Influences on Individual Absorptive Capacity toward Learning Behavior in Australian Universities'

Dolmark, T., Sohaib, O. & Beydon, G. 'The Effect of Technology Readiness on Individual Absorptive Capacity toward Learning Behavior in Australian Universities'

List of Abbreviations

Abbreviation	Explanation
ACAP	Absorptive CAPacity
PACAP	Potential Absorptive CAPacity
RACAP	Realised Absorptive CAPacity
TR	Technology Readiness
TRI	Technology Readiness Index
TAM	Technology Acceptance Model
TKS	Tools for Knowledge Sources
KMS	Knowledge Management System
LMS	Learning Management System
CMS	Content Management System
SI	Social Influences
SN	Social Networks
IWP	Individual Work Performance
SEM	Structural Equation Modelling
PLS	Partial Least Squares
CB	Co-variance Based
UTS	University of Technology Sydney
HC	Higher-order Constructs
HOC	Higher-Order Component
LOC	Lower-Order Components
CR	Composite Reliability
AVE	Average Variance Extract
HTMT	HeteroTrait-MonoTrait
VIF	Variance Inflation Factor
BCa	Bias-Corrected and accelerated
CTA	Confirmatory Tetrad Analysis
IMPA	Importance Performance Map Analysis

Abstract

While hard to define, knowledge is critical for organisational success. Organisations who know this spend a significant amount of resources to manage it. In organisations, there are three common barriers to knowledge transfer which are causal ambiguity, relation between knowledge holder and recipient, and recipient's Absorptive CAPacity (ACAP). Horizontal organizational structures appear to be an effective solution to causal ambiguity and relation between knowledge holder and recipient because they allow knowledge to flow across organisational silos. The recipient's ACAP is defined as a dynamic capability to absorb knowledge. While the content and its context are important for knowledge transfer, technology can also enhance learning.

This study addressed the gap in knowledge by examining the role of Technology Readiness (TR), Tools for Knowledge Sources (TKS), Social Influences (SI) and Social Networks (SN) in an individual's ACAP towards learning behaviour. The research addresses the following research question. What is the effect of an individual's technological belief and use on their capability to absorb knowledge towards their technological learning behaviour?

A research model is proposed to empirically test the relationship between TR and individual's ACAP towards learning behaviour. As beliefs affect behaviour, the TRI measures an individual's propensity towards technology. Other antecedents such as TKS, SI and SN may also have an effect on an individual's ACAP. To assess behaviour under control of an individual the Individual Work Performance (IWP) was adapted towards learning behaviours.

To test the presence of a causal effect, this study applied a quantitative approach to confirm theories. A survey was conducted at the University of Technology Sydney (UTS). An online questionnaire was used to collect data from students. A total of 199 participated in the survey. This questionnaire borrowed items from other academic peer reviewed journals. The data were analysed using the Partial Least Square (PLS)-Structural Equation Modelling (SEM) approach. The PLS approach had many benefits such as being flexible and the use of formative and reflective indicators. A High order Construct (HC) allowed abstraction in the research model. The disjoint two-stage approach enabled further validation of the measurement model in its second stage.

The results generated mixed findings. Among the different hypotheses enumerated, the individual's technological belief in Optimism and Innovation, and the SN had a significantly very weak effect on individual ACAP which in turn had a significantly weak effect on their learning behaviour. This study highlighted the need to assess individual ACAP and learning behaviour.

List of Tables

List of Figures

Chapter 1: Introduction

1.1 Statement of the Problem

Davenport and Prusak (1998, p.2-6) distinguished between data, information and knowledge as follows: when data has meaning, it is information; and when information has been experienced, it is knowledge (Garavelli, Gorgoglione & Scozzi 2002; Karlsen & Gottschalk 2004). However, knowledge is a mix of various factors that are not clearly defined (Davenport & Prusak 1998, p.5). It is intangible and difficult to imitate (Lopez-Cruz & Garnica 2018). The undefinable portion of knowledge is called tacit (Polanyi 1967', p.4-5). Tacit knowledge is hard to encode as it is personal and difficult to formalize, this makes it more difficult to transfer (Goh 2002; Polanyi 1967', p.4-5). This tacit portion of knowledge can be subject to misinterpretation or dispute (Bhatt 2001). However, experience does clearly help develop knowledge (Davenport & Prusak 1998, p.7).

Knowledge is considered critical for organisations to succeed (Karlsen & Gottschalk 2004). Managers who do not leverage knowledge are jeopardizing their operations (Prusak 1997). Organisations that recognize the importance of knowledge spend a lot of resources to manage it (Iyengar, Sweeney & Montealegre 2015). They attempt to transfer knowledge where it can be used (Kuo & Lee 2009; Vance & Eynon 1998). Knowledge transfer is in part a communication process (Vance & Eynon 1998) which is affected by the subjects' objectives, experiences, values and context (Garavelli, Gorgoglione & Scozzi 2002). Knowledge can only be of value if it can be accessed when it is needed (Karlsen & Gottschalk 2004). It is useless if it is accessed in hindsight (Kuo & Lee 2009). And yet being overwhelmed with information yields little value: only information that an individual reflects or learns has value (Kuo & Lee 2009). However, even if organisations fully commit to knowledge management,

barriers to knowledge transfer can still exist (Szulanski 1996). In organisations, these barriers are causal ambiguity, an arduous rapport between knowledge holder and recipient, and recipient's ACAP (Szulanski 1996). Employee motivation is not a barrier in knowledge transfer (Szulanski 1996). Causal ambiguity is when the cause of an effect is uncertain or unknown (Szulanski 1996). It is more likely to be addressed when subunits share knowledge (Uygur 2013) which can be accomplished with horizontal cross-functional communication flows. An arduous relation between the knowledge holder and recipient is another barrier to knowledge transfer (Szulanski 1996). Withholding critical information is considered as a means for managers to assert power (Goh 2002). This is believed to stem from a punitive and distrustful organisational culture rather than a technological issue (Goh 2002). Horizontal structures differ from the traditional vertical hierarchy as they allow communication to flow across business functions (Goh 2002). They appear to be an effective solution to causal ambiguity, and rapport between knowledge holder and recipient (Tang, Xi & Ma 2006; Uygur 2013). In this case the recipient's ACAP remains.

The recipient's ACAP is important as organisations learn through its members (Cohen & Levinthal 1990). Yet, there is little research into individual ACAP (Lowik, Kraaijenbrink & Groen 2017; Minbaeva, Mäkelä & Rabbiosi 2012; Yao & Chang 2017). Technologies and systems can enhance an individual's learning capability (Hamilton, Rosenberg & Akcaoglu 2016). When assistive learning technologies were introduced in American universities, students capabilities improved beyond their education (Raskind & Scott 1993). Content and its context are important for pedagogy and their transformation is enabled by technology (Beydoun, Kultchitsky & Manasseh 2007; Koehler et al. 2014). An individual's behaviour is influenced by their beliefs (Ajzen 1991), their cognition and the affection they receive (Ajzen 2011). An individual's belief towards technology can be measured by the TRI. This aligns well with individuals (Lin, Shih & Sher 2007). The outcome behaviours of individuals can be

assessed with the IWP which can be adapted to construct a generic questionnaire (Koopmans et al. 2013).

1.2 Research Questions

What is the effect of an individual's technological belief and use on their capability to absorb knowledge to their technological learning behaviour?

1.3 Purpose of the Study

This research aims to confirm if an individual's technological belief and usage have an effect on an individual's learning capability and their technological learning behaviours. Its purpose is to provide empirical evidence of any causal-effect. To accomplish this, this study proposes to use the following conceptual framework:

- The ACAP by Zahra & George (2002) reduced at the individual scope to assess their capability to absorb knowledge,
- The TRI v2.0 from Parasuraman & Colby (2015) to measure an individual's technological belief.
- Kelman (1958) SI to assess an individual's subjective norm.
- Individual use of TKS and SN.
- The IWP (Koopmans et al. 2013) to assess an individual's learning behaviour,
- Finally, Ajzen (1991) theory of planned behaviour which states that belief affects behaviour to underpin the model.

To provide empirical evidence of the causal effect, a quantitative approach is preferred. Quantitative research seeks to provide truth using an objective scientific method (Bloomfield & Fisher 2019). It is suitable to confirm theories (Teddlie & Tashakkori 2009, p.22) as it provides methods (Watson 2015) that use statistical analysis for numerical data to test

hypotheses (Bloomfield & Fisher 2019). Small sample sizes run the risk of not gathering enough data to support hypotheses (Fowler & Lapp 2019). Also, the chance of outliers is reduced with a large population sample (Fowler & Lapp 2019). An online web questionnaire allows collecting data from participants within a short amount of time over a large geographic area (Wright 2017). A quantitative approach would use statistical analysis with numerical data from a large population sample to confirm the existence of a causal-effect from an individual's technological belief and use to their capability and learning.

As SEM is the preferred technique to test causal-effect (Hair Jr., Sarstedt, et al. 2014), the PLS-SEM is a well-established analysis method. It has fewer restrictions regarding assumptions (Hair, Ringle & Sarstedt 2011; Hair, Risher & Ringle 2019). It can be used for a small sample size (Hair, Ringle & Sarstedt 2011; Hair, Risher & Ringle 2019). It can work with non-normal data (Cassel, Hackl & Westlund 1999; Hair Jr., Sarstedt, et al. 2014). It does not rely on the model fit concept (Hair Joseph, Sarstedt & Ringle 2019). The research model has formative constructs and hence PLS-SEM is preferred (Hair, Risher & Ringle 2019). It is suitable for theory confirmation and testing (Hair, Ringle & Sarstedt 2011; Hair, Risher & Ringle 2019). For this study, a quantitative approach is preferred to provide empirical evidence by testing hypotheses using PLS-SEM statistical analysis with numerical data gathered with online questionnaires.

1.4 Significance of the Study

This study has many benefits. The research findings provide insight into which individual technological beliefs and use would impact an individual's learning capability and their learning behaviour. More research into individual ACAP may help further understand creativity and innovation (Da Silva & Davis 2011). Findings would confirm if an individual's belief in technological innovation has an effect of either positive or negative on their ACAP.

Insight into which learning capability and behaviour is affected by which individual technological belief and its use would provide guidance as to where to direct efforts when developing technologies and pedagogical methods using technology. This study also provides a model that can be repurposed. While frameworks can at times be poor, frameworks can still offer advantages and remain useful; thus, "it is better to have some than none" (Mishra & Koehler 2006). The means to evaluate e-learning services and delivery must be developed by both practitioners and researchers (Adeyinka et al. 2010; Saarinen 1996). The research model could be repurposed to build instruments to help pedagogues and their students but as well as businesses. This study also contributes to the literature on individual ACAP, technology, and knowledge transfer as individual ACAP as a barrier remains little researched (Lowik, Kraaijenbrink & Groen 2017; Minbaeva, Mäkelä & Rabbiosi 2012). The findings provide results that are applicable beyond education; its significance would be greater than its context. All these benefits would be significant to pedagogues, engineers, businesses and any other stakeholder involved in the transfer of knowledge using technology.

1.5 Thesis Outline

This chapter introduced the research's problem, question, purpose and significance. The next chapter reviews the literature to further expand the background of the research's problem and its question. Chapter 3 introduces a research model and uses the theoretical background to build the research hypotheses. Chapter 4 explains the rationale behind the design for this study and justifies the PLS-SEM method as it is the method of analysis. Chapter 5 provides the results of said analysis enumerating which null hypotheses have not been rejected. Chapter 6 concludes with a summary of its results, implication, limitation, and recommendations for future research.

Chapter 2: Literature Review

This chapter reviews literature to establish and consolidate the research question. It begins with a rough explanation of knowledge. It proceeds to explaining how knowledge can be and is managed along with its shortfalls. The barriers to knowledge transfer in organisations are explained along their potential solutions. As ACAP remains a barrier without a clear solution, ACAP is introduced as the central scope of this research. A case is then made to present technology as an enabler of learning. The TRI is then presented as a framework that measures an individual's propensity towards technology. The TRI taxonomy is useful for categorising a sample population. TKS is argued to have an effect on individual ACAP. SI and SN contend that they are influences on individual ACAP, and are posited to have an impact on individual ACAP. Finally, IWP is proposed as a framework to measure the outcome behaviour from an individual.

2.1 Explaining Knowledge

To understand knowledge management or its transfer; knowledge must first be properly understood. As discussed earlier in Chapter 1 Section 1, information is data that meaning and knowledge is information with experience (Davenport & Prusak 1998, p.2-6; Garavelli, Gorgoglione & Scozzi 2002; Karlsen & Gottschalk 2004). The various factors that make knowledge are not clearly defined (Davenport & Prusak 1998, p.5). While intangible and difficult to imitate (Lopez-Cruz & Garnica 2018), experience does help develop knowledge (Davenport & Prusak 1998, p.7). The undefinable portion of knowledge is referred to as tacit knowledge (Polanyi 1962, p.90; Polanyi 1967, p.4-5). Examples of tacit knowledge would be riding a bike or intuition. This tacit portion of knowledge can be subject to misinterpretation or dispute (Bhatt 2001). Tacit knowledge cannot be reduced nor codified into information (Lopez-Cruz & Garnica 2018). Tacit knowledge is hard to encode as it is personal and

difficult to formalise, and this makes it more difficult to transfer (Goh 2002; Polanyi 1967, p.4-5).

Knowledge transfer is in part a communication process (Vance & Eynon 1998). This communication process begins with the sender encoding information into data, and then this data is transmitted across a medium which can be subjected to pollution (Vance & Eynon 1998). Finally, this data is collected and decoded into information by the receiver (Vance & Eynon 1998). This codification process is affected by the subjects' objectives, experiences, values and context (Garavelli, Gorgoglione & Scozzi 2002). Alas, when organisations attempt to manage or transfer knowledge, they neglect the recipient's perspective and his prior experiences (Bhatt 2001; Muhammad et al. 2016). Being overwhelmed with information yields little value; only information that an individual reflects or learns has value (Kuo & Lee 2009).

2.2 Managing Knowledge

Knowledge is critical for organisational success(Garavelli, Gorgoglione & Scozzi 2002; Goh 2002; Hwang et al. 2008; Karlsen & Gottschalk 2004; Othman, Beydoun & Sugumaran 2014). Organisations that recognise this spend significant resources to manage it (Iyengar, Sweeney & Montealegre 2015). When knowledge is not used, it loiters, until, it becomes redundant (Prusak 1997). This led to Hewlett-Packard's famous statement, "If only HP knew what HP knows, we could be three times more productive!" (Prusak 1997). Managers who do not leverage knowledge are jeopardising their operations (Prusak 1997).

As competition pressures businesses to leverage knowledge, the need for knowledge increases (García-Morales, Ruiz-Moreno & Llorens-Montes 2007; Iyengar, Sweeney & Montealegre 2015; Prusak 1997). In a product's life cycle, each phase has a different knowledge absorption requirement (Zou, Guo & Guo 2016). In the introduction and decline

phases, organisations have little to no need for knowledge whereas in the growth and maturity phase, the need for knowledge is at its highest (Zou, Guo & Guo 2016). Ultimately, when a project ends, its resources are scattered along with its knowledge (Karlsen & Gottschalk 2004; Prusak 1997). This is to the detriment of organisations (Prusak 1997). Knowledge can only be of value if it can be accessed when it is needed (Karlsen & Gottschalk 2004). It is useless if it is accessed in hindsight (Kuo & Lee 2009; Othman, Beydoun & Sugumaran 2014). Organisations that are aware of this attempt to transfer knowledge where it can be used (Kuo & Lee 2009; Vance & Eynon 1998). In organisations, knowledge is relevant, time and task sensitive (Garavelli, Gorgoglione & Scozzi 2002; Kuo & Lee 2009; Othman, Beydoun & Sugumaran 2014; Vance & Eynon 1998).

When organisations are effective at managing knowledge, their ability to innovate improves (García-Morales, Ruiz-Moreno & Llorens-Montes 2007). They then gain a strategic competitive advantage (Iyengar, Sweeney & Montealegre 2015; Karlsen & Gottschalk 2004; Lin, Chang & Chang 2004; Szulanski 1996). They also gain other benefits such as reduced reinvention of wheels, less work generated, fewer questions, better decisions, error reduction, more independence for knowledge workers, improved customer relations, service and profitability (Karlsen & Gottschalk 2004).

2.3 Barriers to Knowledge Transfer in Organisations

Even if organisations fully commit to knowledge management, barriers to knowledge transfer can still exist (Szulanski 1996). In organisations, these barriers are causal ambiguity, an arduous rapport between knowledge holder and recipient, and recipient's ACAP (Szulanski 1996). Employee motivation was also discovered to not be a barrier in knowledge transfer (Szulanski 1996). Causal ambiguity is when the cause of an effect is uncertain or unknown (Szulanski 1996). Causal ambiguity is more likely to be addressed when subunits share

knowledge (Uygur 2013) which can be accomplished with horizontal cross-functional communication flows. An arduous relations between the knowledge holder and recipient is another barrier to knowledge transfer (Szulanski 1996). Withholding critical information is considered as a means to assert power by managers (Goh 2002). This is believed to stem from a punitive and distrustful organisational culture rather than a technological issue (Goh 2002). Horizontal structures have a positive effect by promoting trust and by disseminating aspiration (Goh 2002; Karlsen & Gottschalk 2004; Tang, Xi & Ma 2006; Uygur 2013). These structures differ from the traditional vertical hierarchy as they allow communication to flow across business functions (Goh 2002). Horizontal organisational structures appear to be an effective solution to causal ambiguity, and rapport between knowledge holder and recipient (Karlsen & Gottschalk 2004; Tang, Xi & Ma 2006; Uygur 2013). Recipient's ACAP remains.

2.4 Absorptive Capacity

Some organisations try to absorb knowledge from external sources (García-Morales, Ruiz-Moreno & Llorens-Montes 2007). This differs from the process of formalizing new knowledge which is also known as retentive capacity (Szulanski 1996). Absorbing external knowledge is referred to as ACAP (Cohen & Levinthal 1990). The ability to absorb new external knowledge can provide significant benefits (Jansen, Van Den Bosch & Volberda 2005). For example, when an organisation's ACAP is increased, the organisation's aspiration will shift from measuring performances to observing emerging market opportunities (Cohen & Levinthal 1990).

Cohen & Levinthal (1990) first introduced the concept of ACAP as an organisation's capability to absorb knowledge. Zahra & George (2002) further developed a conceptual framework illustrating ACAP. This framework recognises four different capabilities in the absorption process (see Figure 1.):

1. **Acquisition** is the first capability where the object of knowledge is acquired (Zahra & George 2002). In this capability, trust between all parties, identifying the recipient's knowledge gap and evaluating available processes and tools are all critical (Jacobs & Buys 2010).
2. In the **Assimilation** capability, the knowledge is extracted from the object (Zahra & George 2002). The communication channel and processes must be sound for Assimilation to be effective (Jacobs & Buys 2010). Hence, Social Integration Mechanisms are part of Assimilation which differentiates it from Transformation (Zahra & George 2002).
3. **Transformation** is where processes are re-configured so that the newly acquired knowledge can be exploited (Zahra & George 2002). The existence of prior knowledge processes affects this step (Jacobs & Buys 2010; Szulanski 2000). The deeper the prior knowledge processes are ingrained, the more time and effort it will take to unlearn and relearn the new process (Szulanski 2000).
4. **Exploitation** is the final capability. Here, knowledge is used and its value is returned (Zahra & George 2002). Exploiting knowledge is often viewed as a successful demonstration that knowledge has been absorbed (Jacobs & Buys 2010).

These four capabilities are interdependent (Zahra & George 2002). Acquisition and Assimilation are considered Potential Absorptive CAPacity (PACAP) because knowledge has still not yet been incorporated (Zahra & George 2002). Transformation and Exploitation are referred to as Realised Absorptive CAPacity (RACAP) as knowledge has been incorporated (Zahra & George 2002). PACAP has a positive impact on RACAP (Limaj & Bernroider 2019). Cohen & Levinthal (1990) do not make a distinction between Assimilation and Transformation; instead, they only recognise Assimilation.

Antecedents can affect ACAP differently which can lead to different performance (Jansen, Van Den Bosch & Volberda 2005). These antecedents are:

- **Knowledge Sources** refers to external sources of knowledge that can be acquired by a firm in both breadth and depth {Zahra, 2002 #84}.
- **Experience** defines the future capabilities to acquire knowledge {Zahra, 2002 #84}. It also impacts other capabilities through memory {Zahra, 2002 #84}. The transformation capability is affected by how deep the knowledge processes are ingrained {Zahra, 2002 #84}. This depth of knowledge is affected by experience.
- **Advantages** represent the benefits that results from the absorption of knowledge {Zahra, 2002 #84}.

Other external factors affect ACAP:

- **Activation Triggers** are events that stimulate the process of absorbing knowledge {Zahra, 2002 #84}. Activation Triggers "triggers" ACAP.
- Comprehension and understanding is affected by group heuristics which are made of social interactions {Zahra, 2002 #84}. **Social Integration Mechanism** is that social interaction which affects the comprehension and understanding that make Assimilation.
- **Regime of Appropriablity** is the resulting difficult to imitate value from the Advantages {Zahra, 2002 #84}.

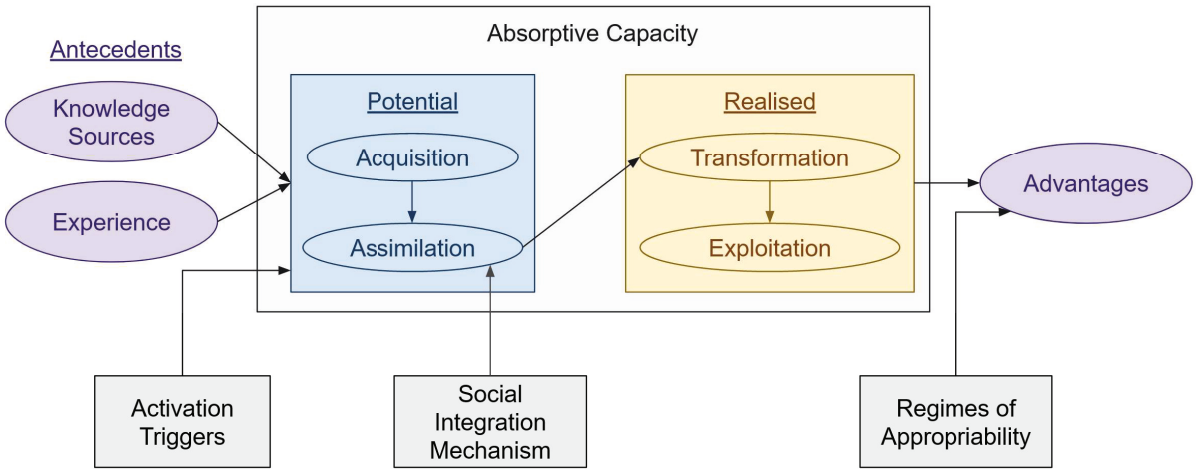

Figure 1. Zahra and Georges (2002) ACAP framework.

This framework is not hard defined, it is dynamic (Zahra & George 2002). A capability is dynamic when its resources and competencies are combined to expand its dimensions to gain an advantage (Teece, Pisano & Shuen 1997). Said resources can be developed, deployed and protected while the relevant competencies can be internal or external (Teece, Pisano & Shuen 1997). A dynamic capability is influenced by its environment (Teece, Pisano & Shuen 1997) such as organisations.

While this framework was developed for organisations, research has used it at an individual level (Lowik, Kraaijenbrink & Groen 2017). Most of the research into ACAP has been into innovation, performance and knowledge transfer from the perspective of organisations (Jansen, Van Den Bosch & Volberda 2005; Lowik, Kraaijenbrink & Groen 2017; Yao & Chang 2017). Pfeffer & Salancik (1979) say that the individual's role and organisational goals are supposedly expected to be fundamentally interdependent (Pradhan & Jena 2017). Cohen and Levinthal (1990, p.131) state that "an organization's absorptive capacity will depend on the absorptive capacities of its individual members" and that "a firm's absorptive capacity is not simply the sum of the absorptive capacities of its employees". As individuals are part of organisations (Cohen & Levinthal 1990, p.131), organisation's knowledge transfer

stems from individuals behaviour (Minbaeva, Mäkelä & Rabbiosi 2012). ACAP was initially conceptualised from individuals' learning cognitive ability (Cohen & Levinthal 1990). Individual ACAP as a barrier remains little researched (Lowik, Kraaijenbrink & Groen 2017; Minbaeva, Mäkelä & Rabbiosi 2012).

2.5 The Benefits of Technology in Learning

Technology changes almost all human work processes (Mishra & Koehler 2006). In the early 1990's, American campuses introduced assistive technologies to students with learning disabilities (Day & Edwards 1996). Such technologies would include word processors, spell checkers, outlining, speech recognition, screen readers, personal data managers, and many more (Raskind 1993). The introduction of word processors enabled iterative writing process which allowed students to write better assignments (Collins 1990). These students would still benefit from using these technologies beyond tertiary education (Raskind & Scott 1993). Today, such technologies have become accepted standards and are currently used by people with no learning disabilities.

Technology enables the transformation of content and pedagogy (Beydoun, Kultchitsky & Manasseh 2007; Koehler et al. 2014) that can enhance learning (Hamilton, Rosenberg & Akcaoglu 2016). However the integration of technology in education is not without risks. When a technology is not aligned with its learning task, it can impact a person's learning outcome and potentially further leave them behind (Lust et al. 2012). Selecting the right technology for learning will depend on the impact it will have on a person which can be different for each individual (Lust et al. 2012). Nevertheless, education is turning towards technologies to enhance learning experiences (Chan, Chow & Jia 2003). Technologies were meant to support learning (Hamilton, Rosenberg & Akcaoglu 2016). There is an interest in

understanding how technologies affects students and their abilities beyond education (Coates, James & Baldwin 2005).

2.6 Technology Readiness Index

With the rise of self-serving technologies, organisations needed a framework to better profile their customers (Parasuraman 2000). Parasuraman (2000) proposed the TRI which measures people's predisposition towards technology. TRI is not to be confused with Technology Readiness Level (TRL) which are different levels of a technology's development and handoff which was first developed by NASA (Sadin, Povinelli & Rosen 1989). As self-teaching technologies and dynamic e-learning have been advancing (Muhammad et al. 2016), the TRI is instructive. Since the original conception of the TRI, it has been streamlined into a new version which is called TRI 2.0 (Parasuraman & Colby 2015). It retains the four following core dimensions (Parasuraman & Colby 2015):

- **Optimism** is the belief that technology offers more control, flexibility and efficiency (Parasuraman 2000).
- **Innovation** is the trend where a technology is a leader or pioneer (Parasuraman 2000).
- **Insecurity** measures scepticism and distrust towards technology (Parasuraman 2000).
- **Discomfort** represents the feeling of being overwhelmed by technology and its perceived lack of control (Parasuraman 2000).

Optimism and Innovation are considered to be motivators as they motivate individuals to use technology (Parasuraman 2000). Optimism here is in the context of technology, whereas the discovery of Szulanski (1996)is that motivation was not a barrier is different then what it was in the context of knowledge. Also, Walczuch, Lemmink & Streukens (2007) later discovered that Innovation negatively impacted Perceived Usefulness. Insecurity and Discomfort are

viewed as inhibitors as they inhibit technology adoption (Parasuraman 2000). TR is individual specific unlike Technology Acceptance Model (TAM) which is system specific (Lin, Shih & Sher 2007). Research has already examined the relationship between TAM and TRI (Hallikainen & Laukkanen 2016; Walczuch, Lemmink & Streukens 2007). The TR is more detailed as it has four dimensions as opposed to TAM's two beliefs model. TR is individual specific in contrast to the system specific TAM (Lin, Shih & Sher 2007). The TR is better suited for research into individual ACAP.

2.7 Technology Readiness Persona

The TR was used as a taxonomy to segregate people into the following different personas (Colby & Parasuraman 2001, p. 59-60) (see Table 1.):

- **Explorers** are the first adopters of technologies as they have the highest amount of motivation and the least amount of fear (Colby & Parasuraman 2001, p.72-74).
- **Pioneers** generally follow explorers as they consider the practical aspects of technologies (Colby & Parasuraman 2001, p.75-77).
- **Sceptics** need to be convinced before they adopt a new technology (Colby & Parasuraman 2001, p.77-80).
- Americans also have **Paranoids** (Tsikriktsis 2004). Paranoids are greatly concerned about risk (Colby & Parasuraman 2001, p.80-83).
- Finally, **Laggards** will only adopt new technology if they are forced to do so (Colby & Parasuraman 2001, p.83-86).

Table 1. TRI Taxonomy Table

	Motivators		Inhibitors	
	Optimism	Innovation	Discomfort	Insecurity
Explorers	High	High	Low	Low
Pioneers	High	High	High	High
Sceptics	Low	Low	Low	Low
Paranoids	High	Low	High	High
Laggards	Low	Low	High	High

This table illustrates the relation between the TR dimensions and its profile (Colby & Parasuraman 2001, p.61). White and grey are respectively used to point out positives and negatives. In inhibitors, low (white) would be positive and high (grey) would be negative.

As taxonomies are a grading classification, the TR taxonomy appears similar to the adopters from the Diffusion of Innovations theory. While said theory states that innovation is diffused through communication over time within social systems (Rogers 2003, p.358-359), it is based on market data (Rogers 2003, p.280), and thus, it is more product specific (Lin, Shih & Sher 2007). Whereas the TR personas was not based on market data, it was based on profile data (Colby 2002, p.33), hence; it is more individually focused (Lin, Shih & Sher 2007). Ultimately, individuals would fall into one of these personas based on their beliefs in adopting technology (Colby 2002, p.34).

2.8 Tools for Knowledge Sources

Technologies can encourage knowledge management and its transfer (Iyengar, Sweeney & Montealegre 2015). For example, one of the methods for organisations to manage knowledge is to implement a Knowledge Management System (KMS)(Karlsen & Gottschalk 2004; Kuo & Lee 2009; Vance & Eynon 1998; Wang, Wang & Shee 2007). These can also be referred

to as ‘‘learning platforms’’, ‘‘distributed learning systems’’, ‘‘course management systems’’, ‘‘content management systems’’, ‘‘portals’’, and ‘‘instructional management systems’’ (Coates, James & Baldwin 2005). These tools or systems that are used to access knowledge sources could simply be referred to as TKS. These often attempt to capture tacit and explicit knowledge in organisations to be reused (Damodaran & Olphert 2000; Kuo & Lee 2009). They are meant to make learning more efficient by delivering content in a malleable manner (Lust et al. 2012).

2.8.1 Benefits of Tools for Knowledge Sources

While there may be nuances for each one, they can provide some of the following functions: content development and delivery (internet links, resources and developing object repositories for learning); formative and summative assessments (online questionnaires, submission, collaborative spaces and feedback); communication synchronous and asynchronous (discussion forums, e-mail, list servers, chat and instant messaging); and user and class management (enrolment and registration, timetables, management of student activities and office hours) within limitations set by the systems customisation capabilities (Coates, James & Baldwin 2005). These systems can also be integrated with other ones (Coates, James & Baldwin 2005). To reduce the workload on staff, templates are often used to standardise and guide the formalisation of knowledge (Coates, James & Baldwin 2005).

2.8.2 The Failing of Tools for Knowledge Sources

However, these systems can be ineffective at managing knowledge as they treats knowledge as if it was some sort of stock (Garavelli, Gorgoglione & Scozzi 2002; Lin & Huang 2008). Knowledge is not simply data on a repository (Cohen & Levinthal 1990; Goh 2002). While technology can easily transform data into information, it is ineffective at transforming information into knowledge (Bhatt 2001). Technology is believed to be incapable of catering

to its user as it is thought to be unable to reconfigure how it presents knowledge (Bhatt 2001). These systems must present knowledge easily and effectively for it to be easily comprehended and appropriately assimilated by its user (Kuo & Lee 2009). Assimilation relies on social interactions which can make it very slow (Bhatt 2001). The effectiveness of these systems for its users to absorb its knowledge relies on a culture that develops and shares knowledge which requires nurturing trust in technology and people (Adams & Lamont 2003; Damodaran & Olphert 2000).

2.8.3 Organisational Responsibility

Antecedents such as knowledge sources can affect absorption of knowledge differently which can lead to different performances (Jansen, Van Den Bosch & Volberda 2005). Leadership can determine the impact of TKS by promoting, reflecting and understanding its effect on learning (Coates, James & Baldwin 2005). Committing to one system can also mean exclusion from another (Coates, James & Baldwin 2005). Organisations that outsource their systems give away control and its content into the hands of other organisations whose operations may not be aligned with their own (Coates, James & Baldwin 2005). Knowledge management and its transfer requires organisations full commitment from the start in order to succeed (Garavelli, Gorgoglione & Scozzi 2002; García-Morales, Ruiz-Moreno & Llorens-Montes 2007; Goh 2002; Iyengar, Sweeney & Montealegre 2015; Karlsen & Gottschalk 2004; Kumar & Bradford 2017; Lin, Chang & Chang 2004; Minbaeva, Mäkelä & Rabbiosi 2012; Prusak 1997; Uygur 2013; Walczuch, Lemmink & Streukens 2007).

2.8.4 Conclusion

The evaluation of these systems is important as organisations invest considerable amounts (Adeyinka et al. 2010; Saarinen 1996). The effect TKS has on an individual ACAP would be of value to said evaluation.

2.9 Social Influences

Assimilation relies on comprehension and understanding which is shaped by group heuristic (Zahra & George 2002). These group heuristics are influenced by social processes. Kelman (1958) proposes the three social processes of Compliance, Identification and Internalisation that he calls SI:

- **Compliance** is described as when an individual accepts influence because he wishes to please another person or group to obtain a reward or avoid punishment while still disagreeing with said person's or group's' value (Kelman 1958). The individual will only comply with SI when he believes he is being watched by influential agents (Kelman 1958). Here, the power of the agent's SI is known as conformity (Kelman 1958).
- **Identification** often means that an individual accepts and defines himself based on the influence of another person or group (Kelman 1958). The individual adopts the role of the other where his responses are defined by identity irrespective of values (Kelman 1958). Identification tends to occur when the individual's relation to the agent will stand out (Kelman 1958). The individual will often identify with an agent they find attractive (Kelman 1958).
- **Internalisation** is when an individual accepts influence because the values that are presented match his or her own (Kelman 1958). The individual will consider the influence to shape his behaviour or actions if it is a useful solution (Kelman 1958). The individual will internally conform based on the agent's credibility (Kelman 1958). The individual will accept the influence of the agent based on its relevance to an issue irrespective of being watched or standing out (Kelman 1958).

Venkatesh et al. (2003) suggested that experienced workers and women would rely more on SI when adopting systems. It would be interesting to assess the effect SI has on individual ACAP through assimilation.

2.10 Social Networks

SN refers to using online spaces to connect, communicate, share, socialise, entertain, work and so on and so forth (Beydoun, Kultchitsky & Manasseh 2007; Gupta & Bashir 2018). SNS allows extensive access to different sources of information (Gupta & Bashir 2018). With the introduction of mobile device applications, the popularity of SN is increasing, especially with lonely or young adults (Gupta & Bashir 2018; Leung 2002; Morahan-Martin & Schumacher 2003; Pempek, Yermolayeva & Calvert 2009).

2.10.1 What is a Social Network

As a communication tool, SN are capable of combining interpersonal and mass communication together (Boyd & Ellison 2007; Gupta & Bashir 2018; Pempek, Yermolayeva & Calvert 2009). While websites are focused on interests and their communities, SN are centred around people (Boyd & Ellison 2007). They differ from each other in their user access and visibility controls (Boyd & Ellison 2007). SN provide the opportunity to connect individuals with similar interests that otherwise could not (Gupta & Bashir 2018; Haythornthwaite 2005). SN facilitate creating new and adding latent ties (Ellison, Steinfield & Lampe 2007; Gupta & Bashir 2018; Haythornthwaite 2005) which have the potential to become stronger ones (Haythornthwaite 2005). As users interact with each other, weak and latent ties can turn into strong ones (Haythornthwaite 2005). Increasing ties enhances social capabilities which benefit ACAP (Jansen, Van Den Bosch & Volberda 2005). However, most users of SN are not looking to create new connections but instead are seeking to extend their already existing SN (Boyd & Ellison 2007; Ellison, Steinfield & Lampe 2007; Gupta

&Bashir 2018; Subrahmanyam et al. 2008). SN are dependent on reciprocal trust which acts as a social glue (Kamel Boulos & Wheeler 2007).

2.10.2 Social Networks in Education

In the context of learning, SN can potentially improve student learning, foster collaboration and enhance creativity (George & Dellasega 2011) if properly integrated with education (Gupta & Bashir 2018). SN offer flexibility to contact peers and teachers outside normal hours (Gupta & Bashir 2018). As teachers interact with their students via SN, they can learn from them as well (Gupta & Bashir 2018). SN can allow for groups to act in concert without users knowing each other (Kamel Boulos & Wheeler 2007). However, SN can have multiple negative consequences such as relationship problems, reduced academic performance or decreased community engagement (Gupta & Bashir 2018; Kuss & Griffiths 2011). SN can have both a positive and negative impact on students (Gupta & Bashir 2018).

2.10.3 Conclusion

The collaborative and interactive nature of SN has tremendous learning potential (Gupta & Bashir 2018). Universities are adopting SN as they understand its power and implications in education (Gupta & Bashir 2018). Assessing the effect of SN on individual ACAP would be valuable.

2.11 Beliefs Affects Learning Behaviour

As behaviour is influenced by beliefs (Ajzen 1991) among other factors such as cognition and affection (Ajzen 2011), an individual's behaviour is affected by their beliefs onto their capability to absorb knowledge. Behaviours in relation to learning in a technological context would be described as technological learning behaviour.

2.11.1 Individual Work Performance

Koopmans et al. (2013) revised the IWP to focus on the behaviour or action under the control of an employee rather than the outcome. Environment constrained behaviours are excluded (Koopmans et al. 2013; Rotundo & Sackett 2002). This IWP generally consists of task performance, contextual and adaptive performance, and counterproductive work behaviour (Koopmans et al. 2013):

- **Tasks performance** is made of explicit behaviours including fundamental responsibilities defined in the job description (Pradhan & Jena 2017). Conway (1999) stated that the cognitive ability required for task performance was facilitated by task knowledge, task skill and task habits (Pradhan & Jena 2017). Thus the ability to do the job and experience are the primary antecedents of task performance (Pradhan & Jena 2017). Koopmans et al. (2013) indicated that work quantity and quality were not appropriate measures of task performance as they review the effectiveness of employee behaviour rather than their behaviour itself.
- **Contextual performance** is described as the organisational, social and psychological behaviours that support the work environment's technical function (Koopmans et al. 2013). This is often referred to as team spirit (Pradhan & Jena 2017). Contextual performance can manifest itself as abiding by the prescribed rules and regulations, helping others in solving difficult tasks, cooperating with others at the time of need, sharing critical resources and information for organisational development, volunteering for extra work, supporting organisational decisions for a better transformation, and upholding enthusiasm at work (Coleman & Borman 2000; Pradhan & Jena 2017).
- **Adaptive performance** refers to an individual's ability to adapt and acclimatise to change in a dynamic work environment (Koopmans et al. 2013; Pradhan & Jena

2017). Koopmans et al. (2013) stated that adaptive performance was not a separate dimension of contextual performance. While contextual performance proactive and adaptive performance is reactive, both can support organisational, social and psychological behaviours (Koopmans et al. 2013).

- **Counterproductive work behaviour** describes behaviour that can harm an organisation or its members (Rotundo & Sackett 2002) such as off-task behaviour, absenteeism, addiction, and theft (Hunt 1996; Koopmans et al. 2013; Koopmans et al. 2011). However, counterproductive work behaviour is not the opposite of contextual performance; hence, the absence of one does not indicate the other (Koopmans et al. 2013).

2.11.2 Conclusion

Koopmans et al. (2013) and Pradhan & Jena (2017) both suggest further research to improve the IWP. Even though frameworks can at times be weak, they can however still offer benefits and remain helpful (Mishra & Koehler 2006). The IWP can be used to construct generic questionnaires (Koopmans et al. 2013). Missing some items is not critical (Koopmans et al. 2013). The IWP can be adapted to assess an individual's learning behaviour.

2.12 Chapter Summary

Knowledge is difficult to define; however, it has elements of information, experience, truth and altruism. Knowledge is hard to manage because it requires relevance, timing, task fit alignment and culture. Organisations who understand how critical knowledge is for success will spend significant resources attempting to manage it. Those who don’t value knowledge are missing a valuable resource. Barriers to knowledge transfer can still exist even if organisations fully commit to it. These are causal ambiguity, an arduous relation between knowledge holder and recipient, and recipients ACAP. Horizontal structures are a solution to

causal ambiguity and arduous relations between knowledge holder and recipient as these structures allow information to flow between organisational silos. This leaves recipients ACAP which is the dynamic capability to absorb knowledge. Individual ACAP remains an under-researched barrier. Technology can enhance learning or the absorption of knowledge. Students who once struggled with learning have been able to overcome their limitations with technologies. As beliefs affect behaviours, an individual's attitude towards technology can be measured by the TRI which is aligned with individuals and not systems. The TRI persona is a useful taxonomy to categorise individuals. As knowledge source is an ACAP antecedent, TKS can lead to different ACAP performances. As comprehension is affected by social mechanisms, SI influences ACAP through Assimilation. As SN are repositories of social connections that enable social interactions, they can also have an influence on ACAP through Assimilation. As again beliefs affect behaviours, an individual's working behaviour can be assessed by the IWP. The IWP can be adapted to assess an individual's learning behaviour.

Chapter 3: Theoretical Background and Research Model

This chapter proposes the approach, different hypotheses, and which conceptual frameworks would be best to answer the research question. Here, the theoretical foundation will first explain the research problem, its purpose and significance. Then, a research model is presented. Finally, hypotheses are developed and stated.

3.1 Theoretical Foundation and Research Model

As discussed in Chapter 2, the recipient's ACAP is a barrier to knowledge transfer in organisations (Szulanski 1996). Technology can enhance learning (Hamilton, Rosenberg & Akcaoglu 2016),and beliefs affects behaviours (Ajzen 1991). Chapter 2 presents the theory from the literature review in more detail.

What is the effect of recipients' technological belief and usage on their capability to absorb knowledge towards their technological learning behaviour?

The research aim of this study is to confirm if an individual's technological belief and usage has an effect on an individual's learning capability and their technological learning behaviours. Its purpose is to provide empirical evidence of said causal-effect. This study will use the Technology Readiness Index (TRI), Tools for Knowledge Source (TKS), Social Influences (SI), Social Network (SN), Absorptive CAPacity (ACAP) and Individual Work Performance (IWP) conceptual frameworks to measure or assess said causal-effect on individuals. The TRI measures people's beliefs technology (Parasuraman 2000). It is individual focused (Lin, Shih & Sher 2007). TKS, SN and SI could also have an effect on ACAP. Recipient's ACAP has been reduced at the individual scope to better align it with the individual focused TRI. While ACAP was initially conceptualised from individuals' learning

cognitive ability (Cohen & Levinthal 1990), there has been little research into individual ACAP (Lowik, Kraaijenbrink & Groen 2017; Minbaeva, Mäkelä & Rabbiosi 2012). As beliefs affects behaviours (Ajzen 1991), and in order to test the effect of an individual's technological belief and usage on their learning capability, an individual's learning behaviour will be assessed adapting the IWP (Koopmans et al. 2013).

This study uses a quantitative approach to provide its empirical evidence. Quantitative research seeks to provide truth using objective scientific method (Bloomfield & Fisher 2019). It is suited to confirming theories (Teddlie & Tashakkori 2009, p.22). It provides methods that use statistical or numerical data to test theories (Watson 2015). It uses statistical analysis on numerical data to test hypotheses (Bloomfield & Fisher 2019). As Fowler & Lapp (2019) states: "a larger population sample reduces the chance of outliers". Furthermore, small sample sizes run the risk of not gathering enough data to support hypotheses (Fowler & Lapp 2019). Confirming a theoretical causal-effect with a large population sample would provide the findings with extrapolation that has a credible generalisation. To gather its numerical data, online questionnaires are used. Among the different statistical analysis methods, PLS-SEM is well-established and can be used to test the hypotheses. A quantitative approach is preferred to provide empirical evidence by testing hypotheses using the PLS-SEM statistical analysis with numerical data gathered with online questionnaires.

3.1.1 Research Model

As discussed earlier in Chapter 3 Section 1, this section provides the research model.

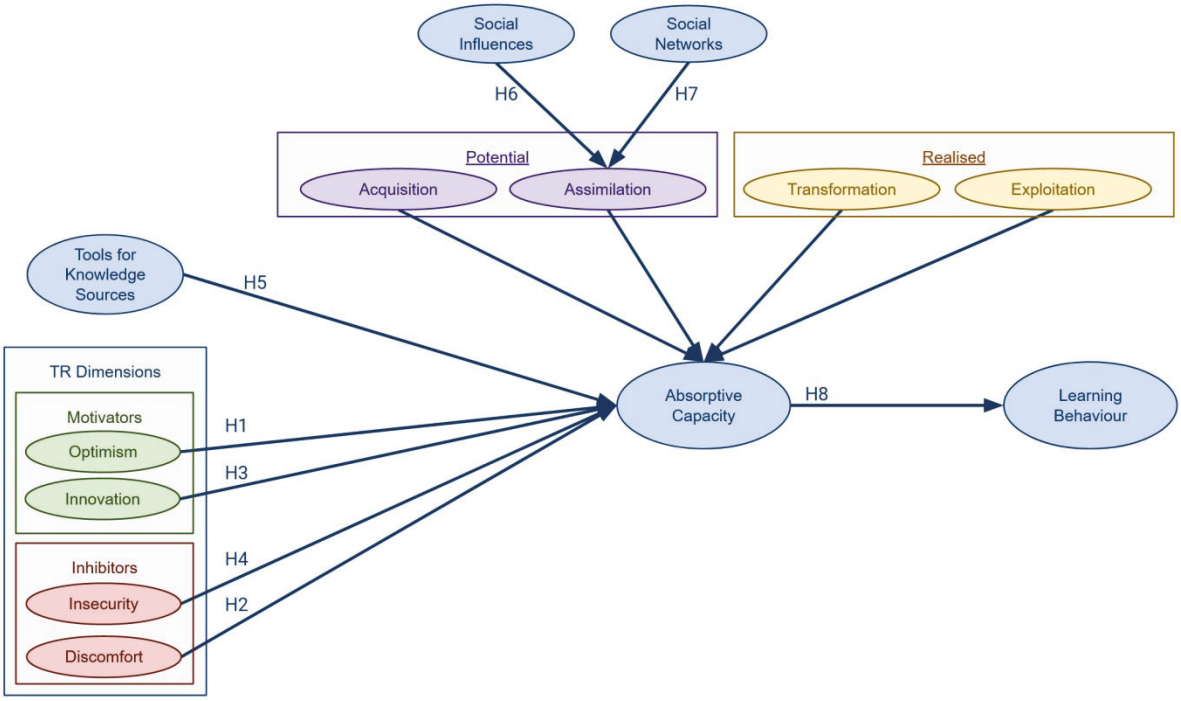

Figure 2. Research Model

3.2 Hypothesis Development

Here follows the list of this study's research hypotheses, how they relate to the different concepts and their rationale (see Figure 2.). Chapter 2 offers detailed explanation for the concepts used.

3.2.1 From TRI on ACAP

Optimism is defined as "a positive view of technology and a belief that it offers people increased control, flexibility, and efficiency in their lives" (Parasuraman 2000). The use of the word 'belief' infers that it is not real but closer to potential. Optimism is a positive view (Parasuraman 2000; Walczuch, Lemmink & Streukens 2007). It is a motivator (Parasuraman 2000). Recipient's motivation to absorb new knowledge was determined to not be a barrier to knowledge transfer (Szulanski 1996). However, said motivation was regarding knowledge

(Szulanski 1996) and did not include technologies. As Optimism is a motivator (Parasuraman 2000) and highly potential, it would be positively associated with individual ACAP.

H1: Optimism positively influences individual ACAP.

Insecurity is defined as "distrust of technology, stemming from scepticism about its ability to work properly and concerns about its potential harmful consequences" (Parasuraman 2000). The use of the word 'potential' is explicit. Insecurity has a strong connotation with negativity (Walczuch, Lemmink & Streukens 2007). It is an inhibitor (Parasuraman 2000). As Insecurity is an inhibitor (Parasuraman 2000) and also potential, it would be negatively associated with individual PACAP.

H2: Insecurity negatively influences individual ACAP.

Innovation is defined as "a tendency to be a technology pioneer and thought leader" (Parasuraman 2000). The tense of the sentence implies that Innovation is in the present state; hence, it is real. Innovation is initially considered a motivator as it enables opportunity (García-Morales, Ruiz-Moreno & Llorens-Montes 2007; Parasuraman 2000). As Innovation is a motivator (Parasuraman 2000) and real, it would be positively associated with individual RACAP.

H3a: Innovation positively influences individual ACAP.

Innovation can impact ACAP differently. Walczuch, Lemmink & Streukens (2007) discovered that it could also be perceived negatively. Innovation does not always improve performance (Vlačić et al. 2019).

H3b: Innovation negatively influences individual ACAP.

Discomfort is defined as "a perceived lack of control over technology and a feeling of being overwhelmed by it." (Parasuraman 2000). The tense is in the past which suggests that it has been realised. Discomfort is a negative experience (Walczuch, Lemmink & Streukens 2007).

Insecurity and discomfort are inhibitors (Parasuraman 2000) and would be negatively associated with individual ACAP.

H4: Discomfort negatively influences individual ACAP.

3.2.2 TKS on ACAP

Antecedents such as Knowledge Sources can affect ACAP differently which can lead to different performance (Jansen, Van Den Bosch & Volberda 2005). Technology can transform data into information (Bhatt 2001). It enables the transformation of content and pedagogy (Beydoun, Kultchitsky & Manasseh 2007; Koehler et al. 2014) which can make learning more efficient by delivering content in a malleable manner (Lust et al. 2012). TKS influences an individual's ACAP.

H5: Tools for Knowledge Source influences individual ACAP.

3.2.3 SI on ACAP

The assimilation of knowledge relies on comprehension and understanding (Zahra & George 2002). This is shaped by group heuristics and communication shape (Jacobs & Buys 2010; Zahra & George 2002). SI affects communication and heuristic (Kelman 1958). SI affects individual's ACAP through Assimilation.

H6: Social Influences affect individual ACAP through Assimilation.

3.2.4 SN on ACAP

SN are used to connect, communicate, share, socialise, entertain, work and so on and so forth (Beydoun, Kultchitsky & Manasseh 2007; Gupta & Bashir 2018). These are capable of interpersonal and mass communication (Boyd & Ellison 2007; Gupta & Bashir 2018; Pempek, Yermolayeva & Calvert 2009). They provide the opportunity to connect individuals with similar interests that otherwise could not (Gupta & Bashir 2018; Haythornthwaite 2005).

They can potentially improve learning, foster collaboration and enhance creativity (George & Dellasega 2011).

H7: Social Networks affect individual ACAP through Assimilation.

3.2.5 ACAP to Learning Behaviour

As behaviour is influenced by beliefs (Ajzen 1991), if an individual's technological belief and usage affects their ACAP, it would also influence their learning behaviour in a technological context.

H8: Individual's ACAP affects their learning behaviour.

3.3 Chapter Summary

Individual ACAP is a barrier to knowledge transfer. As beliefs influence behaviour, does an individual's technological belief influence his ACAP towards his technological learning behaviour? To answer this research question, this study will provide empirical evidence using a large population sample and the quantitative analysis method PLS-SEM. It will add to existing limited research, provide further insights and an adaptable model to help bridge knowledge and technology. The hypotheses to be tested have been enumerated.

Chapter 4: Research Methodology

This chapter explains the methodology chosen to answer the research question, its hypotheses and model from Chapter 3. It first presents the research design. Following this, the preferred population and sample for this study is argued. Instrumentation and measures present terms, definitions and items with their origins are discussed. After this, the ethics consideration proceeds to explain the process, the rationale and the outcome of the ethics application are presented. The data collection procedure then summarises the process and steps taken to collect the data, the response rate, the data filtering and cleansing process. Finally, the data analysis process defends that the PLS-SEM is suitable for this study.

4.1 Research Design

This study has been designed through the following stages (see Figure 3.). This study started with a literature review in Chapter 2 to compile knowledge to determine knowledge gaps and develop a research question. In Chapter 3, this study proposes to use a quantitative approach to provide empirical evidence of the existence of a causal-effect from TRI, TKS, SN and SI to individual ACAP to their learning behaviour (see Figure 2.). A large population sample reduces the chance that the sample is an outlier (Fowler & Lapp 2019) as the data is collected across a large number of participants rather than a small or individual one. This would provide better generalisability to confirm hypotheses concerned with common individuals.

4.1.1 Data Collection Design

Using online questionnaires, a large number of participants can be reached within a short amount of time over a great amount of distance (Wright 2017). While some individuals will complete online questionnaires, others will ignore it and this leads to a systemic bias (Wright 2017). However, there are methods that handle biases, for example, BCa bootstrapping can

address data skewness (Hair, Risher & Ringle 2019). To collect a large amount of data, an online questionnaire was distributed at the University of Technology Sydney. To ensure that the questions used in the questionnaire are credible, these have been copied or adapted from other peer reviewed research and anonymously tested. The data collected will be compiled into a data set that is then analysed with an established approach and method to confirm this study's hypotheses.

4.1.2 Data Analysis Design

The quantitative research approach is suitable for confirming theories (Teddlie & Tashakkori 2009, p.22). As this study attempts to confirm theories, a quantitative research approach is preferred. Quantitative approach also contains methods concerned with statistical or numerical analysis (Watson 2015). Statistical generalisation underpins most quantitative research as it relies on the sample used being representative (Polit & Beck 2010). With random sampling, the generalisation occurs when the population has an equal chance of being measured (Polit & Beck 2010). But this is not generalisation, it is instead "the most probable" (Polit & Beck 2010; Teddlie & Tashakkori 2009, p.22). As findings are always within a context, the extrapolation required for generalisation can never truly be justified (Polit & Beck 2010). Even with this limitation, using a large data set to confirm these research hypotheses with statistical data would allow the results enough credible generalisations at least within its context. The data set is analysed using PLS-SEM which is an established quantitative method. Finally, this study is proofread before its release to ensure that its content is understandable to an average person.

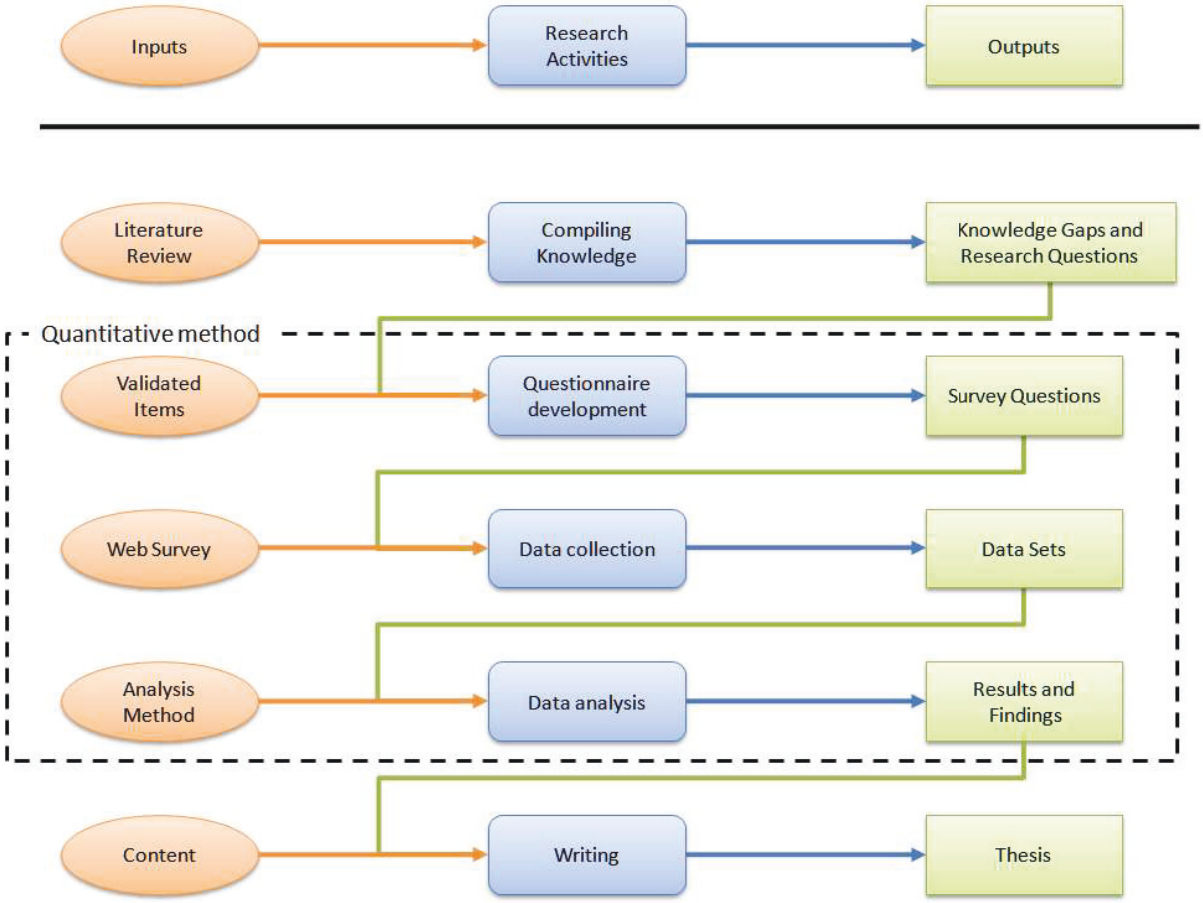

Figure 3. Research Design Flow Chart

4.2 Population and Sample

While this study investigation is around technology, it is centred on an individuals' learning capability. Improving the effectiveness of e-learning and its systems is an important issue for education and information systems (Lee & Lee 2008; Ozkan, Koseler & Baykal 2009). Assessing these systems is inevitable for educational institutions to ensure that it delivers programs that are of high quality and develop of theories (Ozkan, Koseler & Baykal 2009). As universities are educational institutions, they would be a fitting context for this study. Creating an appropriate teaching and learning environment in e-learning is facilitated by understanding users attitudes towards e-learning (Ozkan, Koseler & Baykal 2009). The primary users of a system can be used to evaluate its success (Adeyinka et al. 2010). Students

would be the ideal population sample. Research in education conducted in classroom yielded more relevant results than research conducted in laboratories because the context of experimentation was live which made implementation easier for teachers (Rosenberg & Koehler 2018). When students enter the workforce, they benefit not only from their education but from the technology they learned to use during their education (Raskind & Scott 1993). Teachers would benefit from better understanding students technology usage such as SN (Gupta & Bashir 2018). Sampling university students would add more relevance to the findings.

4.3 Instrumentation and Measurements

Table 2.Terms and Definition Table

Terms	Definitions	References
Technology Readiness Index (TRI)	"The technology-readiness construct refers to people's propensity to embrace and use new technologies for accomplishing goals in home life and at work"	(Parasuraman 2000)
Optimism	"A positive view of technology and a belief that it offers people increased control, flexibility, and efficiency in their lives"	(Parasuraman 2000)
Innovation	"A tendency to be a technology pioneer and thought leader."	(Parasuraman 2000)
Insecurity	"Distrust of technology and skepticism about its ability to work properly."	(Parasuraman 2000)
Discomfort	"A perceived lack of control over technology and a feeling of being overwhelmed by it."	(Parasuraman 2000)

Absorptive CAPacity (ACAP)	"We define ACAP as a set of organisational routines and processes by which firms acquire, assimilate, transform, and exploit knowledge to produce a dynamic organisational capability"	(Zahra & George 2002)
Absorptive CAPacity (ACAP)	“Thus, prior related knowledge confers an ability to recognize the value of new information, assimilate it, and apply it to commercial ends. These abilities collectively constitute what we call a firm's ‘absorptive capacity.’”	(Cohen & Levinthal 1990)
Potential ACAP	"Potential ACAP (PACAP) makes the firm receptive to acquiring and assimilating external knowledge (Lane & Lubatkin, 1998)"	(Zahra & George 2002)
Acquisition	"Acquisition refers to a firm's capability to identify and acquire externally generated knowledge that is critical to its operation."	(Zahra & George 2002)
Assimilation	"Assimilation refers to the firm's routines and processes that allow it to analyze , process, interpret, and understand the information obtained from external sources (Kim, 1997a,b; Szulanski, 1996)"	(Zahra & George 2002)
Realised ACAP	"Realized ACAP (RACAP) is a function of the transformation and exploitation capabilities discussed earlier."	(Zahra & George 2002)
Transformation	"Transformation denotes a firm's capability to develop and refine the routines that facilitate combining existing knowledge and the newly acquired and assimilated knowledge."	(Zahra & George 2002)
Exploitation	“Exploitation as an organisational capability is based on the routines that allow firms to refine, extend, and leverage existing competencies or to create new ones by incorporating acquired and transformed knowledge into its operations.”	(Zahra & George 2002)

e-Learning	"Electronic learning (e-learning), referring to learning via the Internet, has become a major phenomenon in recent years."	(Wang, Wang & Shee 2007)
Knowledge Management Systems	"KMS is an IT-based system developed to support and to enhance knowledge management (KM)."	(Kuo & Lee 2009)
Content Management System	"CMSs are defined as systems that combine a range of subject management and pedagogical tools to provide a means of designing, building and delivering online or virtual learning environments (Coates, James, & Baldwin, 2005)."	(Lust et al. 2012)
Learning Management System	"LMS are enterprise-wide and internet-based systems, such as WebCT and Blackboard, that integrate a wide range of pedagogical and course administration tools."	(Coates, James & Baldwin 2005)
Group Support System	"GSS literature has frequently used the term ''group memory'' for this shared repository and its tools."	(Haseman, Nazareth & Paul 2005)
Social Influences	"Social influence is defined as the degree to which an Individual perceives that important others believe he or she should use the new system."	(Venkatesh et al. 2003)
Social Influences	"The experiment reported here grows out of a broader theoretical framework concerned with the analysis of different processes of attitude change resulting from social influence." "The three processes represent three qualitatively different ways of accepting influence."	(Kelman 1958)
Subjective Norms	"The second predictor is a social factor termed subjective norm; it refers to the perceived social pressure to perform or not to perform the behavior."	(Ajzen 1991)

Normative Beliefs	"Three kinds of salient beliefs are distinguished: behavioral beliefs which are assumed to influence attitudes toward the behavior, normative beliefs which constitute the underlying determinants of subjective norms, and control beliefs which provide the basis for perceptions of behavioral control."	(Ajzen 1991)
Compliance	"Compliance can be said to occur when an individual accepts influence because he hopes to achieve a another person or favorable reaction from group."	(Kelman 1958)
Identification	"Identification can be said to occur when an individual accepts influence because he wants to establish or maintain a Satisfying self-defining relationship to another person or a group."	(Kelman 1958)
Internalisation	"Internalization can be said to occur when an individual accepts influence because the content of the induced behavior-the ideas and actions of which it is composed-is intrinsically rewarding."	(Kelman 1958)
Social Networks	"Social networking usage refers to online space that is used by students to connect, share, communicate, establish or maintain connection with others for academic, entertainment, socialization etc."	(Gupta & Bashir 2018)
Social Networking Sites	"Social networking sites like Twitter, LinkedIn, and Facebook support online groups that allow users to broadcast and construct their profile information, and interact with others by sending personal and public messages, playing games, and sharing photos (Pempek, Yermolayeva, & Calvert, 2009; Boyd & Ellison, 2007)."	(Gupta & Bashir 2018)
Social Networking Sites	"We define social network sites as web-based services that allow individuals to (1) construct a public or semi-public profile within a bounded system, (2) articulate a list of other users with whom they share a connection, and (3) view and traverse their list of connections and those made by others within the system."	(Boyd & Ellison 2007).

Individual Work Performance	"IWP was defined by Campbell (1990, p. 704) as 'behaviors or actions that are relevant to the goals of the organization.'"	(Koopmans et al. 2013)
Task Performance	"Performance in the form of task performance comprises of job explicit behaviors which includes fundamental job responsibilities assigned as a part of job description."	(Pradhan & Jena 2017)
Contextual Performance	"Contextual performance can be defined as behaviors that support the organisational, social, and psychological environment in which the technical core must function (Borman and Motowidlo, 1993, p. 73)."	(Koopmans et al. 2013)
Adaptive Performance	"Adaptive performance can be defined as the extent to which an individual adapts to changes in the work role or environment (Griffin et al., 2007, p. 331)."	(Koopmans et al. 2013)
Adaptive Performance	"An individual's ability to acclimatize and provide necessary support to the job profile in a dynamic work situation is referred to as adaptive performance (Hesketh, & Neal, 1999)."	(Pradhan & Jena 2017)
Counterproductive Work Behaviour	"CWB can be defined as behavior that harms the well-being of the organization (Rotundo and Sackett, 2002, p. 69). It includes behaviors such as absenteeism, off-task behavior, theft, and substance abuse (Koopmans et al., 2011)."	(Koopmans et al. 2013)

4.4 Items Table

To design the online questionnaire, items from other concepts were either taken or adapted (see Table 4.). The items used for the TR dimensions were directly taken from Parasuraman & Colby (2015). TKS was adapted from a variety of sources(Adeyinka et al. 2010), (Kuo & Lee 2009), (Ozkan, Koseler & Baykal 2009). While SI was adapted from Venkatesh et al. (2003), SN was adapted from Gupta & Bashir (2018). ACAP was also adapted from a variety of sources(Lowik, Kraaijenbrink & Groen 2017), (Jansen, Van Den Bosch & Volberda 2005) and (Vlačić et al. 2019). Learning Behaviour was adapted from Koopmans et al. (2013) and

Pradhan & Jena (2017). Adapted items were rephrased to make it easier for participants to understand what was asked. While all items use a Likert type scale, they were reduced to a five point scale from "Strongly agree" being one to "Strongly disagree" being five to keep items consistent with one another. This was to minimise mistakes from the participants.

4.4.1 Demographic Questions

Pradhan & Jena (2017) discovered that an employee's performance was positively associated by his demography (age, gender, years of experience in the present organisation, managerial levels). SI was more important for experienced workers in particular women when adopting systems (Venkatesh et al. 2003). As gender, age and other demographics could potentially influence the findings; demographic items were added at the start of the online questionnaire (see Table 3.). This also allowed the filtering out of participants who did not fit the research context. These questions could be skipped and were all voluntary. The question, "What are you currently studying?" allowed the filtering out of participants who were not students. This kept the sample population closer to the research context.

Table 3. Demographic Items

Demography				
ID	Questions	Answers	Reason	Type
DEMG1	What gender do you identify as ?	Male; Female; Other (textfield); Prefer not to say; I do not know	Identity,	Radiobutton

DEMG2	What is your age ?	18-25; 26-35; 36-45; Above 45; Prefer not to say; I do not know	Experience, Social influences were more important for older workers (Venkatesh et al. 2003)	Radiobutton
DEMG3	How many years have you been using technology ?	1-3 years; 4-6 years; More than 7 years; Prefer not to say; I do not know	Experience with technology	Radiobutton
DEMG5	Are you an international or local student ?	International; Local; Other (textfield); Prefer not to say; I do not know		
DEMG6	What are you currently studying ?	Bachelor's degree; Master's degree; PHD; Prefer not to say; I do not know	Education, Filtering out non students	

Table 4. Online Questionnaire Items

TRI 2.0					
ID	New ID	Questions	Reference	Type of Data	Scale Type
OPTI1	TRI01	New technologies contribute to a better quality of life	(Parasuraman & Colby 2015)	Ordinal categorical data	Likert
OPTI2	TRI02	Technology gives me more freedom of mobility	(Parasuraman & Colby 2015)	Ordinal categorical data	Likert
OPTI3	TRI03	Technology gives people more control over their daily lives	(Parasuraman & Colby 2015)	Ordinal categorical data	Likert

OPTI4	TRI04	Technology makes me more productive in my personal life	(Parasuraman & Colby 2015)	Ordinal categorical data	Likert
INNO1	TRI05	Other people come to me for advice on new technologies	(Parasuraman & Colby 2015)	Ordinal categorical data	Likert
INNO2	TRI06	In general, I am among the first in my circle of friends to acquire new technology when it appears	(Parasuraman & Colby 2015)	Ordinal categorical data	Likert
INNO3	TRI07	I can usually figure out new high-tech products and services without help from others	(Parasuraman & Colby 2015)	Ordinal categorical data	Likert
INNO4	TRI08	I keep up with the latest technological developments in my areas of interest	(Parasuraman & Colby 2015)	Ordinal categorical data	Likert
DISC1	TRI09	When I get technical support from a provider of a high-tech product or service, I sometimes feel as if I am being taken advantage of by someone who knows more than I do	(Parasuraman & Colby 2015)	Ordinal categorical data	Likert
DISC2	TRI10	Technical support lines are not helpful because they don't explain things in terms I understand	(Parasuraman & Colby 2015)	Ordinal categorical data	Likert
DISC3	TRI11	Sometimes, I think that technology systems are not designed for use by ordinary people	(Parasuraman & Colby 2015)	Ordinal categorical data	Likert
DISC4	TRI12	There is no such thing as a manual for a high-tech product or service that's written in plain language	(Parasuraman & Colby 2015)	Ordinal categorical data	Likert
INSE1	TRI13	People are too dependent on technology to do things for them	(Parasuraman & Colby 2015)	Ordinal categorical data	Likert

INSE2	TRI14	Too much technology distracts people to a point that is harmful	(Parasuraman & Colby 2015)	Ordinal categorical data	Likert
INSE3	TRI15	Technology lowers the quality of relationships by reducing personal interaction	(Parasuraman & Colby 2015)	Ordinal categorical data	Likert
INSE4	TRI16	I do not feel confident doing business with a place that can only be reached online	(Parasuraman & Colby 2015)	Ordinal categorical data	Likert

Tools					
ID	Questions	Reference	Reason	Type of Data	Scale Type
TOOLS1	The systems that the university uses to provide course content (for example, Blackboard) seems to be exactly what I need.	(Adeyinka et al. 2010)	Content, Task Fit (Relevance), (Perceived) Usefulness	Ordinal categorical data	Likert
TOOLS2	I find that the university's systems are easy to use.	(Kuo & Lee 2009)	(Perceived) Ease of use	Ordinal categorical data	Likert
TOOLS3	I can effectively and easily manage my time using the university's systems.	(Ozkan, Koseler & Baykal 2009)	Time management, (Perceived) Usefulness, (Perceived) Ease of use	Ordinal categorical data	Likert
TOOLS4	I am informed by announcements through the university's systems.	(Ozkan, Koseler & Baykal 2009)	Communication, (Perceived) Usefulness	Ordinal categorical data	Likert

SN					
ID	Questions	Reference	Reason	Type of Data	Scale Type

SN01	I use social networks to solve my academic problems.	(Gupta & Bashir 2018)	(Perceived) Usefulness	Ordinal categorical data	Likert
SN02	I use social networks to do research.	(Gupta & Bashir 2018)	Acquisition	Ordinal categorical data	Likert
SN03	I use social networks to communicate with my friends to prepare for exams.	(Gupta & Bashir 2018)	Preparation, (Perceived) Usefulness, Communicate	Ordinal categorical data	Likert
SN04	I use social networks to seek help from my teachers.	(Gupta & Bashir 2018)	Knowledge Holder, Communication, (Perceived) Usefulness	Ordinal categorical data	Likert
SN05	I use social networks to share new ideas.	(Gupta & Bashir 2018)	Innovation, Communication	Ordinal categorical data	Likert
SN06	I find it difficult to find accurate information about academia on social networks.	(Gupta & Bashir 2018)	(Perceived) Ease of use, Accuracy	Ordinal categorical data	Likert
SN07	I usually postpone my academic task to spend more time on social networks.	(Gupta & Bashir 2018)	Off Task Behaviour, Time usage	Ordinal categorical data	Likert

Social Influences					
ID	Questions	Reference	Reason	Type of Data	Scale type

SI1	People who are important to me think I should use the university's systems.	(Venkatesh et al. 2003)	Subjective Norms, Compliance	Ordinal categorical data	Likert
SI2	I use the university's systems because of the proportion of students who use them.	(Venkatesh et al. 2003)	Social Factor, Internalisation	Ordinal categorical data	Likert
SI3	The teachers help me use the university's systems.	(Venkatesh et al. 2003)	Social Factor, Internalisation	Ordinal categorical data	Likert
SI4	People who use the university's systems have more prestige than those who do not.	(Venkatesh et al. 2003)	Image, Identification	Ordinal categorical data	Likert
ACAP					
ID	Questions	Reference	Reason	Type of Data	Scale type
	Acquisition				
ACQU01	I am always actively looking for new knowledge.	(Lowik, Kraaijenbrink & Groen 2017)	Motivation, Innovation	Ordinal categorical data	Likert
ACQU02	I can easily identify what new knowledge is most valuable.	(Lowik, Kraaijenbrink & Groen 2017)	Value recognition	Ordinal categorical data	Likert
ACQU03	I collect information	(Jansen, Van Den Bosch & Volberda	Diversity, Research,	Ordinal categorical	Likert

	through informal means such as talking with students, industry professionals or mentors.	2005)	Communication	data	
ACQU04	I regularly approach teachers, tutors or other staff.	(Jansen, Van Den Bosch & Volberda 2005)	Support, Engagement, Communication, Motivation	Ordinal categorical data	Likert
	Assimilation				
ASSM01	I frequently share my new knowledge with other students.	(Lowik, Kraaijenbrink & Groen 2017)	Knowledge Sharing	Ordinal categorical data	Likert
ASSM02	I translate new knowledge in such a way that students understand what I mean.	(Lowik, Kraaijenbrink & Groen 2017)	Language, Transformation	Ordinal categorical data	Likert
ASSM03	I maintain relevant knowledge over time.	(Vlačić et al. 2019)	Maintenance, Duration	Ordinal categorical data	Likert
	Transformation				
TRNS01	I can turn existing knowledge into new ideas.	(Lowik, Kraaijenbrink & Groen 2017)	Innovation	Ordinal categorical data	Likert
TRNS02	I record and store new knowledge for future reference.	(Jansen, Van Den Bosch & Volberda 2005)	Knowledge absorbing	Ordinal categorical data	Likert
TRNS03	I am proficient in repurposing existing knowledge for new uses.	(Vlačić et al. 2019)	Incremental Innovation	Ordinal categorical data	Likert

	Exploitation				
EXPL01	I constantly consider how I can apply new knowledge to improve my work.	(Lowik, Kraaijenbrink & Groen 2017)	Incremental Innovation		
EXPL02	I clearly know how activities within their course should be performed.	(Jansen, Van Den Bosch & Volberda 2005)	Context, process	Ordinal categorical data	Likert
EXPL03	I have difficulty implementing new knowledge.	(Jansen, Van Den Bosch & Volberda 2005)	Application	Ordinal categorical data	Likert
Performance					
ID	Questions	Reference	Reason	Type of Data	Scale type
IWP1	I take into account my teacher's wishes in my work.	(Koopmans et al. 2013)	Expectation, Context	Ordinal categorical data	Likert
IWP2	I am able to cope well with difficult situations and setbacks.	(Koopmans et al. 2013)	Stress, Adaptive	Ordinal categorical data	Likert
IWP3	I handle assignments without much supervision.	(Pradhan & Jena 2017)	Independence, Task	Ordinal categorical data	Likert
IWP4	I complete my assignments on time.	(Pradhan & Jena 2017)	Time management, Task	Ordinal categorical data	Likert

All survey items can be found in Appendix A.

4.5 Ethics Consideration

A consent form was placed at the beginning of the online questionnaire before the demographic items. It explained to the participant who was responsible, what the research was for, and how the data they supplied was going to be used. The consent form also explained that the questionnaire was voluntary and that the participants could withdraw anytime before completion without any consequences.

All demographic items could be skipped and the words “Prefer not to say” and “I do not know” were included to provide further options to not answer. “Prefer not to say” allowed participants who do not consent to not provide information. “I do not know” measured ambiguity for items when participants may not have been able to provide accurate answers.

The consent form also informed participants that the questionnaire was anonymous. To not record participants' date of birth, the online questionnaire instead asked participants to select their age range. Name, date of birth or any questions that would directly identify a participant were not asked to protect their identity and safeguard their anonymity. This was to gain their trust to further increase the chance that they would answer honestly. This also would protect the identity of participants in the event of a data breach.

The questionnaire was submitted to the UTS Human Research Ethics Committee. A data management plan was also supplied to ensure that the data would be properly handled. The risk was determined to be negligible. The online questionnaire was approved to be released to the public by the UTS Human Research Ethics Committee.

4.6 Data Collection Procedure

The questionnaire was hosted on Qualtrics which is an online web survey platform. It contained 62 items including the consent form. Qualtrics estimated that it takes less than 15

min to complete it. Prior to its release, it had been tested by two participants who wished to remain anonymous. All answers were deleted before the questionnaire was released to the public. The data collected was downloaded as an excel file. A total of 252 rows existed in the excel file, three of which were headers, leaving a total of 249 records. Records whose progress were not '100' were filtered out, leaving 204 completed records. As the context of this research is universities, participants who had answered they were not studying a Bachelor's or Master's degree, or Ph.D. were also omitted, leaving 199 completed records. This study deemed that ensuring the research context outweighed the omission of five records. Said filtered data was copied and pasted into a CSV spreadsheet that was then imported into SmartPLS3. The record on line 137 column 'DEMG1_4_TEXT' had the value "Female sex, no gender". SmartPLS3 interpreted the comma as a column separator. To resolve this issue, the record was updated to "Female sex no gender" as it was thought it would not affect the value of the statement. The CSV spreadsheet was then imported into SmartPLS3 without any issues.

4.7 Data Analysis Process

Among the different quantitative methods, the preferred method for this study which is PLS-SEM is argued in the following section.

4.7.1 Structural Equation Modelling (SEM)

While Wright (1921) first developed path analysis in the early 1920's (Hair, Ringle & Sarstedt 2011), Structural models only started to be applied in the social sciences in the 1970's (Bollen 1989; Hair, Ringle & Sarstedt 2011). Structural Equation Modelling (SEM) began to appear in the early 1980's (e.g. (Bagozzi & Yi 1988; Fornell & Larcker 1981a, 1981b)) (Hair, Ringle & Sarstedt 2011). SEM has gained popularity as concepts and complete theories required testing (Hair Jr., Sarstedt, et al. 2014). SEM's method is able to

assess the measurement of and test the relationships between latent variables (Babin, Hair & Boles 2008; Hair Jr., Sarstedt, et al. 2014). Bollen & Long (1993) is ‘‘a synthesis of procedures developed in econometrics, and psychometrics’’ (Henseler et al. 2014, p.1). Byrne (1998) states that there are two important features that define the term SEM (Henseler et al. 2014, p.3):

A. “the causal processes under study are represented by a series of structural (i.e., regression) equations”,
B. “that these structural relations can be modelled pictorially to enable a clearer conceptualization of the theory under study”.

4.7.2 Partial Least Square-Structural Equation Modelling

Wold (1974), 1980) originally developed the Partial Least Square SEM (PLS-SEM) technique which through iteration maximizes the explained variance of endogenous constructs (Fornell & Bookstein 1982; Hair Jr., Sarstedt, et al. 2014). As a causal modelling approach, PLS-SEM maximizes the dependent latent constructs’ explained variance (Hair, Ringle & Sarstedt 2011). Henseler et al. (2014) articulated that PLS could be used to estimate composite factor models and provided benefits in exploratory research. PLS-SEM estimation of structural models is more robust (Hair, Ringle & Sarstedt 2011; Reinartz, Haenlein & Henseler 2009). PLS-SEM has been used in:

- marketing and business (Fornell & Bookstein 1982; Hair, Ringle & Sarstedt 2011; Hair, Sarstedt, Ringle, et al. 2012; Hair Jr., Sarstedt, et al. 2014; Ringle, Sarstedt & Straub 2012),
- management (Hair, Sarstedt, Pieper, et al. 2012; Hair Jr., Sarstedt, et al. 2014; Ringle, Sarstedt & Straub 2012),

- management information systems (Hair Jr., Sarstedt, et al. 2014; Ringle, Sarstedt & Straub 2012),
- operations management (Hair Jr., Sarstedt, et al. 2014; Peng & Lai 2012),
- accounting (Hair Jr., Sarstedt, et al. 2014; Lee et al. 2011; Ringle, Sarstedt & Straub 2012),
- and social sciences (Hair, Risher & Ringle 2019; Hair Jr., Sarstedt, et al. 2014; Henseler et al. 2014; Lee et al. 2011; Peng & Lai 2012; Sosik, Kahai & Piovoso 2009).

Many software systems are available for PLS such as PLS-Graph, SmartPLS and even R (e.g. semPLS) (Hair, Risher & Ringle 2019; Monecke & Leisch 2012).

Assumptions

Regarding assumptions, PLS-SEM has fewer restrictions; therefore, if the assumptions in CB-SEM cannot be met, PLS-SEM is preferred (Hair, Ringle & Sarstedt 2011; Hair, Risher & Ringle 2019). However, CB-SEM remains robust when breaking assumptions (Reinartz, Haenlein & Henseler 2009) and the absence of distributional assumption is not sufficient reason for selecting PLS-SEM (Hair, Risher & Ringle 2019).

Sample Size

PLS-SEM can work efficiently with a wider sample size range and thus models are increased in complexity (Hair, Ringle & Sarstedt 2011; Hair, Risher & Ringle 2019). Although PLS-SEM can still be used for a small sample size (Hair, Risher & Ringle 2019), the model's complexity and data characteristic still depend on the sample size (Henseler et al. 2014). The required sample size should be determined by power analyses based on anticipated significance level, model structure and the expected effect sizes (Hair, Risher & Ringle 2019; Marcoulides & Chin 2013). The inverse square root and gamma exponential methods can

also be used to calculate the minimum sample size (Hair, Risher & Ringle 2019; Kock & Hadaya 2018).

Non-Normal Data

Non-normal data can make CB-SEM deliver abnormal results (Hair, Risher & Ringle 2019; Reinartz, Haenlein & Henseler 2009). PLS-SEM transforms non-normal data in accordance with the central limit theorem and hence non-normal data is less stringent to work with (Cassel, Hackl & Westlund 1999; Hair Jr., Sarstedt, et al. 2014). PLS-SEM appears to be more robust with non-normal data in comparison to its CB-SEM counterpart (Hair, Risher & Ringle 2019; Sarstedt et al. 2016). Using BCa bootstrapping can adjust skewness of confidence intervals (Hair, Risher & Ringle 2019).

Statistical Power

PLS-SEM's focus on maximizing partial structures is one of its disadvantages (Hair, Ringle & Sarstedt 2011). The statistical analysis' power can be reduced with highly skewed data (Hair Jr., Sarstedt, et al. 2014). Skewness can be reduced with Bias-Corrected and accelerated (BCa) bootstrapping (Hair, Risher & Ringle 2019). The higher statistical power of SEM-PLS is useful for theories under development in exploratory research (Hair, Risher & Ringle 2019).

Goodness of Fit

As PLS-SEM does not rely on the model fit concept (Hair Joseph, Sarstedt & Ringle 2019), it is sometimes wrongly thought of as not useful for theory testing and confirmation (Hair, Risher & Ringle 2019; Westland 2015). Model's goodness of fit has no adequate global measurements which restrict PLS-SEM from being used to test and confirm theories (Hair, Ringle & Sarstedt 2011). PLS-SEM is also appropriate for theory confirmation (Hair, Risher & Ringle 2019).

Measures: Formative vs. Reflective

When the structural model has formative constructs then the preferred approach is PLS-SEM (Hair, Risher & Ringle 2019). This research's model is made of formative and reflective constructs.

Reflective measures are when indicators are caused by the construct (arrows pointing from the construct to the indicator) (Hair Jr., Sarstedt, et al. 2014). The effect of a construct on a reflective indicator is referred to as a loading. As for the remaining constructs, the TRI measures beliefs (Parasuraman 2000). The indicators for the TR dimension were directly taken from Parasuraman & Colby (2015). The IWP measures behaviours (Koopmans et al. 2013). The indicators used for Learning Behaviour were derived from Koopmans et al. (2013) and Pradhan & Jena (2017). As "personality" and "attitudes" causes something that is observable, these indicators are realised therefore reflective (Diamantopoulos & Winklhofer 2001; Fornell & Bookstein 1982). To avoid measuring the same behaviour twice, the antithetical counterproductive work behaviour was not added to the online questionnaire.

Formative measures are when indicators cause the construct (arrows pointing from the indicator to the construct) (Hair Jr., Sarstedt, et al. 2014). The effect of a formative indicator on a construct is referred to as a weight. When a combination of indicators make a construct then they should be formative (Fornell & Bookstein 1982). TKS refer to systems such as KMS, Learning Management System (LMS) and Content Management System (CMS) that deliver knowledge. Indicators for this construct were derived from three sources (Adeyinka et al. 2010; Kuo & Lee 2009; Ozkan, Koseler & Baykal 2009). SN refers to online sites and services that allow individuals to connect and interact with one another (Gupta & Bashir 2018). Indicators for SN were adapted from Gupta & Bashir (2018). The combination of the indicators forms the TKS and SN in the model. The different set of indicators that make SI in the model were derived from Venkatesh et al. (2003). Acquisition, Assimilation,

Transformation and Exploitation are interdependent (Zahra & George 2002). The indicators used for these four capabilities make the PACAP, RACAP and ACAP construct. When the indicators make the construct, as such, these have been set to the formative. PLS-SEM allows the usage of formative indicators (Hair Jr., Sarstedt, et al. 2014).

Hair Jr., Sarstedt, et al. (2014) recommends applying the most recent evaluation of criteria to ensure validity for said indicators.

Using Higher-Order Construct

Higher-order Constructs (HC) allows for abstract constructs modelling (referred to as Higher-Order Component (HOC)) along with its sub constructs (Becker et al. 2019). This extends the abstraction from single layer to multiple layers (Becker et al. 2019). It also achieves model parsimony by reducing the number of path models relationships (Becker et al. 2019; Johnson, Rosen & Chang 2011). This can also help HC with the bandwidth-fidelity dilemma (Cronbach & Gleser 1965, p.100). In addition, they can reduce formative indicator collinearity (Becker et al. 2019). There are three concerns regarding HC (Becker et al. 2019). First, the measurement theory must be well developed for the conceptualisation and specification of HC (Becker et al. 2019). Researchers must decide on the Lower-Order Components (LOC) measurement model specification and the HOC and its LOC relationship (Becker et al. 2019). The four types of HC are reflective-reflective, reflective-formative, formative-reflective, and formative-formative (Becker et al. 2019; Becker, Klein & Wetzels 2012; Cheah et al. 2019). The second concern is the choice of approach for identifying HC (Becker et al. 2019). The repeated indicators approach or the two-stage approach are among the more prominent (Becker et al. 2019). Finally, the measurement quality of HC is challenging to evaluate (Becker et al. 2019). The LOC and HOC reliability and validity are sometimes not assessed, and other times the relationship between them is interpreted as a structural model (Becker et al. 2019). The LOC should be assessed as elements of the HC

measurement model (Becker et al. 2019). The discriminant validity should be assessed on both LOC and HC (Becker et al. 2019). Acquisition, Assimilation, Transformation and Exploitation are all dynamic capabilities of ACAP that are interdependent (Zahra & George 2002). ACAP is the HOC of said LOC capabilities of Acquisition, Assimilation, Transformation and Exploitation. As all components are formative, the preferred HC is formative-formative.

Theory Testing and Confirmation

PLS-SEM is suited for prediction and developing theories (Hair, Ringle & Sarstedt 2011; Hair, Risher & Ringle 2019; Reinartz, Haenlein & Henseler 2009). From a statistical point of view, CB-SEM and PLS-SEM differ methodologically, however, estimations from PLS-SEM can be a good substitute for CB-SEM results (Hair, Ringle & Sarstedt 2011). For theory testing, PLS-SEM is a good alternative (Hair, Ringle & Sarstedt 2011; Hair, Risher & Ringle 2019).

Conclusion

The objective of the analysis must be understood before selecting an appropriate method for SEM (Hair, Ringle & Sarstedt 2011). Despite the increased usage of PLS-SEM, it is still perceived as less rigorous and thus less suitable for examining latent variable relationships (Hair, Ringle & Sarstedt 2011). However, PLS-SEM offers many benefits that CB-SEM does not have when properly applied (Hair, Ringle & Sarstedt 2011). In contrast to CB-SEM, PLS-SEM can deal with more problems (Hair, Ringle & Sarstedt 2011). For every model, every distribution, every set of parameter values, and every sample size, there is no such thing as the perfect estimation method (Henseler et al. 2014). An objective mind should highlight the advantages and limitations of any method (Henseler et al. 2014). When the objective is to test cause-effect-relationships models with latent variables, SEM is the technique of choice (Hair Jr., Sarstedt, et al. 2014). Even though PLS-SEM is a preferred method for predictions (Hair,

Ringle & Sarstedt 2011; Reinartz, Haenlein & Henseler 2009), it is also appropriate for theory confirmation (Hair, Risher & Ringle 2019). As the purpose of this study is to provide evidence of a causal-effect between conceptual frameworks, PLS-SEM remains an appropriate method to predict and confirm said causal-effect.

4.7.3 The PLS-SEM Algorithm

Hair, Ringle & Sarstedt (2011) details the following algorithms for PLS-SEM which is featured in the table below.

Stages and steps in calculating the basic PLS-SEM algorithm (Hair, Ringle & Sarstedt 2011) are as follows:

1) Stage One: Iterative estimation of latent construct scores
    1) Step 1: Outer approximation of latent construct scores (the scores of Y1, Y2, and Y3 are computed based on the manifest variables' scores and the outer coefficients from step 4)
    2) Step 2: Estimation of proxies for structural model relationships between latent constructs (P1 and P2)
    3) Step 3: Inner approximation of latent construct scores (based on scores for Y1, Y2, and Y3 from step 1 and proxies for structural model relationships, P1 and P2, from step 2)
    4) Step 4: Estimation of proxies for coefficients in the measurement models (the relationships between indicator variables and latent constructs with scores from step 3; W1 to W7)
2) Stage Two: Final estimates of coefficients (outer weights and loadings, structural model relationships) are determined using the ordinary least squares method for each partial regression in the PLS-SEM model.

4.7.4 Evaluation of PLS-SEM Results

The evaluation of PLS-SEM results requires first the assessment of the measurement and then the structural model (Hair, Risher & Ringle 2019).

Assessing Measurement Model

Formative and reflective indicators rely on a different criteria for their evaluations (Hair, Risher & Ringle 2019; Hair Jr., Sarstedt, et al. 2014).

Reflective Indicators and Constructs

To assess reflective measurements model, the steps (see Figure 4.) are as follows:

1. Examine reflective indicator loading (Hair, Risher & Ringle 2019). To provide acceptable indicator reliability, recommended loadings should be above 0.708. This means that the indicator's variance of the construct is above 50 per cent. Indicators with outer loadings beneath 0.40 should always be removed (Hair Jr., Hult, et al. 2014, p. 103). Indicators with outer loadings between 0.40 and 0.70 should be removed if it increases the Composite Reliability (CR) or Average Variance Extracted (AVE).

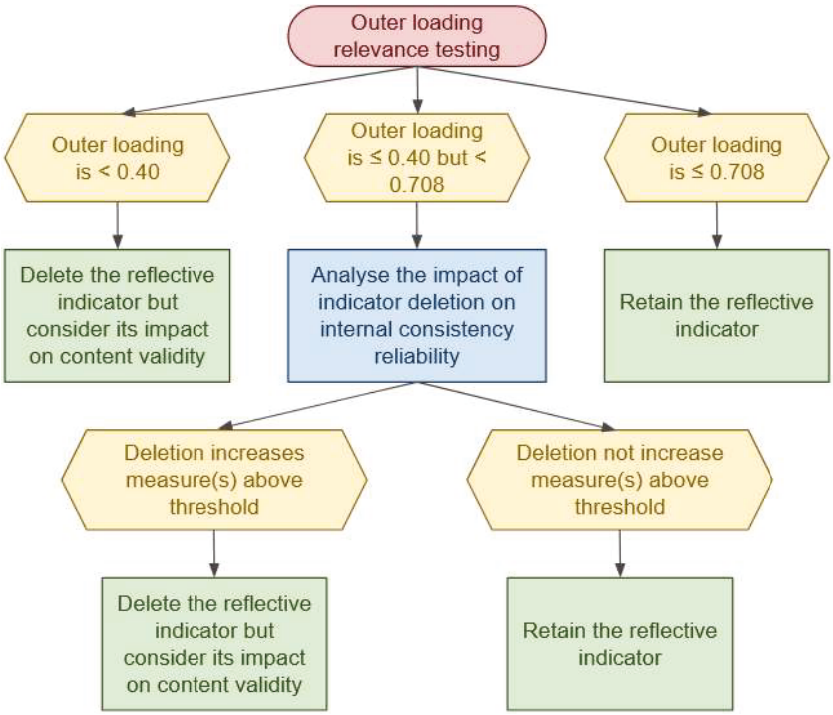

Figure 4. Reflective Indicator and Construct Assessment, Outer Loading Relevance Testing (Hair 2017, p.114)

2. Assess internal consistency reliability(Hair, Risher & Ringle 2019).For exploratory research, Jöreskog's CR is recommended as it uses items weight based on the construct indicators' individual loadings (Hair, Risher & Ringle 2019). Values from 0.60 to 0.70 are "acceptable", while from 0.70 to 0.90 are "satisfactory to good" and higher than 0.95 indicate that there are redundant indicators or undesirable responses (Hair, Risher & Ringle 2019). Cronbach's Alpha is considered less precise as it uses unweighted indicators (Hair, Risher & Ringle 2019). Pa (also known as rho a) can be used as an alternative to approximate the exact measure of a construct reliability as long as the factor model is assumed to be correct (Dijkstra & Henseler 2015; Hair, Risher & Ringle 2019). It is more precise than Cronbach's Alpha but not as precise as Jöreskog's CR (Hair, Risher & Ringle 2019). Bootstrap confidence intervals (95%) can also be used if the construct reliability is higher than the minimum threshold (0.70) or lower than the maximum threshold (0.95) (Hair, Risher &

Ringle 2019). The percentile method should be preferred (Aguirre-Urreta & Rönkkö 2018; Hair, Risher & Ringle 2019).

3. Address the convergent validity which explains the variance of items (Hair, Risher & Ringle 2019). On each construct, the AVE should be used for all indicators. The AVE is calculated by squaring the loading of each indicator on a construct then calculating the mean value (Hair, Risher & Ringle 2019). To explain at least 50 percent of the variance of its indicators, the AVE value should be higher than 0.50 (Hair, Risher & Ringle 2019).

4. Assess discriminant validity which indicates how distinct is a construct from another construct in the model (Hair, Risher & Ringle 2019). The HeteroTrait-MonoTrait ratio (HTMT) of the correlations is the recommended assessment measurement (Hair, Risher & Ringle 2019; Henseler, Ringle & Sarstedt 2015; Voorhees et al. 2016). When HTMT values are high, it indicates problems with discriminant validity (Hair, Risher & Ringle 2019). A recommended threshold value less than 0.85 is recommended even though 0.90 would still indicate that there are no problems (Hair, Risher & Ringle 2019; Henseler, Ringle & Sarstedt 2015).

Assessing Formative Indicators and Constructs

The evaluation of formative measurement models is based on indicator collinearity, statistical significance, and relevance of the indicator weights (Hair, Risher & Ringle 2019).

Indicator collinearity can be evaluated using Variance Inflation Factor (VIF) which should be ideally lower or close to 3 (Hair, Risher & Ringle 2019). Collinearity issues can still exist with values below 3 (Becker et al. 2015; Hair, Risher & Ringle 2019; Mason 1991). VIF is assessed in the structural model.

The following process is used to assess the statistical significance of formative indicators (see Figure 5.). Statistical significance can be evaluated using bootstrapping (Hair, Risher & Ringle 2019). In case the indicator weights bootstrap distribution is skewed, the BCa bootstrap is recommended to test the statistical significance (Hair, Risher & Ringle 2019). The percentile method can be used as a fallback to build bootstrap-based confidence intervals (Aguirre-Urreta & Rönkkö 2018; Hair, Risher & Ringle 2019). If the outer weight of a formative indicator is not significant (p-value is above 0.05) then its outer loading should be assessed (Hair, Risher & Ringle 2019). If its outer loading is above 0.50 then it is absolutely but not relatively important (Hair Jr., Hult, et al. 2014, p. 129). A formative indicator's loading of and below 0.50 should be removed except if there is strong justification based on measurement theory (Hair, Risher & Ringle 2019). An indicator's loading is not significant (p-value above 0.05) then it can be considered for removal (Hair Jr., Hult, et al. 2014, p. 129-130). However, removing an indicator from formative measurement can reduce the measurement content validity as these are not interchangeable (Diamantopoulos & Winklhofer 2001; Hair, Risher & Ringle 2019).

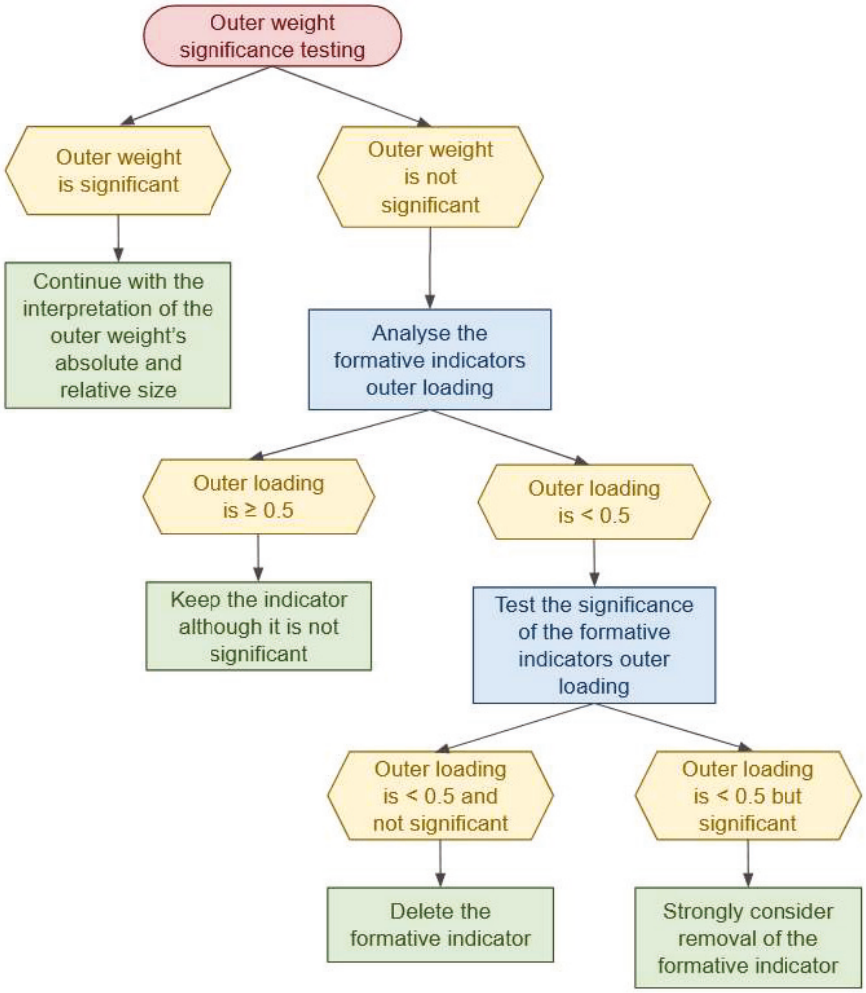

Figure 5. Formative Indicator and Construct Assessment, Outer Loading Relevance Testing (Hair 2017, p.150)

Following this, the relevance of the indicator's weight should be assessed (Hair, Risher & Ringle 2019). Weights close to +1 or -1 indicate a strong positive relationship, close to 0 a weak relationship, and in rare cases the value can even be above +1 or lower than -1 which indicates abnormal results (Hair, Risher & Ringle 2019).

Assessing Structural Models

The coefficient of determination (R^2 also known or in-sample predictive power (Rigdon 2012) or the blindfolding-based cross validated redundancy measure Q2, the statistical significance and relevance of the path coefficients are all criteria to assess the structural model (Hair, Risher & Ringle 2019).

Ensuring no regression bias

But first, to ensure that collinearity does not bias the regression results, the VIF values can be calculated from the predictors constructs latent variable scores in a partial regression (Hair, Risher & Ringle 2019). Again, the VIF values should be 3 or lower (Hair, Risher & Ringle 2019).

Examining the effect of constructs

The R^2 value of endogenous construct should then be examined (Hair, Risher & Ringle 2019). R^2 of 0.75 is substantial, R^2 of 0.50 is moderate, R^2 of 0.25 is weak (Hair, Ringle & Sarstedt 2011), although, depending on the discipline, values as low as 0.10 can be satisfactory (Hair, Risher & Ringle 2019; Raithel et al. 2012). Although Q2 value is presented as another out of sample prediction measurement, it is not as if it combines the aspects of out-of-sample prediction and in-sample explanatory power (Hair, Risher & Ringle 2019; Shmueli et al. 2016). R^2 can only indicate a model's in-sample and not out-of-sample explanatory power (Dolce, Esposito Vinzi & Lauro 2017; Hair, Risher & Ringle 2019; Shmueli 2010; Shmueli & Koppius 2011).

F2 can be used to report the effect size along with path coefficients where F2 values higher than 0.02 are small effects, 0.15 are medium, and 0.35 are large (Hair, Risher & Ringle 2019). F2 is recommended to be reported only if requested by reviewers or editors (Hair, Risher & Ringle 2019).

Selecting a Higher-Order Constructs Approach

The repeated indicators or the two-stage approaches are among the more prominent approach of identifying HC (Becker et al. 2019; Ringle, Sarstedt & Straub 2012). To estimate the HC, measurement models can be used by the PLS algorithm either in Mode A or Mode B (Becker et al. 2019). Mode A is typically used to estimate reflective measurement models and Mode

B is used to estimate formative measurement models (Becker et al. 2019). To evaluate the HC, the LOC measurement models and the HC measurement model relationships between HOC and LOC are needed (Becker et al. 2019).

The (extended) repeated indicators approach

The repeated indicators approach assigns all indicators of the LOC to the HOC (Becker et al. 2019). When all LOC have the same number of indicators, this approach works best (Becker, Klein & Wetzels 2012; Ringle, Sarstedt & Straub 2012). Small biases are produced when the repeated indicator approach is used in the estimation of the HC measurements model (Becker et al. 2019). The repeated indicators approach becomes problematic when used with a dependant reflective-formative and formative-formative HC in the path model (Becker et al. 2019). Antecedent constructs not part of the HC but in the path model and cannot explain any HC variance as its path coefficient will be close to zero and not significant (Becker et al. 2019; Ringle, Sarstedt & Straub 2012). The relationship between the antecedent constructs and the LOC need to be specified (Becker et al. 2019). The antecedent construct's total effect on the HOC including all indirect effects via LOC needs to be analysed to portray an accurate picture of antecedent's actual effect on HOC (Becker et al. 2019; Becker, Klein & Wetzels 2012).

Estimation process

To estimate measurement model in the repeated indicators, the choice of modes is applied to the orientation of HOC and not LOC (Becker et al. 2019; Becker, Klein & Wetzels 2012).

Validation process

Repeated indicators cannot evaluate HC because its measurement model is defined by its relation with its LOC (Becker et al. 2019). Standard measurement model assessment criteria needs to be applied to the relationship between HOC and LOC (Becker et al. 2019). Also

discriminant validity issue cannot be resolved by HC (Becker et al. 2019). LOC must be considered as the HOC measurement model to assess its discriminant validity (Becker et al. 2019). HOC only needs to be assessed as part of the structural model (Becker et al. 2019). Structural model robustness checks should complement the analysis (Becker et al. 2019; Sarstedt et al. 2019).

The two-stage approach

The two-stage approach has two versions that lead to similar results (Becker et al. 2019; Cheah et al. 2019). It has a better parameter recovery of paths pointing from and to the HC and exogenous construct in the path model (Becker et al. 2019). In the first stage, the scores of all constructs are saved and are used as new variable in the dataset (Becker et al. 2019). In the second stage of the embedded approach, the constructs score are used as the HC measurement model (Becker et al. 2019). In the second stage of the disjoint approach, LOC construct scores are used to measure the HC (Becker et al. 2019).

Estimation

To estimate the measurement model in the disjoint two-stage approach, the standard settings should be applied with mode A for reflective measurements and mode B for formative (Becker et al. 2019). Becker et al. (2019) recommends for the estimation of HC to use the path weighting scheme as the default setting in PLS-SEM.

Validation Process

Stage one considers all measurement models including LOC (Becker et al. 2019). Stage two measurement model needs to assess HC as an expression of the relationships between HOC and LOC (Becker et al. 2019). As the disjoint two stage approach uses multi-items allows the assessment of the structural model (Becker et al. 2019). Other advanced PLS-SEM analysis techniques such as Confirmatory Tetrad Analysis (CTA)-PLS, PLSpredict or Importance

Performance Map Analysis (IPMA) needs further research to address the use in stage two of un-standardised latent variable scores from stage one (Becker et al. 2019).

Conclusion

CTA-PLS, PLSpredict or IPMA from PLS-SEM requires further research to address the use in stage two of un-standardised latent variable scores from stage one (Becker et al. 2019). However as opposed to the repeated indicator approach, the disjoint two stage approach can assess the structural model (Becker et al. 2019). The disjoint two stage approach remains the preferred HC approach.

4.8 Chapter Summary

PLS-SEM has many advantages over its CB-SEM counterpart. It has fewer restrictions with assumptions, works better with wider sample range and complex models and is more robust with non-normal data. It has higher statistical power making it useful for exploratory research and does not rely on the model fit concept. With PLS-SEM, the use of HC allows for abstract modelling. The two stage approach has better parameter recovery with the disjoint approach allowing for structural model assessment. To use the two stage approach, the latent variable scores are saved from stage 1. They are then used as indicators in stage 2.

To assess the measurement model, reflective indicators' loading must be above 0.4. The constructs must be for CR between 0.6 and 0.95, for AVE above 0.50, and for HTMT below 0.85. For formative indicators, there should not be any indicator whose weight is not significant (above 0.05) and loading is below 0.5 and insignificant (above 0.05). Weights need to be in between +1 and -1 for the results to be normal.

To assess the structural model, the VIF values must be below 3, the p-value must be below the statistical significance threshold of 0.05 and the R^2 value assesses the construct's effect

with 0.75 as substantial, 0.50 as moderate, 0.25 as weak, and depending if the discipline accepts it, 0.10 as very weak. With HC, more research is required to use other methods of assessment.

Chapter 5: Results

This chapter presents the results produced using the methodology described in Chapter 4. Here, the demographic variables are described and analysed starting with gender identity, biological age, technological age, provenance of students, education and TRI taxonomy of participants. In addition, this chapter reports the measurement model and structural model results of stage 1 and stage 2 disjoint approach to demonstrate that these are all within acceptable thresholds and their statistical significance. This chapter finishes with explaining that further research is required to use other PLS-SEM reporting methods.

5.1 Descriptive Analysis of Demographic Variables

The answers collected from the demography section of the online questionnaire are discussed. From those answers, the inclusion of options such as “Prefer not to answer”, “I do not know” and “Other” is justified. First, gender identities are introduced. Second, the different age demographics are presented. Then, the technological ages are discussed. After, the residential addresses are argued. The provenance of participants is then shown. The participants' curriculum is made known. Finally, the TRI taxonomy is argued.

5.1.1 Gender Identity

When asked participants about “What gender do you identify as ?”, 53% of the participants predominantly identified as female and 45% as male (see Figure 6.). None of the participants answered “I do not know” (see Table 5.). The three participants who answered “Prefer not to say” validate the inclusion of said consent option (see Table 6.). Participants who answered “Other” were provided a text field to enter further information. The “Other” answers provided were “Female sex, no gender” and “Genderqueer” (see Table 6.). While the

majority of participants answered either “Male” or “Female”, the “Other” answers provided information that gender identities other than male and female exist.

Table 5. Gender Identity Count

Gender	Count
Male	89
Female	105
Other	2
Prefer not to say	3
I do not know	0

Table 6. Other Gender Identities Responses

Other Responses
“Female sex, no gender”
“Genderqueer”

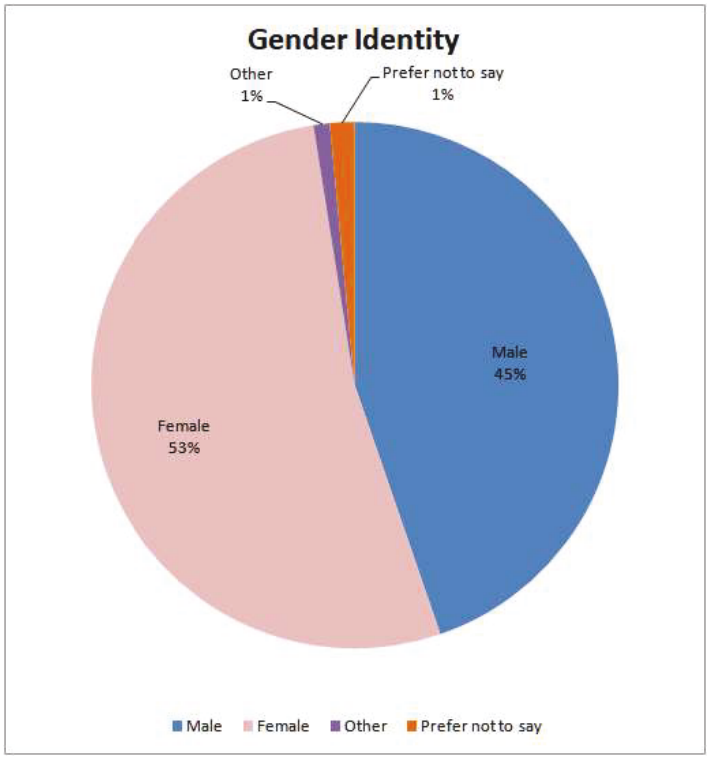

Figure 6. Gender Identity Distribution Pie Chart

5.1.2 Biological Age

Among the participants who were asked about their age range, one chose “Prefer not to say” (see Table 7.). This again gives credence to the inclusion of said consent option. None answered “I do not know” (see Table 7.). 27% answered “18-25”, 42% predominantly answered “26-35”, 14% answered “36-45” which is the lowest directly after spiking, %17 answered “Above 45”. 69% of participants answered that they were below 35.

Table 7. Age Range Response Rate Count

Age Range Responses Rate	Count
Responses	198
Prefer not to say	1
I do not know	0

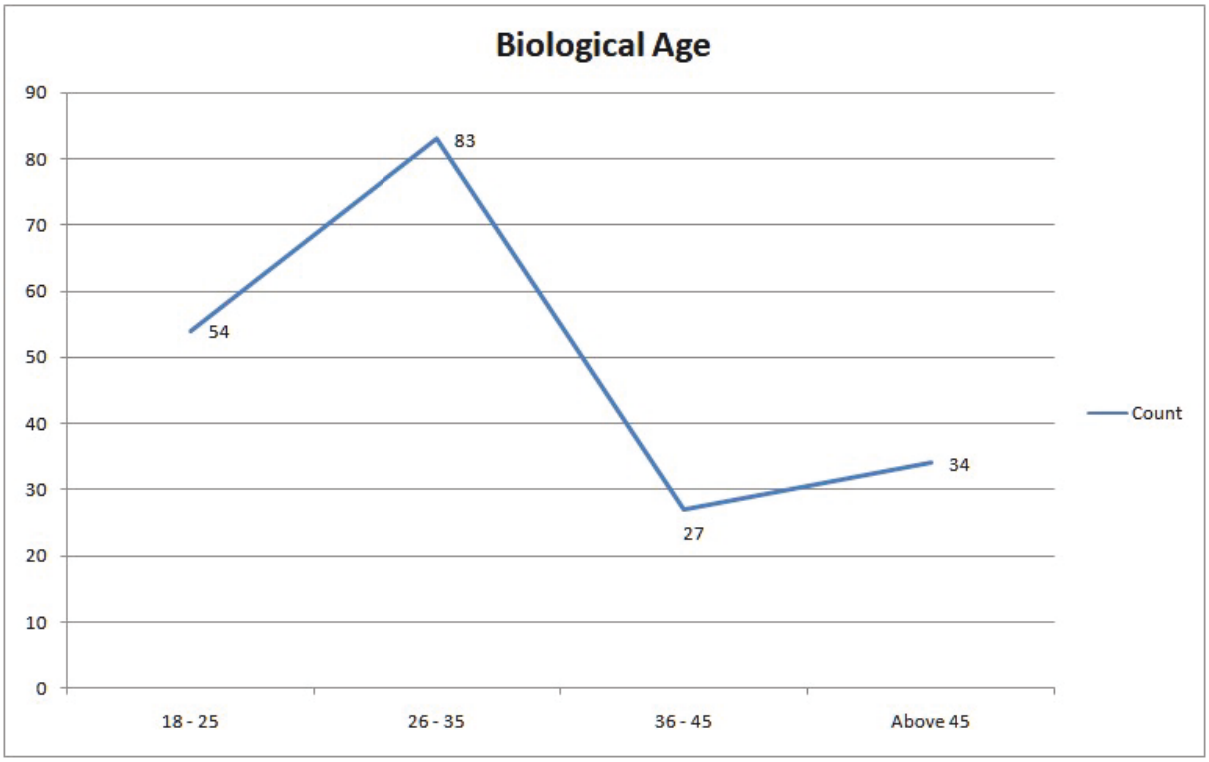

Figure 7. Age Range Count Graph

5.1.3 Technological Age

Among the participants who answered “How many years have you been using technology ?”, four answered “I do not know” which indicates that participants may not know accurately how long they have been exposed to technology (see Table 8.). two answered “1-3 years”, five answered “4-6 years” and 188 predominantly answered “More than 7 years” (see Figure 8.). There is an increase from “1-3 years” to “4-6 years” and then a spike for “More than 7 years”. The majority of participants have had exposure to technology for over seven years.

Table 8. Tech Age Response Rate Count

Tech Age Response Rate	Count
Responses	195
Prefer not to say	0
I do not know	4

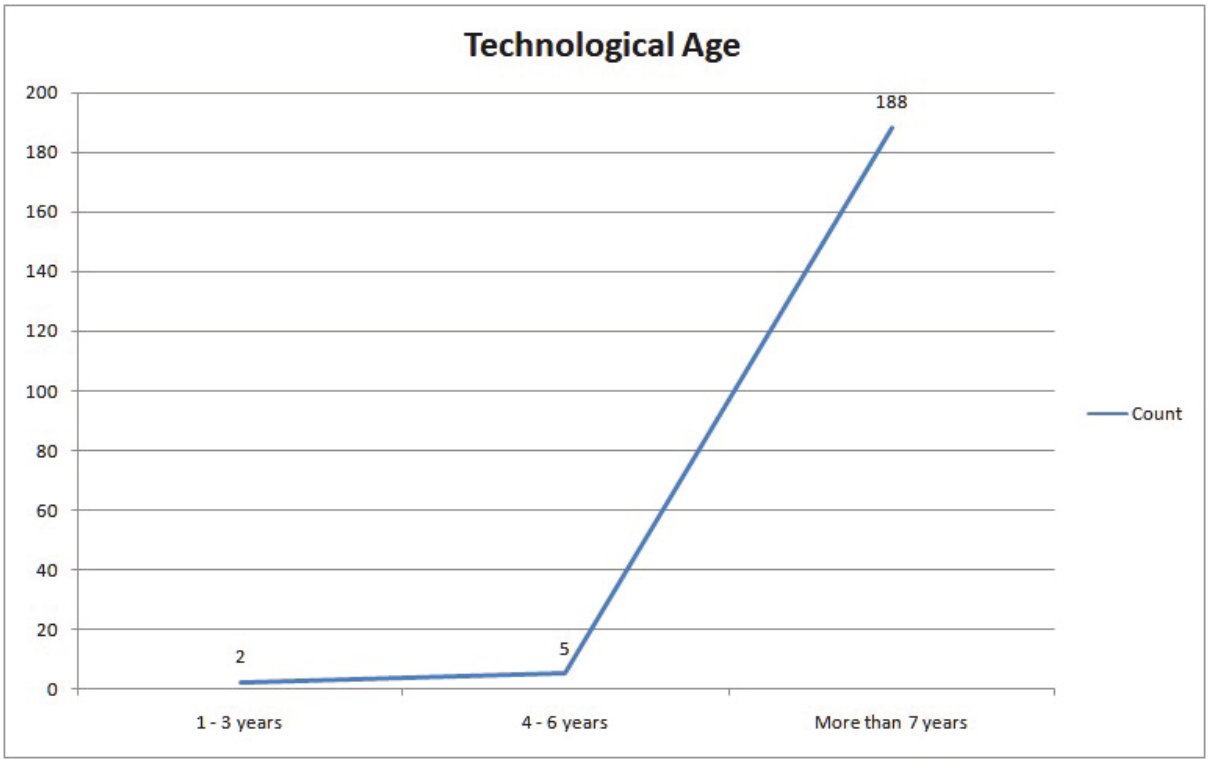

Figure 8. Tech Age Range Count Graph

5.1.4 Provenance of Students

Among the responses, 65% answered “Local”, 29% answered “International”, two answered “Prefer not to answer”, 5% or nine answered “Other” which included 5 who were Interstate, two from Melbourne, one was “Distance education”, and one was “Both” (see Table 9. and 10.). Adding “Local”, interstate and Melbourne together sums the total of domestic students at 137 which is close to 69%.

Table 9. Student Provenance Count

Students Provenance	Count
Local	130
International	58
Other	9
Prefer not to say	2
I do not know	0

Table 10. Other Responses Count

Other Responses	Count
Interstate	5
Melbourne	2
Distance education	1
Both	1

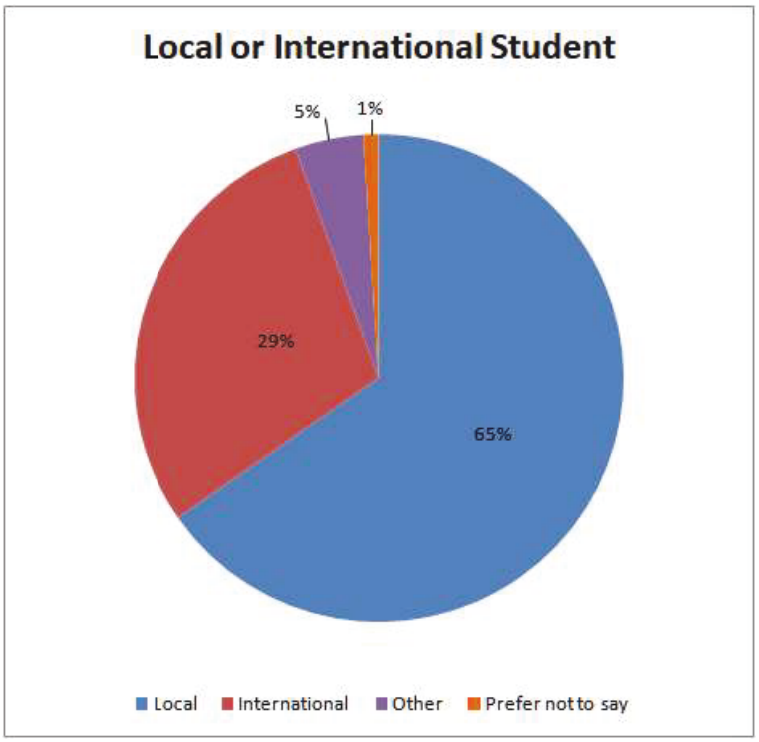

Figure 9. Student Provenance Distribution Pie Chart

5.1.5 Current Education

Participant's answers that were not studying a Bachelor's degree, Master's degree or Ph.D. were omitted to keep the context of this research focused on students. As there were only five records that either answered "Prefer not to say" and "I do not know", their omission was determined to bear minimal impact on the analysis. 23% answered "Bachelor's degree", 6% answered "Master's degree" and 71% answered "PHD" (see Figure 10.). There is a slump at Master's degree then a huge spike at "PHD". Sending out 2000 emails to all post graduate students appears to have been more effective than soliciting undergraduate students in lectures and tutorials.

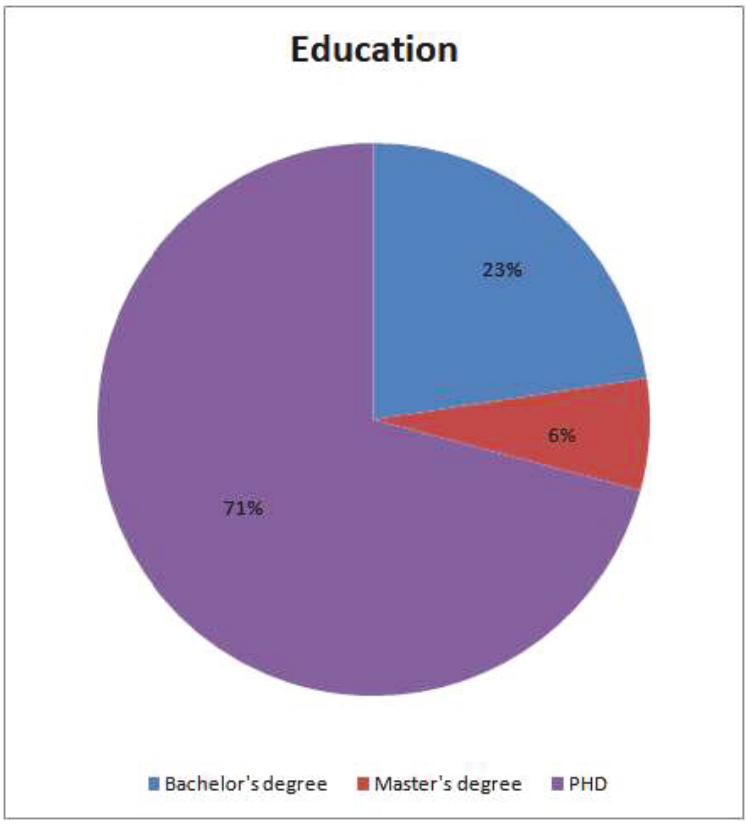

Figure 10. Current Education Distribution Pie Chart

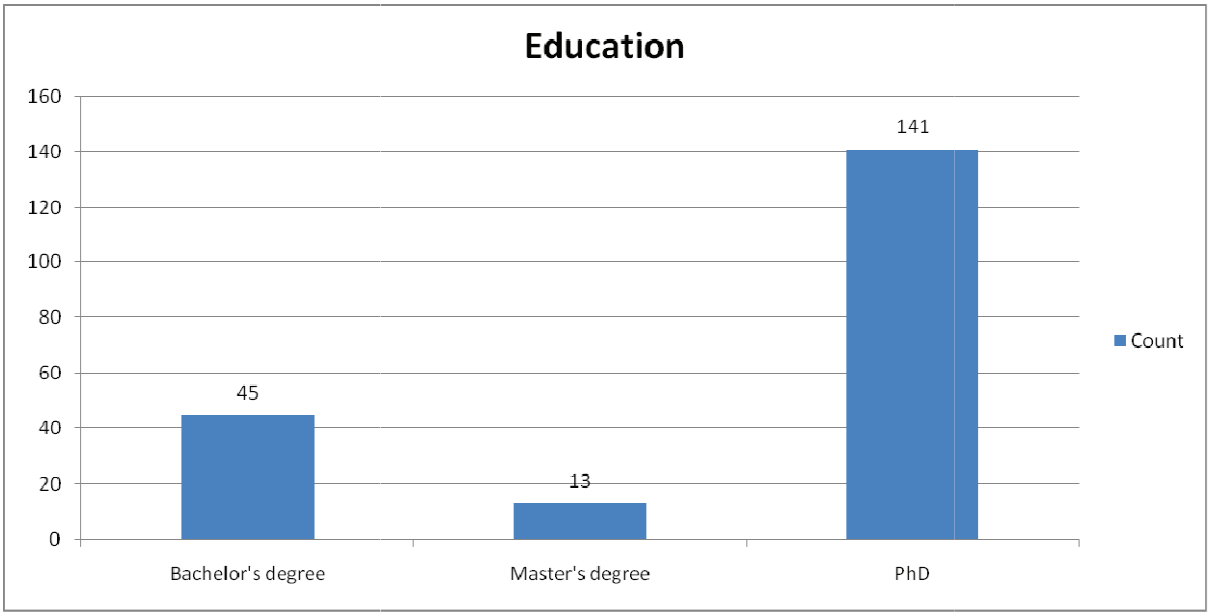

Figure 11. Current Education Count Bar Chart

5.1.6 TRI Taxonomy

The TRI answers shows that rounding the respondent average answer is for Optimism "Somewhat agree", for Innovation "Neither agree nor disagree", for Discomfort "Neither agree nor disagree" and for Insecurity "Somewhat agree" (see Table 11.). With optimism as high, insecurity as high, innovation as medium or not low, and discomfort as also not low, this would place the average participant as a pioneer (see Figure 12.). Using the same logic with medians, the median participant is also a pioneer (see Figure 12.). Ultimately, innovation made the difference between pioneer and paranoid.

Table 11. TR Dimensions Average and Median Response

TR Dimensions	Average	Average Rounded	Median	Average Corresponding Responses	Median Corresponding Responses
Optimism	2.043969849	2	2	Somewhat agree	Somewhat agree
Innovation	2.543969849	3	2	Neither agree nor disagree	Somewhat agree
Discomfort	3.159547739	3	3	Neither agree nor disagree	Neither agree nor disagree
Insecurity	2.305276382	2	2	Somewhat agree	Somewhat agree

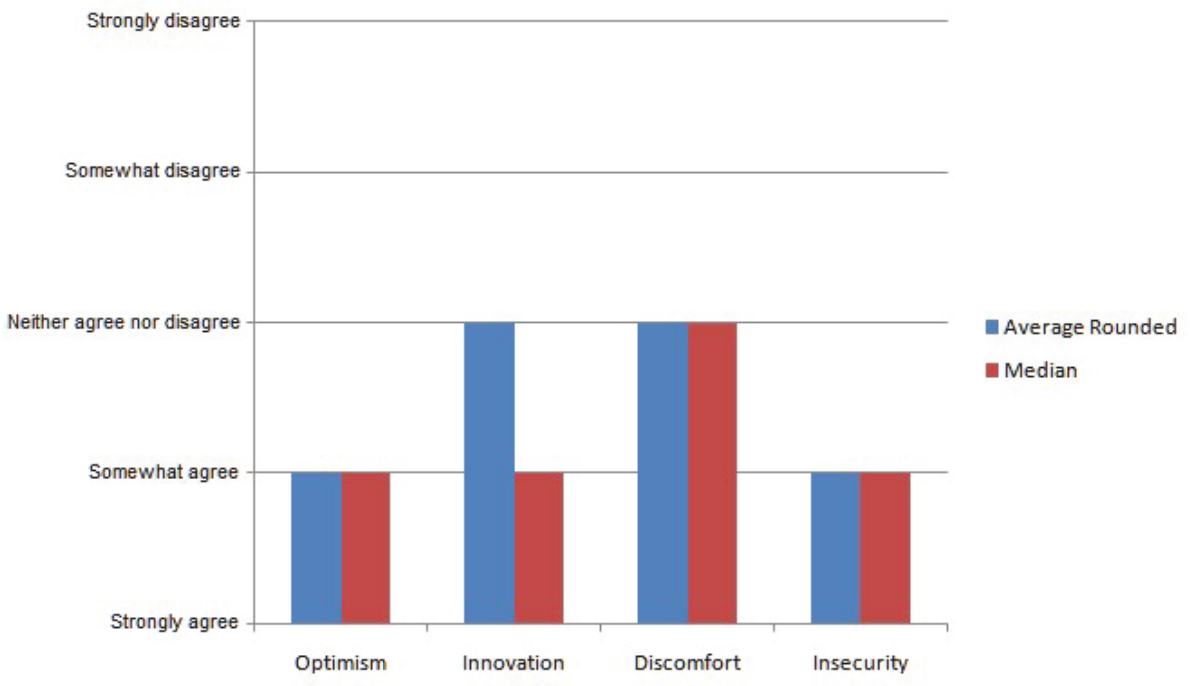

Figure 12. TR Dimensions Average and Median Response Graph

5.2 Stage 1 Measurement Model

In this section, recommendations for the analysis method argued in Chapter 4 are followed. The results have been generated using SmartPLS 3.0. As this research model uses a HC, the preferred method to generate results was the disjoint two stage approach. In stage 1, the results of the LOC measurement model are assessed. Reflective and formative indicators are assessed in the measurement model. Latent variable scores from stage 1 are saved and used to generate results in stage 2. In stage 2, the measurement model and finally the structural model of the HOC are assessed.

5.2.1 Reliability and Validity

As this model is made of reflective and formative indicators, reflective and formative indicators need to be evaluated separately. First in stage 1, reflective indicators item reliability, construct reliability and validity, and construct discriminant validity are assessed.

Then the statistical significance of formative indicators is assessed. Finally, indicator collinearity and structural model assessment are examined together as they both are assessed by VIF scores.

Reflective Indicators Item Reliability

As recommended in Chapter 4, these results were generated using the PLS-SEM algorithm with the weighting scheme set to 'Path', maximum iteration set to '300', and stop criterion set to '7'.

Table 12. Stage 1 Reflective Indicator Outer Loadings

	Discomfort	Innovation	Insecurity	Learning Behaviour	Optimism
DISC1	0.574				
DISC2	0.593				
DISC3	0.738				
DISC4	0.884				
INNO1		0.799			
INNO2		0.688			
INNO3		0.850			
INNO4		0.805			
INSE2			0.598		
INSE4			0.887		
IWP2				0.713	
IWP3				0.809	
IWP4				0.742	
OPTI1					0.677
OPTI2					0.674
OPTI4					0.862

All indicator loadings are above the 0.4 removal threshold (see Table 12.). While the recommended threshold should be above 0.708, all CR and AVE are within good thresholds. Reflective indicators' loading are all within acceptable thresholds. They should therefore be reliable.

Construct Reliability and Validity

Table 13. Stage 1 Reflective Indicator Construct Reliability and Average Variance Extracted

	Composite Reliability	Average Variance Extracted (AVE)
Discomfort	0.80	0.50
Innovation	0.87	0.62
Insecurity	0.72	0.57
Learning Behaviour	0.80	0.57
Optimism	0.78	0.55

All CR are above 0.7 which is "satisfactory to good" and below 0.9 which indicates there are no redundant items. The CR values indicate that the internal consistency is reliable (see Table 13.). All reflective indicators AVE are above 0.5 which addresses the convergent validity.

Construct Discriminant Validity

Table 14. Stage 1 Reflective Indicator Heterotrait-Monotrait Ratio

	Discomfort	Innovation	Insecurity	Learning Behaviour	Optimism
Discomfort					
Innovation	0.179				
Insecurity	0.733	0.189			
Learning Behaviour	0.260	0.244	0.275		
Optimism	0.210	0.294	0.377	0.163	

All HTMT values are below the recommended threshold of 0.85 (see Table 14.) which indicates that there are minimal problems with the discriminant validity.

Formative Indicators Statistical Significance

As again recommended in Chapter 4, these results were generated using bootstrapping with '5000' sample, with 'complete bootstrap', and 'Bias-Corrected and Accelerated (BCa) Bootstrap (default)' to reduce skewness.

Table 15. Stage 1 Formative Indicator Statistical Significance

	Outer Weights P-values	Outer Loadings P-values	
ACQU01 ->Acquisition	0	0	Continue
ACQU01 -> Absorptive Capacity	0.014	0	Continue
ACQU02 -> Acquisition	0	0	Continue
ACQU02 -> Absorptive Capacity	0.01	0	Continue
ACQU03 -> Acquisition	0.813	0.015	Consider
ACQU03 -> Absorptive Capacity	0.949	0.012	Consider
ACQU04 -> Acquisition	0.281	0.004	Consider
ACQU04 -> Absorptive Capacity	0.518	0.002	Consider
ASSM01 -> Assimilation	0.549	0	Consider
ASSM01 -> Absorptive Capacity	0.736	0	Consider
ASSM02 -> Assimilation	0.05	0	Continue
ASSM02 -> Absorptive Capacity	0.523	0	Consider
ASSM03 -> Assimilation	0	0	Continue
ASSM03 -> Absorptive Capacity	0.95	0	Consider
EXPL01 -> Exploitation	0	0	Continue
EXPL01 -> Absorptive Capacity	0.005	0	Continue
EXPL02 -> Exploitation	0.001	0	Continue

EXPL02 -> Absorptive Capacity	0.029	0	Continue
EXPL03 -> Exploitation	0	0	Continue
EXPL03 -> Absorptive Capacity	0.036	0	Continue
SI1 -> Social Influences	0.713	0.602	Keep
SI2 -> Social Influences	0.507	0.919	Keep
SI3 -> Social Influences	0.023	0.014	Continue
SI4 -> Social Influences	0.459	0.893	Keep
SN01 -> Social Networks	0.328	0.546	Keep
SN02 -> Social Networks	0.96	0.982	Keep
SN05 -> Social Networks	0.027	0.021	Continue
SN06 -> Social Networks	0.915	0.847	Keep
TOOLS1 -> Tools for Knowledge Sources	0.68	0.025	Consider
TOOLS2 -> Tools for Knowledge Sources	0.572	0.026	Consider
TOOLS3 -> Tools for Knowledge Sources	0.055	0	Consider
TRNS01 -> Transformation	0.03	0	Continue
TRNS01 -> Absorptive Capacity	0.969	0	Consider
TRNS02 -> Transformation	0.011	0	Continue
TRNS02 -> Absorptive Capacity	0.659	0	Consider
TRNS03 -> Transformation	0	0	Continue
TRNS03 -> Absorptive Capacity	0.414	0	Consider

Indicators whose weights were not significant and their loading above 0.5 were kept (see Table 15.). Those whose weights were not significant and their loadings were beneath 0.5 but not significant were removed (see Table 15.). Those whose weights were not significant but their loadings were significant, were considered and not removed (see Table 15.). None of the weights are above +1 or below -1 (see Table 15.), hence, these should be all relevant.

Indicator Collinearity and Structural Model Assessment

These VIF scores were generated using the PLS-SEM algorithm with the weighting scheme set to ‘Path’, maximum iteration set to ‘300’, and stop criterion set to ‘7’.

Table 16. Stage 1 Collinearity Statistics VIF

	VIF
ACQU01	1.6
ACQU01	1.8
ACQU02	1.4
ACQU02	1.7
ACQU03	1.2
ACQU03	1.3
ACQU04	1.2
ACQU04	1.4
ASSM01	1.4
ASSM01	1.7
ASSM02	1.5
ASSM02	1.9
ASSM03	1.3
ASSM03	1.7
DISC1	1.3
DISC2	1.4
DISC3	1.6
DISC4	1.5
EXPL01	1.1
EXPL01	1.8
EXPL02	1.1
EXPL02	1.3

EXPL03	1.1
EXPL03	1.2
INNO1	1.9
INNO2	1.6
INNO3	1.5
INNO4	1.8
INSE2	1.0
INSE4	1.0
IWP2	1.1
IWP3	1.4
IWP4	1.3
OPTI1	1.5
OPTI2	1.4
OPTI4	1.1
SI1	1.3
SI2	1.5
SI3	1.2
SI4	1.4
SN01	1.4
SN02	1.5
SN05	1.1
SN06	1.1
TOOLS1	1.7
TOOLS2	2.9
TOOLS3	2.9
TRNS01	1.8
TRNS01	2.1
TRNS02	1.3

TRNS02	1.5
TRNS03	1.6
TRNS03	1.9

While collinearity issues can still exist with VIF scores below 3 (see Table 16.), these values are below the said score. This should ensure that all formative indicators are statistically significant and do not bias the regression results of the structural model.

5.3 Stage 2 Disjoint Approach

Stage 2 disjoint approach calculates its results using the latent variable scores from stage 1. In stage 2, the HC measurement model is assessed as an expression of the relationship between HOC and LOC (Becker et al. 2019). As the relationship between LOC and HOC is formative-formative, the measurement model should assess the statistical significance of formative indicators.

5.3.1 Measurement Model

Formative Indicators Statistical Significance

These results were generated using bootstrapping with '5000' sample, with 'complete bootstrap', and 'Bias-Corrected and Accelerated (BCa) Bootstrap (default)' to reduce skewness.

Table 17. Disjoint Stage 2 Formative Indicator Statistical Significance

	Outer Weights P-values	Outer Loadings P-values	
Acquisition -> Absorptive Capacity	0.000	0.000	Continue
Assimilation -> Absorptive Capacity	0.500	0.000	Consider
Exploitation -> Absorptive Capacity	0.055	0.000	Consider

Transformation -> Absorptive Capacity	0.035	0.000	Continue

This stage followed the same process in stage 1. Indicators loading were all significant (see Table 17.). Those whose weight was not significant were considered and not removed (see Table 17.). Again, none of the weights are above +1 or below -1 (see Table 17.) and thus they should be all relevant.

Indicator Collinearity and Structural Model Assessment

These VIF scores were generated using the PLS-SEM algorithm with the weighting scheme set to 'Path', maximum iteration set to '300', and stop criterion set to '7'.

Table 18. Disjoint Stage 2 Collinearity Statistics VIF

	VIF
Acquisition	1.816
Assimilation	1.765
Discomfort	1.000
Exploitation	1.881
Innovation	1.000
Insecurity	1.000
Learning Behaviour	1.000
Optimism	1.000
Social Influences	1.000
Social Networks	1.000
Tools for Knowledge Sources	1.000
Transformation	2.166

While collinearity issues can still exist with VIF scores below 3, these values are below the said score (see Table 18.). This should ensure that all formative indicators are statistically significant and do not bias the regression results of the structural model.

5.3.2 Statistical Significance

The p-values of the path coefficient were generated using bootstrapping with '5000' sample, 'complete bootstrap', and 'Bias-Corrected and Accelerated (BCa) Bootstrap (default)' to reduce skewness. The path coefficient and R^2 values were generated using the PLS-SEM algorithm with the weighting scheme set to 'Path', maximum iteration set to '300', and stop criterion set to '7'.

Table 19. Path Coefficients Relevance and Statistical Significance

Hypothesis Number	Path	Path Coefficient	Standard Deviation (STDEV)	T Value (T Statistics)	P-values	Supported?
H1	Optimism -> Absorptive Capacity	0.174	0.085	2.044	0.041	Yes
H2	Insecurity -> Absorptive Capacity	-0.006	0.091	0.068	0.946	No
H3a	Innovation -> Absorptive Capacity	0.219	0.070	3.128	0.002	Yes
H3b	Innovation -> Absorptive Capacity	0.219	0.070	3.128	0.002	Yes
H4	Discomfort -> Absorptive Capacity	-0.088	0.083	1.060	0.289	No
H5	Tools for Knowledge Sources -> Absorptive Capacity	0.070	0.074	0.939	0.348	No
H6	Social Influences -> Absorptive Capacity	0.059	0.067	0.879	0.379	No

H7	Social Networks -> Absorptive Capacity	0.233	0.079	2.960	0.003	Yes
H8	Absorptive Capacity -> Learning Behaviour	0.461	0.067	6.872	0.000	Yes

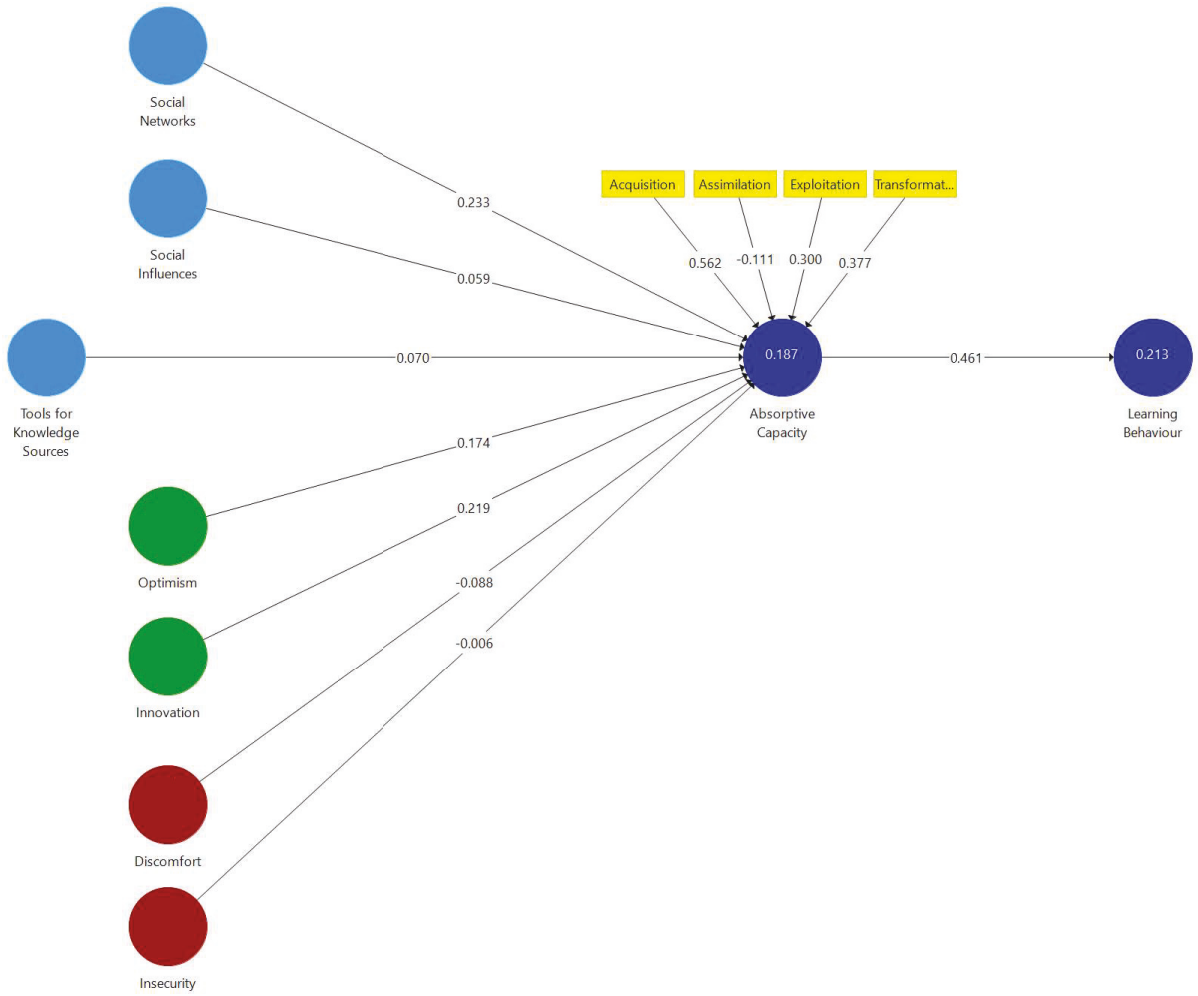

Figure 13. Disjoint Stage 2 Construct Effect Model

The following hypotheses were developed in Chapter 3. The results produced from the PLS-SEM determine if said hypothesis have had their null hypothesis rejected or not based on the statistical significance. The strength of the effect is determined by the R^2 score. F2 value is provided as an extra measurement even though it is not required.

H1: Optimism positively influences individual ACAP.

'Optimism -> Absorptive Capacity' path coefficient p-value of 0.041 is below 0.05 which is significant. The null hypothesis is rejected. The path coefficient value of 0.174 is positive.

While some disciplines accept R^2 values as low as 0.10, the ACAP R^2 value of 0.187 is beneath the weak threshold of 0.25 and thus very weak. F2 value is 0.032 which is above the small effect threshold of 0.02 but lower than the medium effect threshold of 0.15.

H2: Insecurity negatively influences individual ACAP.

'Insecurity -> Absorptive Capacity' path coefficient p-value of 0.946 is not significant. The null hypothesis is not rejected.

H3a: Innovation positively influences individual ACAP.

'Innovation -> Absorptive Capacity' path coefficient p-value of 0.002 is significant. The null hypothesis is rejected. The path coefficient value of 0.219 is positive. This hypothesis is not rejected. Again, ACAP R^2 value of 0.187 is above the 0.10 but still beneath 0.25. F2 value is 0.054 which is above the small effect threshold.

H3b: Innovation negatively influences individual ACAP.

'Innovation -> Absorptive Capacity' path coefficient p-value of 0.002 is significant. The null hypothesis is rejected. The path coefficient value of 0.219 is not negative. This hypothesis is rejected. Innovation does not have a negative influence on individual ACAP.

H4: Discomfort negatively influences individual ACAP.

'Discomfort -> Absorptive Capacity' path coefficient p-value of 0.289 is not significant. The null hypothesis is not rejected.

H5: Tools for knowledge source influences individual ACAP.

'Tools for Knowledge Sources -> Absorptive Capacity' path coefficient p-value of 0.348 is not significant. The null hypothesis is not rejected.

H6: Social Influences affect ACAP through Assimilation.

'Social Influences -> Absorptive Capacity' path coefficient p-value of 0.379 is not significant. The null hypothesis is not rejected.

H7: Social Networks affect ACAP through Assimilation.

'Social Networks -> Absorptive Capacity' path coefficient p-value of 0.003 is significant. The null hypothesis is rejected. The path coefficient value of 0.233 is positive. Again, the ACAP R^2 value of 0.187 is above 0.10 which is very weak. F2 value is 0.065 which is above the small effect threshold.

H8: Individual's ACAP affects their learning behaviour.

'Absorptive Capacity -> Learning Behaviour' path coefficient p-value of 0.000 is significant. The null hypothesis is rejected. The path coefficient value of 0.461 is positive. Learning Behaviour R^2 value of 0.213 is above the very weak threshold of 0.10 and close but still below the weak threshold of 0.25. F2 value is 0.270 which is above the small effect threshold.

Further research on the use in stage two of un-standardised latent variable scores from stage one is required to address the use of CTA-PLS, PLSpredict or IPMA (Becker et al. 2019). Other methods of reporting have not been used.

5.4 Chapter Summary

The demographic items gave a fair representation of participants in regard to the general population. It also allowed filtering out records from participants that did not fit the research context. Five records were filtered out because they were not studying any degree, masters or

Ph.D. The TRI was also reverse engineered to determine that the average participant was a pioneer. SmartPLS 3 was used to perform the PLS-SEM analysis. The PLS algorithm was executed with the weighting scheme set to 'Path', maximum iteration set to '300', and stop criterion set to '7'. Bootstrapping was executed with '5000' sample, with 'complete bootstrap', and 'Bias-Corrected and Accelerated (BCa) Bootstrap (default)' to reduce skewness. All the values that are used in the assessment of measurements model and structural model are within acceptable results. These results follow the recommended guidelines. The rejection of null hypotheses should be valid. Optimism, Innovation and SN have a very weak significant effect on individual ACAP, and individual ACAP has a weak significant effect on Learning Behaviour. Other hypotheses have been rejected.

Chapter 6: Discussion, Implication and Conclusion

By using a quantitative approach, this study is able to provide empirical results to support its findings. This chapter revisits the research question with the results it has produced and makes propositions about its contributions and its limitations. It concludes this study while leaving its audience with highlighted value that they can repurpose. It first revisits this research's stated aim and objective, question and hypotheses. It then follows with a discussion about its findings. The contributions and implications both theoretical and practical of the results are then presented. Limitations are also enumerated and explained. A conclusion and a brief summary are provided.

6.1 Revisiting the Research's Aim and Objectives, Research Questions, and Hypotheses

In this section; the study's aim and its objectives which are set in Chapter 1, the research question and its hypotheses posited in Chapter 3; are revisited using the results from Chapter 5. The aims and objectives were introduced as early as Chapter 1.

6.1.1 Aim: Confirm that an individual's technological beliefs have an effect on an individual's learning capabilities and their learning behaviour.

The aim of this research was to confirm that technology had an effect on individual learning and behaviour. It did confirm that individual belief towards technology and some social interfaces had an effect on their capability to absorb knowledge which then affected their learning behaviour.

6.1.2 Objective 1: Provide empirical evidence.

As findings are always within a context (Polit & Beck 2010), a different data set might produce different results. However, the data collected along with PLS-SEM analysis allows the results to be recalculated. The validity of PLS-SEM was argued extensively in Chapter 4. As these results can be verified by independent reviewers, this study provides empirical evidence to sustain its results.

6.1.3 Objective 2: Determine which factor has an effect e.g. which TR dimension affects individual ACAP and learning behaviour.

This study has found that an individual's technological motivators such as optimism and innovation have a significant causal-effect on an individual's absorptive capacity. SN has a significant causal-effect on an individual's absorptive capacity through Assimilation. The individual's absorptive capacity has a significant causal-effect on their learning behaviour. Although, all these effects are very weak, this study provides some insight about which factors have a significant effect on individual ACAP.

6.1.4 Objective 3: Provide a model to build instruments.

The model's study can be reproduced or improved upon which can be used to develop instruments for future researchers and pedagogues to help identify where individuals fail to learn. This study provides a research model to measure the causal-effect of factors onto learning and behaviour.

6.1.5 Research Question

Chapter 2 established that knowledge is important (Garavelli, Gorgoglione & Scozzi 2002; Goh 2002; Hwang et al. 2008; Karlsen & Gottschalk 2004; Othman, Beydoun & Sugumaran 2014), and the recipient's ACAP is among the different barriers to its transfer (Szulanski

1996) and that individual ACAP is little researched (Lowik, Kraaijenbrink & Groen 2017; Minbaeva, Mäkelä & Rabbiosi 2012; Yao & Chang 2017). Technology can enhance learning (Hamilton, Rosenberg & Akcaoglu 2016) and beliefs affects behaviours (Ajzen 1991). This raised the following question in Chapter 3.

What is the effect of an individual's technological belief and use on their capability to absorb knowledge to their technological learning behaviour?

This question was answered using a quantitative approach (see Chapter 3). 199 records were used as data for the statistical analysis which was performed by PLS-SEM (see Chapter 4). The results and its validation were reported in Chapter 5.

6.1.6 Hypotheses Results

The hypotheses from Chapter 3 are revisited and explained taking into account the results from Chapter 5.

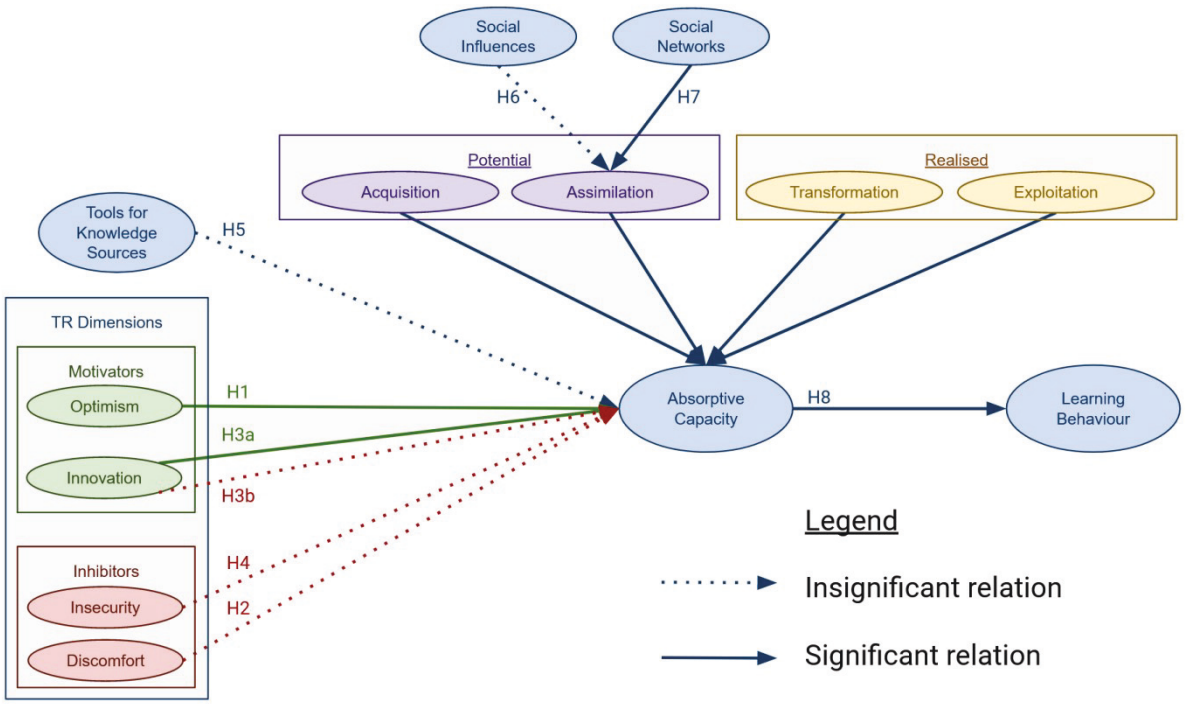

Figure 14. Summary of Research Results

H1: Optimism positively influences individual ACAP.

Optimism is the positive view that technology offers more control, flexibility and efficiency in their lives (Parasuraman 2000). Optimism has a very weak significant effect on an individual's ACAP. See Chapter 5 for further information about the results.

H2: Insecurity does not negatively influence individual ACAP.

Insecurity is a distrust of technology, stemming from scepticism about its ability to work properly and concerns about its potential harmful consequences (Parasuraman 2000).

However, insecurity does not have a significant effect on an individual's ACAP. See Chapter 5 for further information about the results.

H3a: Innovation positively influences individual ACAP.

Innovation is the thought that technology has a tendency to be pioneer and leader (Parasuraman 2000). Innovation has a very weak significant positive effect on an individual's ACAP. See Chapter 5 for further information about the results.

H3b: Innovation does not negatively influence individual ACAP.

Walczuch, Lemmink & Streukens (2007)discovered that innovation could also be perceived negatively. It does not always improve performance (Vlačić et al. 2019). However the results did satisfy that Innovation does not have a very weak significant negative effect on an individual's ACAP. See Chapter 5 for further information about the results.

H4: Discomfort does not negatively influence individual ACAP.

Discomfort is the perceived lack of control over technology and a feeling of being overwhelmed by it (Parasuraman 2000). However, Discomfort does not have a significant effect on an individual's ACAP. See Chapter 5 for further information about the results.

H5: Tools for Knowledge Source does not influence individual ACAP.

Knowledge Sources is an antecedent to ACAP which can affect ACAP differently which can lead to different performance (Jansen, Van Den Bosch & Volberda 2005). Organisations invest considerably into tools for these knowledge sources (Adeyinka et al. 2010; Saarinen 1996). However, TKS does not have a significant effect on an individual's ACAP. See Chapter 5 for further information about the results.

H6: Social Influences do not affect ACAP through Assimilation.

When adopting systems, SI is relied on more by experienced workers and women (Venkatesh et al. 2003). However SI does not have a significant effect on an individual's ACAP. See Chapter 5 for further information about the results.

H7: Social Networks affect ACAP through Assimilation.

SN can improve learning, foster collaboration and enhance creativity (George & Dellasega 2011). Comprehension and understanding is shaped by group heuristic which makes Assimilation (Zahra & George 2002). The results show that SN has a very weak significant effect on an individual's ACAP through Assimilation. SN can have both a positive and negative impact on individuals' comprehension (Gupta & Bashir 2018). See Chapter 5 for further information about the results.

H8: Individual's ACAP affects their learning behaviour.

Behaviour is influenced by beliefs (Ajzen 1991) as well as other factors (Ajzen 2011). Instead of outcomes, behaviours or actions are under the control of an employee (Koopmans et al. 2013). Individual's ACAP has a weak significant effect on an individual's learning behaviour. Individual's ACAP is a mediating effect towards learning behaviour. See Chapter 5 for further information about the results.

These results relied on 199 data records collected via an online questionnaire. However, the validity of this data should be addressed by the PLS-SEM analysis. The results validity relied also on the PLS-SEM measurement and structural model assessment. Mistakes and errors are still possible, however, in Chapter 5, a great amount of effort has been placed to ensure validity of these results.

6.1.7 Conclusion

The aim was satisfied even though the results were not as decisive as we had hoped. Objectives have also been satisfied although future research could further fulfil these objectives. The rejection or not of the hypotheses used to answer the research question are sustained by reliable results.

6.2 Discussion on Research Findings

As the results in Chapter 5 establish which hypotheses are supported, these are discussed further in the following section and how they relate to findings from other research.

H1: Optimism positively influences individual ACAP.

Optimism has a very weak effect on individual ACAP. Although expected, this finding was still surprising. Szulanski (1996) found that motivation was not a barrier to knowledge transference. While Optimism in technology and motivation in knowledge transference are not immediately perceived as directly related, there is, after reflection, a genuine question about how Optimism and motivation are related.

H2: Insecurity does not negatively influence individual ACAP.

Insecurity was not established to have a negative influence on ACAP. This may be because the sample population was on average pioneers. Future research could investigate a sample

population of paranoids or laggards. While the results are disappointing, they are sustained by the collected data and an appropriate analysis method.

H3a: Innovation positively influences individual ACAP.

Even though Innovation has a very weak effect on ACAP, the rejection of its null hypothesis is aligned with Lowik, Kraaijenbrink & Groen (2017) findings' that Innovation has a positive effect on individual ACAP. Lowik, Kraaijenbrink & Groen (2017) researched if individual ACAP affected innovation performance. This study shows that believing in technological innovation enhances individual ACAP and learning behaviour.

H3b: Innovation does not negatively influence individual ACAP.

Innovation has a positive and not a negative influence. As this null hypothesis was not rejected, as it aligns with what was said in the previous section.

H4: Discomfort does not negatively influence individual ACAP.

Discomfort like Insecurity was not established to have a negative influence on ACAP. Again, this could also be because of the sample population being on average pioneers rather than paranoid or laggard. Similar to insecurity, sampling another population may yield different results.

H5: Tools for Knowledge Source does not influence individual ACAP.

TKS does not appear to affect individual ACAP. This was unexpected as knowledge sources are an antecedent to ACAP, their tools could have had an effect as well. The results, however, show that these have no effect. This suggests that there is a distinction between technology and knowledge.

H6: Social Influences do not affect ACAP through Assimilation.

SI have no effect on individual ACAP. This was surprising because Venkatesh et al. (2003) suggested that SI had an effect on individuals that were either women or with experience, however, this was when adopting technologies and not absorbing knowledge. Perhaps the distinction between technology and knowledge is greater than expected.

H7: Social Networks affect ACAP through Assimilation.

The other finding is that SN has a significant causal-effect on individual ACAP through Assimilation. The effect of SN is very weak. SN has an effect on an individual's understanding. With the advent of social media and its popularity, future research could investigate their effect on learning in more detail.

H8: Individual's ACAP affects their learning behaviour.

An individual's ACAP has a significant weak effect on their learning behaviour. This effect demonstrates that absorbing knowledge has an effect on behaviour. This indicates that individual ACAP can be a mediator to individual learning behaviour. This lends to Ajzen (2011) statement where he suggests that beliefs are not solely responsible for behaviour. This causal effect from individual ACAP to learning behaviour could be adapted when investigating knowledge transfer failures or for future research.

Optimism and Innovation are technological motivators while Insecurity and Discomfort are technological inhibitors (Parasuraman 2000). Insecurity and Discomfort appear to not have a causal-effect on individual ACAP. The average and median participant is a pioneer as their beliefs in motivators and inhibitors are high. Perhaps a different population sample might yield different results. TKS and SI appear not to affect an individual's learning capability but Social Networks appear to do so. Finally, the results showed that individual ACAP has an effect on their learning behaviour.

6.3 Contribution and Implications of the Results

This study and the implications of its results contribute to both theoretical fields and practical application in the areas of learning and technology.

6.3.1 Theoretical Implications

The theoretical implication from this study shows that behaviour is not solely affected by beliefs, that it contributes to already existing research and that its failure still has value to offer.

Its results also add to the underlying theory of planned behaviour that says beliefs influence behaviour (Ajzen 1991) . The very weak effect that individual technological beliefs has on individuals does pertain to Ajzen (2011) revision of his (Ajzen 1991) theory where he states that there are other factors than beliefs that affect people's behaviour.

Never-the-less, this study demonstrates that individual ACAP is a mediating factor towards individual learning behaviour. This adds to the literature about learning and performance. Obviously further research would help understand this causal-effect in more detail.

This study adds to the literature on individual ACAP, IWP, SN and PLS-SEM. However, this could be expected from all research. While individual ACAP has little research (Lowik, Kraaijenbrink & Groen 2017; Minbaeva, Mäkelä & Rabbiosi 2012), this study shows that there is a relation between individuals' learning and behaviour. It would be of great value to further investigate said relation from a theoretical perspective as well as a practical one. As technology becomes more embedded into individuals' lives, the findings that SN has an effect on individual's learning further ads to the increasing interest in leveraging SN to enhance learning. PLS-SEM is gaining popularity. Even though this study may not contribute much to the already existing pool of literature using PLS-SEM, it never-the-less does.

While it is disappointing that other concepts such as Insecurity, Discomfort, TKS or SI were not shown to have an effect on individual ACAP, this still contributes to research. The absence of an effect from TKS to individual ACAP in particular does imply that perhaps in regards to knowledge transfer the tool is not the issue but rather the knowledge source itself. Lowik, Kraaijenbrink & Groen (2017) recommends further investigation of the effect of antecedents on individual ACAP. Perhaps technology may not be at fault when knowledge transfer fails. Though, further research would be required to investigate and sustain this.

6.3.2 Practical Implications

This study has practical implications with its findings on Optimism, Innovation and SN. Its model also offers an instrument to measure learning and behaviour.

The findings show that Optimism and Innovation have a significant very weak effect. This implies that individuals with Optimism and Innovation technological beliefs should have slightly better ACAP. This suggests that perhaps teaching individuals to be optimistic and innovative with technology will improve their learning capability slightly. This might only be observable over a long period of time. Never-the-less, efforts should be dedicated to increase individuals' motivation in technology such as Optimism and Innovation to improve their learning behaviour. Lowik, Kraaijenbrink & Groen (2017) makes recommendations to improve innovation which are bisociative cognitive style and network diversity.

Learning practices should also take into account Social Networks of individuals as they have a significant very weak causal-effect on individual ACAP through assimilation. Pedagogues could take note of the SN their students belong to. Students should also be made aware that expanding their social circle might help them increase their individual ACAP as network diversity enhances individual ACAP (Lowik, Kraaijenbrink & Groen 2017).

While Optimism, Innovation and SN may each have a very weak effect on individual ACAP, the combination of all these factors together might have a greater effect than anticipated. Discovering other constructs which have a positive influence on individual ACAP may help understand learning further and help guide pedagogues further.

While this study has limitations, frameworks can still offer advantages and remain helpful (Mishra & Koehler 2006). This study demonstrates an application for individual ACAP and the IWP as a new method to measure individual learning to their behaviour using PLS-SEM. Individual ACAP has a mediating effect on learning behaviour. Further investigation of the relation between individual ACAP and IWP could further improve the practical application of this model. This study offers practitioners a model and method to further understand how students approach technology.

6.4 Limitations and Recommendations for Future Research

While this study did its best to provide reliable and honest results, it still has limitations. Among these limitations, those identified so far were demographic bias; self-reporting bias; social network as an ambiguous term; an organisation is not only the sum of its individuals; the truth in ACAP; ACAP is a dynamic capability; the different versions of ACAP; PLS-SEM limitations, and innovation has many meanings; insecurity, discomfort, TKS and SI; innovation can mean many different things; the IWP limitation; and limitations from other work this study builds upon. All these limitations are discussed further below.

6.4.1 Demographic Bias

Large population sampling in quantitative research reduces the chance of outliers (Fowler & Lapp 2019). However this does not erase said chance but only reduces it. 141 students who answered were studying for a Ph.D., 13 for a master's degree, and 45 for a bachelor's degree as stated in Chapter 5. While this study has a visible demographic skewness, BCa

bootstrapping should hopefully address any skewness of data (Hair, Risher & Ringle 2019). Never-the-less, these are all university students. While university students could be assumed to have high ACAP, the average and median participant appears to be according to the TRI a pioneer. This could be due to the data collection method as online questionnaires use technology which could have deterred paranoids or laggards from answering said questionnaire. The future research with a different sample population would expand this research. A laggard population could be sampled using data collection methods that are more suited for laggards instead of a technological online questionnaire.

6.4.2 Self-Reporting Bias

Another potential limitation could stem from individuals themselves which is known as the self reporting bias. As individuals emphasize merits and downplay faults, they are motivated to self-enhance which is known as the leniency effect (van der Heijden & Nijhof 2004). This leniency effect according to Koopmans et al. (2013) is a limitation of the IWP. While participants have been informed that this questionnaire was voluntary and anonymous, they could still have been prone to self-reporting bias for the IWP and other concepts like ACAP. Again, BCa bootstrapping should mitigate data skewness (Hair, Risher & Ringle 2019).

6.4.3 Social Network is an Ambiguous Term

The other limitation that stemmed from individuals came from their own understanding. Even though the questionnaire was tested prior to distribution, a few participants have reported that "Social Network" was ambiguous as it could pertain to both real life and technology. This ambiguity was deliberate to invoke both Social Networking Sites and Services in the participants' minds. Participants could still be confused or misunderstand other terms or questions in the survey. However this would have been mitigated with the anonymous test before the questionnaire was released. Also if this ambiguity was to bias the data, the

rejection of the null hypothesis should still remain because the measurement and structural model were assessed appropriately as demonstrated in Chapter 5.

6.4.4 An Organisation is Not Only the Sum of its Individuals

The focus of this study on individuals is also a limitation. While ACAP was initially conceptualised from individuals' learning cognitive ability (Cohen & Levinthal 1990), Cohen and Levinthal (1990, p.131) state that "an organization's absorptive capacity will depend on the absorptive capacities of its individual members" and that "a firm's absorptive capacity is not simply the sum of the absorptive capacities of its employees". The expectation that individual role and organisational goals are interdependent (Pradhan & Jena 2017) is an assumption. The research scope on individuals might not be translatable into collective or organisational ACAP. This warrants further research.

6.4.5 The Truth in Absorptive Capacity

Another limitation of ACAP is that it does not consider truth within knowledge. Szulanski (2000) explained that in the transformation capability, the amount of time and effort needed to reconfigure the knowledge process was dependent on how ingrained the experience was. While experience confers justification to belief, warrant is required for true belief to become knowledge (Huemer 2013). For it to be knowledge it needs to be true, justified and believed (Plato 1999). Nowhere within ACAP is the element of truth discussed. This limitation still exists even at the individual scope. It would be very interesting to understand where and how truth pertains in individuals' ACAP.

6.4.6 ACAP is a Dynamic Capability

The ACAP framework is dynamic and not static (Zahra & George 2002). A dynamic capability gains an advantage when its dimensions gain resources and competencies (Teece, Pisano & Shuen 1997). This means that ACAP can change over time depending on factors.

To assess said change over time a longitudinal study would be required, but alas this was impossible as this study had limited time for its completion. It would be interesting to see how individual ACAP changes over time and this could be investigated in future research.

6.4.7 The Different Versions of ACAP

There have been multiple iterations of said ACAP. The Cohen & Levinthal (1990) version did not make a distinction between Transformation and Assimilation, and instead only recognised Assimilation. This version was thought to be a bit too abstract. Todorova & Durisin (2007) proposed a more detailed revision of ACAP. This version was a bit too rigid. This study preferred to use Zahra & George (2002) version of the ACAP framework for its simplicity while keeping Transformation as a separate process from Assimilation. This version appeared to be balanced between abstract and rigid. However the difference between versions remains a limitation.

6.4.8 PLS-SEM Limitations

BCa bootstrapping was used to mitigate any skewness in the data that this study used. This method may have limitations. PLS-SEM certainly does with its focus on maximising partial model structures (Hair, Ringle & Sarstedt 2011). However all statistical methods are prone to shortfalls (Henseler et al. 2014). As limitations still exist and mistakes can happen, this study has done its best to provide reliable and honest results.

6.4.9 Insecurity, Discomfort, TKS and SI

The results of this study were unable to establish that Insecurity, Discomfort, TKS and SI has an effect on ACAP. The discussion did not elaborate on this as there was no contribution to add to the default state of the null hypothesis. There is, however, still value to know that these constructs have no effect in this research context as perhaps a different context may prove that these do have an effect.

6.4.10 Innovation Can Mean Many Different Things

In this study, Innovation is, using Parasuraman (2000) definition, which is that, "a tendency to be a technology pioneer and thought leader". However, Innovation has many other definitions. Zaltman, Duncan & Holbek (1973) offer three definitions to innovation which are the combination of entities or concepts that produce a unique configuration, the process of adoption, and finally, a novel idea, practice or object has been invented irrespective if it is adopted or not. Dewar & Dutton (1986) redefine innovation to include its adoption process. An individual's social environment can motivate and drive the adoption of an innovation (Talukder 2012). It is also an idea, practice, or material artefact perceived to be new by the relevant unit of adoption (Dewar & Dutton 1986). Innovation may appear as a fashion trend although it originates from anti-conformity. Dewar & Dutton (1986) do make a distinction between the two types of innovations: radical and incremental. Radical innovation can lead to a major modification of a product or process which requires depth of knowledge provided by technical experts (Dewar & Dutton 1986). Whereas incremental innovation does not require as much knowledge depth as they are small improvements or adjustments (Dewar & Dutton 1986). Limaj & Bernroider (2019) defines innovations as exploratory or exploitative. Exploratory innovation is exploring for new opportunities to make new products (Limaj & Bernroider 2019). Exploitative innovation is merely exploiting existing capabilities to make incremental changes to a product (Limaj & Bernroider 2019). Limaj & Bernroider (2019) explicitly use the word 'incremental' to define exploitative. The difference lies with the focus on the process rather than the outcome. Radical and incremental innovation differ by the amount of their new technical content and knowledge (Dewar & Dutton 1986). This was not measured in this study. Perhaps future research could investigate if there is a relation between successful innovation adoption and the amount of knowledge absorbed required for innovation adoption.

6.4.11 The IWP Limitation

One limitation of the IWP is antithetical items which are items that are not opposite but measure the same content (Dalal 2005; Koopmans et al. 2013). For example, contextual performance and counterproductive work behaviour could potentially measure the same item more than once (Koopmans et al. 2013). As the IWP items suffer from not measuring all dimensions together, it also does not incorporate all individual behaviours (Koopmans et al. 2013).

6.4.12 Limitations from Other Research

Furthermore this study would inherit all the limitations of the previous research it uses to build upon such as the TRI, ACAP, IWP and other constructs. The sparseness of empirical research has hindered the development of the IWP (Pradhan & Jena 2017). Further research is needed to improve the IWP (Koopmans et al. 2013; Pradhan & Jena 2017). Hopefully, this research's contribution to IWP will further warrant its interest.

6.4.13 Conclusion

This study did its best to provide enough evidence to warrant to its results. These results however are not absolute. They require qualifications and have limitations. As stated before, frameworks even though at times poor can still offer benefits and be useful (Mishra & Koehler 2006). These results answered the research question as best as it could.

6.5 Summary

This study has demonstrated that an individual's technological belief of Optimism and Innovation has a very weak effect on their capability to absorb knowledge, and that SN has a very weak effect on an individual's understanding when absorbing knowledge, and

furthermore that an individuals' capability to absorb knowledge has a weak effect on their learning behaviour.

Using a quantitative approach required a large population sample. Online questionnaires allowed data to be collected from participants over a large distance. 199 records were used for the analysis. PLS-SEM, as a quantitative method was able to analyse large collected data sets to provide results that can be recalculated. While this study may fall short because of its limitations, these have been acknowledged in Chapter 6. It has done its best to be transparent to provide validity to its results. Even if the results are weak at best, they never-the-less answer the question that it set out to answer. Its insight tells that efforts should be directed to an individual technological Optimism and Innovation, as an individual's SN could influence his or her understanding and an individual's learning capability could lead to learning behaviour. Its findings will hopefully be of use to other researchers, organisations, pedagogues and the general public. The model could be adapted for future research or to make a measuring instrument. The journey to bridge knowledge and technology is a long one, even if one stumbles, one must persevere to progress.

References

Adams, G.L. & Lamont, B.T. 2003, 'Knowledge management systems and developing sustainable competitive advantage', *Journal of Knowledge Management*, vol. 7, no. 2,pp. 142-54.

Adeyinka, T., Mutula, S.M., Athulang, M. & Angelina, T. 2010, 'An Evaluation of WebCT Course Content Management System at the University of Botswana', *International Journal of E-Adoption (IJEA)*, vol. 2, no. 2,pp. 48-78.

Aguirre-Urreta, M.I. & Rönkkö, M. 2018, 'STATISTICAL INFERENCE WITH PLSC USING BOOTSTRAP CONFIDENCE INTERVALS', *MIS Quarterly*, vol. 42, no. 3,pp. 1001-20.

Ajzen, I. 1991, 'The Theory of Planned Behavior', *Organizational Behavior and Human Decision Processes*, vol. 50, no. 2,pp. 179-211.

Ajzen, I. 2011, 'The theory of planned behaviour: Reactions and reflections', *Psychology & Health*, vol. 26, no. 9,pp. 1113-27.

Babin, B.J., Hair, J.F. & Boles, J.S. 2008, 'Publishing Research in Marketing Journals Using Structural Equation Modeling', *Journal of Marketing Theory and Practice*, vol. 16, no. 4,pp. 279-86.

Bagozzi, R.P. & Yi, Y. 1988, 'On the evaluation of structural equation models', *Journal of the Academy of Marketing Science*, vol. 16, no. 1,pp. 74-94.

Becker, J.-M., Hwa, C., Ringle, C., Sarstedt, M. & Hair, J. 2019, 'How to specify, estimate, and validate higher-order constructs in PLS-SEM', *Australasian Marketing Journal (AMJ)*.

Becker, J.-M., Klein, K. & Wetzels, M. 2012, 'Hierarchical Latent Variable Models in PLS-SEM: Guidelines for Using Reflective-Formative Type Models', *Long Range Planning*, vol. 45, no. 5,pp. 359-94.

Becker, J.-M., Ringle, C.M., Sarstedt, M. & Völckner, F. 2015, 'How collinearity affects mixture regression results', *Marketing Letters*, vol. 26, no. 4,pp. 643-59.

Beydoun, G., Kultchitsky, R. & Manasseh, G. 2007, 'Evolving semantic web with social navigation', *Expert Systems with Applications*, vol. 32, no. 2,pp. 265-76.

Bhatt, G.D. 2001, 'Knowledge management in organizations: examining the interaction between technologies, techniques, and people', *Journal of Knowledge Management*, vol. 5, no. 1,pp. 68-75.

Bloomfield, J. & Fisher, M.J. 2019, 'Quantitative research design', *Journal of the Australasian Rehabilitation Nurses' Association (JARNA)*, vol. 22, no. 2,pp. 27-30.

Bollen, K.A. 1989, *Structural Equations with Latent Variables*, John Wiley & Sons, Incorporated, Somerset, UNITED STATES.

Bollen, K.A. & Long, J.S. 1993, *Testing Structural Equation Models*, SAGE Publications.

Boyd, D.M. & Ellison, N.B. 2007, 'Social Network Sites: Definition, History, and Scholarship', *Journal of Computer-Mediated Communication*, vol. 13, no. 1,pp. 210-30.

Byrne, B.M. 1998, *Structural Equation Modeling with LISREL, PRELIS, and SIMPLIS: Basic Concepts, Applications, and Programming*, L. Erlbaum Associates.

Cassel, C., Hackl, P. & Westlund, A.H. 1999, 'Robustness of partial least-squares method for estimating latent variable quality structures', *Journal of Applied Statistics*, vol. 26, no. 4,pp. 435-46.

Chan, A.Y.K., Chow, K.O. & Jia, W. 2003, 'A Framework for Evaluation of Learning Effectiveness in Online Courses', Springer Berlin Heidelberg, Berlin, Heidelberg, pp. 383-95.

Cheah, J.-H., Ting, H., Ramayah, T., Memon, M.A., Cham, T.-H. & Ciavolino, E. 2019, 'A comparison of five reflective–formative estimation approaches: reconsideration and recommendations for tourism research', *Quality & Quantity*, vol. 53, no. 3,pp. 1421-58.

Coates, H., James, R. & Baldwin, G. 2005, 'A Critical Examination Of The Effects Of Learning Management Systems On University Teaching And Learning', *Tertiary Education and Management*, vol. 11, no. 1,pp. 19-36.

Cohen, W.M. & Levinthal, D.A. 1990, 'Absorptive Capacity: A New Perspective on Learning and Innovation', *Administrative Science Quarterly*, vol. 35, no. 1,pp. 128-52.

Colby, C.L. 2002, *E-Techno-Ready Marketing of e-Services Customer Beliefs About Technology and the Implications for Marketing e-Services*, Routledge, Armonk, UNITED STATES.

Colby, C.L. & Parasuraman, A. 2001, *Techno-Ready Marketing: How and Why Customers Adopt Technology*, Free Press.

Coleman, V.I. & Borman, W.C. 2000, 'Investigating the Underlying Structure of the Citizenship Performance Domain', *Human Resource Management Review*, vol. 10, no. 1,pp. 25-44.

Collins, T. 1990, 'The impact of microcomputer word processing on the performance of learning disabled students in a required first-year writing course', *Computers and Composition*, vol. 8, no. 1,pp. 49-67.

Conway, J.M. 1999, 'Distinguishing contextual performance from task performance for managerial jobs', *Journal of Applied Psychology*, vol. 84, no. 1,pp. 3-13.

Cronbach, L.J. & Gleser, G.C. 1965, *Psychological tests and personnel decisions*, U. Illinois Press, Oxford, England.

Da Silva, N. & Davis, A.R. 2011, 'Absorptive Capacity at the Individual Level: Linking Creativity to Innovation in Academia', *The review of higher education*, vol. 34, no. 3,pp. 355-79.

Dalal, R.S. 2005, 'A Meta-Analysis of the Relationship Between Organizational Citizenship Behavior and Counterproductive Work Behavior', *Journal of Applied Psychology*, vol. 90, no. 6,pp. 1241-55.

Damodaran, L. & Olphert, W. 2000, 'Barriers and facilitators to the use of knowledge management systems', *Behaviour & Information Technology*, vol. 19, no. 6,pp. 405-13.

Davenport, T.H. & Prusak, L. 1998, *Working Knowledge: How Organizations Manage What They Know*, Harvard Business School Press, Boston.

Day, S.L. & Edwards, B.J. 1996, 'Assistive Technology for Postsecondary Students with Learning Disabilities', *Journal of Learning Disabilities*, vol. 29, no. 5,pp. 486-92.

Dewar, R.D. & Dutton, J.E. 1986, 'The Adoption of Radical and Incremental Innovations: An Empirical Analysis', *Management Science*, vol. 32, no. 11,pp. 1422-33.

Diamantopoulos, A. & Winklhofer, H.M. 2001, 'Index Construction with Formative Indicators: An Alternative to Scale Development', *Journal of Marketing Research*, vol. 38, no. 2,pp. 269-77.

Dijkstra, T.K. & Henseler, J. 2015, 'CONSISTENT PARTIAL LEAST SQUARES PATH MODELING', *MIS Quarterly*, vol. 39, no. 2,pp. 297-A5.

Dolce, P., Esposito Vinzi, V. & Lauro, C. 2017, 'Predictive Path Modeling Through PLS and Other Component-Based Approaches: Methodological Issues and Performance Evaluation', in H. Latan & R. Noonan (eds), *Partial Least Squares Path Modeling: Basic Concepts, Methodological Issues and Applications*, Springer International Publishing, Cham, pp. 153-72.

Dolmark, T., Sohaib, O. & Beydon, G. 2019, 'The Effect of Technology Readiness on Individual Absorptive Capacity for Knowledge Transfer', *ISD 2019*, ed. C.B. A. Siarheyeva, M. Lang, H. Linger, & C. Schneider, Information Systems Development: Information Systems Beyond 2020 (ISD2019 Proceedings), Toulon, France: ISEN Yncréa Méditerranée.

Ellison, N.B., Steinfield, C. & Lampe, C. 2007, 'The Benefits of Facebook "Friends:" Social Capital and College Students' Use of Online Social Network Sites', *Journal of Computer-Mediated Communication*, vol. 12, no. 4,pp. 1143-68.

Fornell, C. & Bookstein, F.L. 1982, 'Two Structural Equation Models: LISREL and PLS Applied to Consumer Exit-Voice Theory', *Journal of Marketing Research*, vol. 19, no. 4,pp. 440-52.

Fornell, C. & Larcker, D.F. 1981a, 'Evaluating Structural Equation Models with Unobservable Variables and Measurement Error', *Journal of Marketing Research*, vol. 18, no. 1,pp. 39-50.

Fornell, C. & Larcker, D.F. 1981b, 'Structural equation models with unobservable variables and measurement error: Algebra and statistics', *JMR, Journal of Marketing Research (pre-1986)*, vol. 18, no. 000003,p. 382.

Fowler, S.B. & Lapp, V. 2019, 'Sample size in quantitative research: Sample size will affect the significance of your research', *American Nurse Today*, vol. 14, p. 61+.

Garavelli, A.C., Gorgoglione, M. & Scozzi, B. 2002, 'Managing knowledge transfer by knowledge technologies', *Technovation*, vol. 22, no. 5,pp. 269-79.

García-Morales, V.J., Ruiz-Moreno, A. & Llorens-Montes, F.J. 2007, 'Effects of Technology Absorptive Capacity and Technology Proactivity on Organizational Learning, Innovation and Performance: An Empirical Examination', *Technology Analysis & Strategic Management*, vol. 19, no. 4,pp. 527-58.

George, D.R. & Dellasega, C. 2011, 'Use of social media in graduate-level medical humanities education: Two pilot studies from Penn State College of Medicine', *Medical Teacher*, vol. 33, no. 8,pp. e429-e34.

Goh, S.C. 2002, 'Managing effective knowledge transfer: an integrative framework and some practice implications', *Journal of Knowledge Management*, vol. 6, no. 1,pp. 23-30.

Gupta, S. & Bashir, L. 2018, 'SOCIAL NETWORKING USAGE QUESTIONNAIRE: DEVELOPMENT AND VALIDATION IN AN INDIAN HIGHER EDUCATION CONTEXT', *Turkish Online Journal of Distance Education (TOJDE)*, vol. 19, no. 4,pp. 214-27.

Hair, J.F. 2017, *A primer on partial least squares structural equation modeling (PLS-SEM)*, Second edition. edn, Sage, Thousand Oaks, California.

Hair, J.F., Ringle, C.M. & Sarstedt, M. 2011, 'PLS-SEM: Indeed a Silver Bullet', *Journal of Marketing Theory and Practice*, vol. 19, no. 2,pp. 139-52.

Hair, J.F., Risher, J.J.S., Marko & Ringle, C.M. 2019, 'When to use and how to report the results of PLS-SEM', *European Business Review*, vol. 31, no. 1,pp. 2-24.

Hair, J.F., Sarstedt, M., Pieper, T.M. & Ringle, C.M. 2012, 'The Use of Partial Least Squares Structural Equation Modeling in Strategic Management Research: A Review of Past Practices and Recommendations for Future Applications', *Long Range Planning*, vol. 45, no. 5,pp. 320-40.

Hair, J.F., Sarstedt, M., Ringle, C.M. & Mena, J.A. 2012, 'An assessment of the use of partial least squares structural equation modeling in marketing research', *Journal of the Academy of Marketing Science*, vol. 40, no. 3,pp. 414-33.

Hair Joseph, F., Sarstedt, M. & Ringle, C.M. 2019, 'Rethinking some of the rethinking of partial least squares', *European Journal of Marketing*, vol. 53, no. 4,pp. 566-84.

Hair Jr., J.F., Hult, G.T.M., Ringle, C.M. & Sarstedt, M. 2014, *A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM)*, SAGE Publications.

Hair Jr., J.F., Sarstedt, M., Hopkins, L. & Kuppelwieser, V.G. 2014, 'Partial least squares structural equation modeling (PLS-SEM): An emerging tool in business research', *European Business Review (Bingley)*, vol. 26, no. 2,pp. 106-21.

Hallikainen, H. & Laukkanen, T. 2016, 'How technology readiness explains acceptance and satisfaction of digital services in B2b healthcare sector?', *PACIS*, p. 294.

Hamilton, E.R., Rosenberg, J.M. & Akcaoglu, M. 2016, 'The Substitution Augmentation Modification Redefinition (SAMR) Model: a Critical Review and Suggestions for its Use', *TechTrends*, vol. 60, no. 5,pp. 433-41.

Haseman, W.D., Nazareth, D.L. & Paul, S. 2005, 'Implementation of a group decision support system utilizing collective memory', *Information & Management*, vol. 42, no. 4,pp. 591-605.

Haythornthwaite, C. 2005, 'Social networks and Internet connectivity effects', *Information, Communication & Society*, vol. 8, no. 2,pp. 125-47.

Henseler, J., Dijkstra, T.K., Sarstedt, M., Ringle, C.M., Diamantopoulos, A., Straub, D.W., Ketchen, D.J., Hair, J.F., Hult, G.T.M. & Calantone, R.J. 2014, 'Common Beliefs and Reality About PLS:Comments on Rönkkö and Evermann (2013)', *Organizational Research Methods*, vol. 17, no. 2,pp. 182-209.

Henseler, J., Ringle, C.M. & Sarstedt, M. 2015, 'A new criterion for assessing discriminant validity in variance-based structural equation modeling', *Journal of the Academy of Marketing Science*, vol. 43, no. 1,pp. 115-35.

Huemer, M. 2013, 'Epistemological asymmetries between belief and experience', *Philosophical Studies*, vol. 162, no. 3,pp. 741-8.

Hunt, S.T. 1996, 'GENERIC WORK BEHAVIOR: AN INVESTIGATION INTO THE DIMENSIONS OF ENTRY-LEVEL, HOURLY JOB PERFORMANCE', *Personnel Psychology*, vol. 49, no. 1,pp. 51-83.

Hwang, H.-G., Chang, I.C., Chen, F.-J. & Wu, S.-Y. 2008, 'Investigation of the application of KMS for diseases classifications: A study in a Taiwanese hospital', *Expert Systems with Applications*, vol. 34, no. 1,pp. 725-33.

Iyengar, K., Sweeney, J.R. & Montealegre, R. 2015, 'Information Technology Use as a Learning Mechanism: The Impact of IT Use on Knowledge Transfer Effectiveness, Absorptive Capacity, and Franchisee Performance', *Mis Quarterly*, vol. 39, no. 3,pp. 615-41.

Jacobs, M.J. & Buys, A.J. 2010, 'Evaluating the Military's Technology Absorptive Capacity', *PICMET 2010 Technology Management For Global Economic Growth*, Phuket, pp. 1-6.

Jansen, J.J.P., Van Den Bosch, F.A.J. & Volberda, H.W. 2005, 'Managing Potential and Realized Absorptive Capacity: How Do Organizational Antecedents Matter?', *The Academy of Management Journal*, vol. 48, no. 6,pp. 999-1015.

Johnson, R.E., Rosen, C.C. & Chang, C.-H. 2011, 'To Aggregate or Not to Aggregate: Steps for Developing and Validating Higher-Order Multidimensional Constructs', *Journal of Business and Psychology*, vol. 26, no. 3,pp. 241-8.

Kamel Boulos, M.N. & Wheeler, S. 2007, 'The emerging Web 2.0 social software: an enabling suite of sociable technologies in health and health care education', *Health Information And Libraries Journal*, vol. 24, no. 1,pp. 2-23.

Karlsen, J.T. & Gottschalk, P. 2004, 'Factors affecting knowledge transfer in IT projects', *Engineering Management Journal*, vol. 16, no. 1,pp. 3-10.

Kelman, H.C. 1958, 'COMPLIANCE, IDENTIFICATION, AND INTERNALIZATION: THREE PROCESSES OF ATTITUDE CHANGE', *Journal of Conflict Resolution*, vol. 2, no. 1,pp. 51-60.

Kock, N. & Hadaya, P. 2018, 'Minimum sample size estimation in PLS-SEM: The inverse square root and gamma-exponential methods', *Information Systems Journal*, vol. 28, no. 1,pp. 227-61.

Koehler, M.J., Mishra, P., Kereluik, K., Shin, T.S. & Graham, C.R. 2014, 'The Technological Pedagogical Content Knowledge Framework', *Handbook of research on educational communications and technology*, Springer, pp. 101-11.

Koopmans, L., Bernaards, C., Hildebrandt, V., Buuren, S.v., van der Beek, A.J. & de Vet, H.C.W. 2013, 'Development of an individual work performance questionnaire', *International Journal of Productivity and Performance Management*, vol. 62, no. 1,pp. 6-28.

Koopmans, L., Bernaards, C.M., Hildebrandt, V.H., Schaufeli, W., de Vet, H.C.W. & van der Beek, A.J. 2011, 'Conceptual frameworks of individual work performance – A systematic review', *Journal of Occupational and Environmental Medicine*, vol. 53, no. 8,pp. 846-66.

Kumar, V. & Bradford, J. 2017, 'An investigation into the development of the absorptive capacity of manufacturing SMEs AU - Saad, Mohammed', *International Journal of Production Research*, vol. 55, no. 23,pp. 6916-31.

Kuo, R.Z. & Lee, G.G. 2009, 'KMS adoption: the effects of information quality', *Management Decision*, vol. 47, no. 10,pp. 1633-51.

Kuss, D.J. & Griffiths, M.D. 2011, 'Online Social Networking and Addiction-A Review of the Psychological Literature', *International Journal of Environmental Research and Public Health*, vol. 8, no. 9,pp. 3528-52.

Lee, J.-K. & Lee, W.-K. 2008, 'The relationship of e-Learner's self-regulatory efficacy and perception of e-Learning environmental quality', *Computers in Human Behavior*, vol. 24, no. 1,pp. 32-47.

Lee, L., Petter, S., Fayard, D. & Robinson, S. 2011, 'On the use of partial least squares path modeling in accounting research', *International Journal of Accounting Information Systems*, vol. 12, no. 4,pp. 305-28.

Leung, L. 2002, 'Loneliness, self-disclosure, and ICQ ("I seek you") use', *Cyberpsychology & Behavior: The Impact Of The Internet, Multimedia And Virtual Reality On Behavior And Society*, vol. 5, no. 3,pp. 241-51.

Limaj, E. & Bernroider, E.W.N. 2019, 'The roles of absorptive capacity and cultural balance for exploratory and exploitative innovation in SMEs', *Journal of Business Research*, vol. 94, pp. 137-53.

Lin, C.-H., Shih, H.-Y. & Sher, P.J. 2007, 'Integrating Technology Readiness into Technology Acceptance: The TRAM Model', *Psychology & Marketing*, vol. 24, no. 7,pp. 641-57.

Lin, C., Chang, S. & Chang, C.-S. 2004, 'The impact of technology absorptive capacity on technology transfer performance', *International journal of technology transfer and commercialisation*, vol. 3, no. 4,pp. 384-409.

Lin, T.-C. & Huang, C.-C. 2008, 'Understanding knowledge management system usage antecedents: An integration of social cognitive theory and task technology fit', *Information & Management*, vol. 45, no. 6,pp. 410-7.

Lopez-Cruz, O. & Garnica, N.J. 2018, 'Engineering Organizational Absorptive Capacity for Effective Knowledge Transfer', *International Conference on Software Process Improvement*, Springer International Publishing, Cham, pp. 186-97.

Lowik, S., Kraaijenbrink, J. & Groen, A.J. 2017, 'Antecedents and effects of individual absorptive capacity: a micro-foundational perspective on open innovation', *Journal of Knowledge Management*, vol. 21, no. 6,pp. 1319-41.

Lust, G., Juarez Collazo, N.A., Elen, J. & Clarebout, G. 2012, 'Content Management Systems: Enriched learning opportunities for all?', *Computers in Human Behavior*, vol. 28, no. 3,pp. 795-808.

Marcoulides, G.A. & Chin, W.W. 2013, 'You Write, but Others Read: Common Methodological Misunderstandings in PLS and Related Methods', *New Perspectives in Partial Least Squares and Related Methods*, eds H. Abdi, W.W. Chin, V. Esposito Vinzi, G. Russolillo & L. Trinchera, Springer New York, New York, NY, pp. 31-64.

Mason, C.H.P., William D. Jr. 1991, 'Collinearity, Power, and Interpretation of Multiple Regressi', *JMR, Journal of Marketing Research*, vol. 28, no. 3,p. 268.

Minbaeva, D.B., Mäkelä, K. & Rabbiosi, L. 2012, 'Linking HRM and knowledge transfer via individual-level mechanisms', *Human Resource Management*, vol. 51, no. 3,pp. 387-405.

Mishra, P. & Koehler, M.J. 2006, 'Technological pedagogical content knowledge: A framework for teacher knowledge', *Teachers College Record*, vol. 108, no. 6,p. 1017.

Monecke, A. & Leisch, F. 2012, 'semPLS: Structural Equation Modeling Using Partial Least Squares', *Journal of Statistical Software*, vol. 48, no. 3,p. 32.

Morahan-Martin, J. & Schumacher, P. 2003, 'Loneliness and social uses of the Internet', *Computers in Human Behavior*, vol. 19, no. 6,pp. 659-71.

Muhammad, A., Zhou, Q., Beydoun, G., Xu, D. & Shen, J. 2016, 'Learning path adaptation in online learning systems', *2016 IEEE 20th International Conference on Computer Supported Cooperative Work in Design (CSCWD)*, pp. 421-6.

Othman, S.H., Beydoun, G. & Sugumaran, V. 2014, 'Development and validation of a Disaster Management Metamodel (DMM)', *Information Processing & Management*, vol. 50, no. 2,pp. 235-71.

Ozkan, S., Koseler, R. & Baykal, N. 2009, 'Evaluating learning management systems: Adoption of hexagonal e-learning assessment model in higher education', *Transforming Government: People, Process and Policy*, vol. 3, no. 2,pp. 111-30.

Parasuraman, A. 2000, 'Technology readiness index (TRI): A multiple-item scale to measure readiness to embrace new technologies', *Journal of Service Research*, vol. 2, no. 4,pp. 307-20.

Parasuraman, A. & Colby, C.L. 2015, 'An Updated and Streamlined Technology Readiness Index: TRI 2.0', *Journal of Service Research*, vol. 18, no. 1,pp. 59-74.

Pempek, T.A., Yermolayeva, Y.A. & Calvert, S.L. 2009, 'College students' social networking experiences on Facebook', *Journal of Applied Developmental Psychology*, vol. 30, no. 3,pp. 227-38.

Peng, D.X. & Lai, F. 2012, 'Using partial least squares in operations management research: A practical guideline and summary of past research', *Journal of Operations Management*, vol. 30, no. 6,pp. 467-80.

Pfeffer, J. & Salancik, G.R. 1979, 'The External Control of Organizations. A Resource Dependence', *The Economic Journal*, vol. 89, no. 356,pp. 969-70.

Plato 1999, *Theaetetus*, Project Gutenberg.

Polanyi, M. 1962, *Personal Knowledge: Towards a Post-critical Philosophy*, Routledge & Kegan Paul, London.

Polanyi, M. 1967, *The Tacit Dimension*, Peter Smith, Gloucester.

Polit, D.F. & Beck, C.T. 2010, 'Generalization in quantitative and qualitative research: Myths and strategies', *International Journal of Nursing Studies*, vol. 47, no. 11,pp. 1451-8.

Pradhan, R.K. & Jena, L.K. 2017, 'Employee Performance at Workplace: Conceptual Model and Empirical Validation', *Business Perspectives and Research*, vol. 5, no. 1,pp. 69-85.

Prusak, L. 1997, *Knowledge in Organizations*, Butterworth-Heinemann, Boston.

Raithel, S., Sarstedt, M., Scharf, S. & Schwaiger, M. 2012, 'On the value relevance of customer satisfaction. Multiple drivers and multiple markets', *Journal of the Academy of Marketing Science*, vol. 40, no. 4,pp. 509-25.

Raskind, M. 1993, 'Assistive technology and adults with learning disabilities: A blueprint for exploration and advancement', *Learning Disability Quarterly*, vol. 16, no. 3,pp. 185-96.

Raskind, M.H. & Scott, N.G. 1993, 'Technology for Postsecondary Students with Learning Disabilities', in S.A. Vogel & P.B. Adelman (eds), *Success for college students with learning disabilities*, Springer, New York, pp. 240-79.

Reinartz, W., Haenlein, M. & Henseler, J. 2009, 'An empirical comparison of the efficacy of covariance-based and variance-based SEM', *International Journal of Research in Marketing*, vol. 26, no. 4,pp. 332-44.

Rigdon, E.E. 2012, 'Rethinking Partial Least Squares Path Modeling: In Praise of Simple Methods', *Long Range Planning*, vol. 45, no. 5,pp. 341-58.

Ringle, C.M., Sarstedt, M. & Straub, D.W. 2012, 'A Critical Look at the Use of PLS-SEM in MIS Quarterly', *MIS Quarterly*, vol. 36, no. 1,pp. iiv-8.

Rogers, E.M. 2003, *Diffusion of innovations*, Free Press.

Rosenberg, J.M. & Koehler, M.J. 2018, 'Context and Teaching with Technology in the Digital Age', in I.R. Management Association (ed.), *Teacher Training and Professional Development: Concepts, Methodologies, Tools, and Applications*, IGI Global, Hershey, PA, pp. 440-65.

Rotundo, M. & Sackett, P.R. 2002, 'The relative importance of task, citizenship, and counterproductive performance to global ratings of job performance: A policy-capturing approach', *Journal of Applied Psychology*, vol. 87, no. 1,pp. 66-80.

Saarinen, T. 1996, 'An expanded instrument for evaluating information system success', *Information & Management*, vol. 31, no. 2,pp. 103-18.

Sadin, S.R., Povinelli, F.P. & Rosen, R. 1989, 'The NASA technology push towards future space mission systems', *Acta Astronautica*, vol. 20, pp. 73-7.

Sarstedt, M., Hair, J.F., Ringle, C.M., Thiele, K.O. & Gudergan, S.P. 2016, 'Estimation issues with PLS and CBSEM: Where the bias lies!', *Journal of Business Research*, vol. 69, no. 10,pp. 3998-4010.

Sarstedt, M., Ringle, C.M., Cheah, J.-H., Ting, H., Moisescu, O.I. & Radomir, L. 2019, 'Structural model robustness checks in PLS-SEM', *Tourism Economics*, p. 1354816618823921.

Shmueli, G. 2010, 'To Explain or to Predict?', *Statistical Science*, vol. 25, no. 3,pp. 289-310.

Shmueli, G. & Koppius, O.R. 2011, 'Predictive Analytics in Information Systems Research', *MIS Quarterly*, vol. 35, no. 3,pp. 553-72.

Shmueli, G., Ray, S., Velasquez Estrada, J.M. & Chatla, S.B. 2016, 'The elephant in the room: Predictive performance of PLS models', *Journal of Business Research*, vol. 69, no. 10,pp. 4552-64.

Sosik, J.J., Kahai, S.S. & Piovoso, M.J. 2009, 'Silver Bullet or Voodoo Statistics?:A Primer for Using the Partial Least Squares Data Analytic Technique in Group and Organization Research', *Group & Organization Management*, vol. 34, no. 1,pp. 5-36.

Subrahmanyam, K., Reich, S.M., Waechter, N. & Espinoza, G. 2008, 'Online and offline social networks: Use of social networking sites by emerging adults', *Journal of Applied Developmental Psychology*, vol. 29, no. 6,pp. 420-33.

Szulanski, G. 1996, 'Exploring Internal Stickiness: Impediments To The Transfer Of Best Practice Within The Firm', *Strategic Management Journal*, vol. 17, no. S2,pp. 27-43.
Szulanski, G. 2000, 'The Process of Knowledge Transfer: A Diachronic Analysis of Stickiness', *Organizational Behavior and Human Decision Processes*, vol. 82, no. 1,pp. 9-27.
Talukder, M. 2012, 'Factors affecting the adoption of technological innovation by individual employees: An Australian study', *Procedia - Social and Behavioral Sciences*, vol. 40, pp. 52-7.
Tang, F., Xi, Y. & Ma, J. 2006, 'Estimating the effect of organizational structure on knowledge transfer: A neural network approach', *Expert Systems with Applications*, vol. 30, no. 4,pp. 796-800.
Teddlie, C. & Tashakkori, A. 2009, *Foundations of Mixed Methods Research: Integrating Quantitative and Qualitative Approaches in the Social and Behavioral Sciences*, SAGE Publications.
Teece, D.J., Pisano, G. & Shuen, A. 1997, 'Dynamic Capabilities and Strategic Management', *Strategic Management Journal*, vol. 18, no. 7,pp. 509-33.
Todorova, G. & Durisin, B. 2007, 'Absorptive Capacity: Valuing a Reconceptualization', *The Academy of Management Review*, vol. 32, no. 3,pp. 774-86.
Tsikriktsis, N. 2004, 'A Technology Readiness-Based Taxonomy of Customers: A Replication and Extension', *Journal of Service Research*, vol. 7, no. 1,pp. 42-52.
Uygur, U. 2013, 'Determinants of causal ambiguity and difficulty of knowledge transfer within the firm', *Journal of Management and Organization*, vol. 19, no. 6,pp. 742-55.
van der Heijden, B.I.J.M. & Nijhof, A.H.J. 2004, 'The value of subjectivity: problems and prospects for 360-degree appraisal systems', *The International Journal of Human Resource Management*, vol. 15, no. 3,pp. 493-511.
Vance, D. & Eynon, J. 1998, 'On the Requirements of Knowledge Transfer Using Information Systems: A Schema Whereby Such Transfer Is Enhanced', *AMCIS 1998 Proceedings 212*, Baltimore, pp. 632-4.
Venkatesh, V., Morris, M.G., Davis, G.B. & Davis, F.D. 2003, 'User Acceptance of Information Technology: Toward a Unified View', *MIS Quarterly*, vol. 27, no. 3,pp. 425-78.
Vlačić, E., Dabić, M., Daim, T. & Vlajčić, D. 2019, 'Exploring the impact of the level of absorptive capacity in technology development firms', *Technological Forecasting and Social Change*, vol. 138, pp. 166-77.
Voorhees, C.M., Brady, M.K., Calantone, R. & Ramirez, E. 2016, 'Discriminant validity testing in marketing: an analysis, causes for concern, and proposed remedies', *Journal of the Academy of Marketing Science*, vol. 44, p. 119+.
Walczuch, R., Lemmink, J. & Streukens, S. 2007, 'The effect of service employees' technology readiness on technology acceptance', *Information & Management*, vol. 44, no. 2,pp. 206-15.
Wang, Y.-S., Wang, H.-Y. & Shee, D.Y. 2007, 'Measuring e-learning systems success in an organizational context: Scale development and validation', *Computers in Human Behavior*, vol. 23, no. 4,pp. 1792-808.
Watson, R. 2015, 'Quantitative research', *Nursing standard (Royal College of Nursing (Great Britain) : 1987)*, vol. 29, pp. 44-8.
Westland, J.C. 2015, 'Partial Least Squares Path Analysis', in J.C. Westland (ed.), *Structural Equation Models: From Paths to Networks*, Springer International Publishing, Cham, pp. 23-46.
Wold, H. 1974, 'Causal flows with latent variables: Partings of the ways in the light of NIPALS modelling', *European Economic Review*, vol. 5, no. 1,pp. 67-86.

Wold, H. 1980, 'Model Construction and Evaluation When Theoretical Knowledge Is Scarce'pp. 47-74.
Wright, K.B. 2017, 'Researching Internet-Based Populations: Advantages and Disadvantages of Online Survey Research, Online Questionnaire Authoring Software Packages, and Web Survey Services', *Journal of Computer-Mediated Communication*, vol. 10, no. 3.
Wright, S. 1921, *Correlation and Causation*.
Yao, F.K. & Chang, S. 2017, 'Do Individual Employees' Learning Goal Orientation and Civic Virtue Matter? A Micro-Foundations Perspective on Firm Absorptive Capacity', *Strategic Management Journal*, vol. 38, no. 10,pp. 2041-60.
Zahra, S.A. & George, G. 2002, 'Absorptive Capacity: A Review, Reconceptualization, and Extension', *The Academy of Management Review*, vol. 27, no. 2,pp. 185-203.
Zaltman, G., Duncan, R. & Holbek, J. 1973, *Innovations & Organizations*, R.E. Krieger Publishing Company.
Zou, B., Guo, F. & Guo, J. 2016, 'Absorptive capacity, technological innovation, and product life cycle: a system dynamics model', *SpringerPlus*, vol. 5, no. 1,p. 1662.

Appendix A Survey Items

PartInfoSheet	THE EFFECT OF TECHNOLOGY AND ITS BELIEF ON INDIVIDUAL ABSORPTIVE CAPACITY IN LEARNING UTS HREC ETH19-4176 PARTICIPANT INFORMATION SHEET WHO IS DOING THE RESEARCH? My name is Thomas Dolmark and I am a student at UTS. My supervisor is Dr Osama Sohaib, Osama.Sohaib@uts.edu.au. WHAT IS THIS RESEARCH ABOUT? This research is to find out about the effect of technology and its belief on individual absorptive capacity in learning. WHY HAVE I BEEN ASKED? You have been invited to participate in this study because you are a UTS student. IF I SAY YES, WHAT WILL IT INVOLVE? If you decide to participate, we will invite you to answer a questionnaire that will take approximately 15 minutes to complete. We do not record any personal information. ARE THERE ANY RISKS/INCONVENIENCE? No, there are no risks involved as personal information is not recorded and the experiment is a 15 min survey. DO I HAVE TO SAY YES? Participation in this study is voluntary. It is completely up to you whether or not you decide to take part. WHAT WILL HAPPEN IF I SAY NO? If you decide not to participate, it will not affect your relationship with the researchers or the University of Technology Sydney. If you wish to withdraw from the study once it has started, you can do so at any time without having to give a reason, by contacting [redacted]@student.uts.edu.au.	

	If you decide to leave the research project, we will not collect additional personal information from you. You should be aware that data collected up to the time you withdraw will form part of the research project results. If you do not want us to do this, you must tell us before you join the research project. CONFIDENTIALITY By signing the consent form, you consent to the research team collecting and using personal information about you for the research project. All this information will be treated confidentially. The survey will not record any identifiable information as it is anonymous. Your information will only be used for the purpose of this research project. We plan to publish the results in a journal. WHAT IF I HAVE CONCERNS OR A COMPLAINT? If you have concerns about the research that you think I or my supervisor can help you with, please feel free to contact us on [redacted]@student.uts.edu.au or Osama.Sohaib@uts.edu.au. NOTE: This study has been approved in line with the University of Technology Sydney Human Research Ethics Committee [UTS HREC] guidelines. If you have any concerns or complaints about any aspect of the conduct of this research, please contact the Ethics Secretariat on phone: +61 2 9514 2478 or email: Research.Ethics@uts.edu.au, and quote UTS HREC ETH19-4176. Any matter raised will be treated confidentially, investigated and you will be informed of the outcome.	
Consent1	CONSENT FORM I agree to participate in the research project "The effect of technology and its belief on individual absorptive capacity in learning" UTS HREC ETH19-4176 being conducted by Thomas Dolmark, [redacted]@student.uts.edu.au.	□ I am 18 years old or above

Consent2	I understand the purposes, procedures and risks of the research as described in the Participant Information Sheet. I have had an opportunity to ask questions and I am satisfied with the answers I have received. I freely agree to participate in this research project as described and understand that I am free to withdraw at any time without affecting my relationship with the researchers or the University of Technology Sydney.	□ I have read the Participant Information Sheet or someone has read it to me in a language that I understand.	
Consent3	I agree that the research data gathered from this project may be published in a form that	□ Does not identify me in any way.	
Consent4	I am aware that I can contact Thomas Dolmark if I have any concerns about the research.	◯ I agree with the terms and condition and hereby agree to participate in this research.	◯ I do **NOT** agree with the terms and condition and hereby wish not to participate in this research.

DEMG1	What gender do you identify as ? - Selected Choice	◯ Prefer not to say	◯ Male	◯ Female	◯ Other _____	◯ I do not know	
DEMG2	What is your age ?	◯ Prefer not to say	◯ 18 - 25	◯ 26 - 35	◯ 36 - 45	◯ Above 45	◯ I do not know
DEMG3	How many years have you been using technology ?	◯ Prefer not to say	◯ 1 - 3 years	◯ 4 - 6 years	◯ More than 7 years	◯ I do not know	
DEMG5	Are you an international or local student ? - Selected Choice	◯ Prefer not to say	◯ Local	◯ International	◯ Other _____	◯ I do not know	
DEMG6	What are you currently studying ?	◯ Prefer not to say	◯ Bachelor's degree	◯ Master's degree	◯ PHD	◯ I do not know	
OPTI1	New technologies contribute to a better quality of life.	◯ Strongly agree	◯ Somewhat agree	◯ Neither agree nor disagree	◯ Somewhat disagree	◯ Strongly disagree	

OPTI2	Technology gives me more freedom of mobility.	◯ Strongly agree	◯ Somewhat agree	◯ Neither agree nor disagree	◯ Somewhat disagree	◯ Strongly disagree
OPTI3	Technology gives people more control over their daily lives.	◯ Strongly agree	◯ Somewhat agree	◯ Neither agree nor disagree	◯ Somewhat disagree	◯ Strongly disagree
OPTI4	Technology makes me more productive in my personal life.	◯ Strongly agree	◯ Somewhat agree	◯ Neither agree nor disagree	◯ Somewhat disagree	◯ Strongly disagree
INNO1	Other people come to me for advice on new technologies.	◯ Strongly agree	◯ Somewhat agree	◯ Neither agree nor disagree	◯ Somewhat disagree	◯ Strongly disagree
INNO2	In general, I am among the first in my circle of friends to acquire new technology when it appears.	◯ Strongly agree	◯ Somewhat agree	◯ Neither agree nor disagree	◯ Somewhat disagree	◯ Strongly disagree
INNO3	I can usually figure out new high-tech products and services without help from others.	◯ Strongly agree	◯ Somewhat agree	◯ Neither agree nor disagree	◯ Somewhat disagree	◯ Strongly disagree
INNO4	I keep up with the latest technological developments in my areas of interest.	◯ Strongly agree	◯ Somewhat agree	◯ Neither agree nor disagree	◯ Somewhat disagree	◯ Strongly disagree
DISC1	When I get technical support from a provider of a high-tech product or service, I sometimes feel as if I am being taken advantage of by someone who knows more than I do.	◯ Strongly agree	◯ Somewhat agree	◯ Neither agree nor disagree	◯ Somewhat disagree	◯ Strongly disagree

DISC2	Technical support lines are not helpful because they don't explain things in terms I understand.	◯ Strongly agree	◯ Somewhat agree	◯ Neither agree nor disagree	◯ Somewhat disagree	◯ Strongly disagree
DISC3	Sometimes, I think that technology systems are not designed for use by ordinary people.	◯ Strongly agree	◯ Somewhat agree	◯ Neither agree nor disagree	◯ Somewhat disagree	◯ Strongly disagree
DISC4	There is no such thing as a manual for a high-tech product or service that's written in plain language.	◯ Strongly agree	◯ Somewhat agree	◯ Neither agree nor disagree	◯ Somewhat disagree	◯ Strongly disagree
INSE1	People are too dependent on technology to do things for them.	◯ Strongly agree	◯ Somewhat agree	◯ Neither agree nor disagree	◯ Somewhat disagree	◯ Strongly disagree
INSE2	Too much technology distracts people to a point that is harmful.	◯ Strongly agree	◯ Somewhat agree	◯ Neither agree nor disagree	◯ Somewhat disagree	◯ Strongly disagree
INSE3	Technology lowers the quality of relationships by reducing personal interaction.	◯ Strongly agree	◯ Somewhat agree	◯ Neither agree nor disagree	◯ Somewhat disagree	◯ Strongly disagree
INSE4	I do not feel confident doing business with a place that can only be reached online.	◯ Strongly agree	◯ Somewhat agree	◯ Neither agree nor disagree	◯ Somewhat disagree	◯ Strongly disagree
TOOLS 1	The systems that the university uses to provide course content (for example, Blackboard) seems to be exactly what I need.	◯ Strongly agree	◯ Somewhat agree	◯ Neither agree nor disagree	◯ Somewhat disagree	◯ Strongly disagree

TOOLS 2	I find that the university's systems are easy to use.	◯ Strongly agree	◯ Somewhat agree	◯ Neither agree nor disagree	◯ Somewhat disagree	◯ Strongly disagree
TOOLS 3	I can effectively and easily manage my time using the university's systems.	◯ Strongly agree	◯ Somewhat agree	◯ Neither agree nor disagree	◯ Somewhat disagree	◯ Strongly disagree
TOOLS 4	I am informed by announcements through the university's systems.	◯ Strongly agree	◯ Somewhat agree	◯ Neither agree nor disagree	◯ Somewhat disagree	◯ Strongly disagree
SN01	I use social networks to solve my academic problems.	◯ Strongly agree	◯ Somewhat agree	◯ Neither agree nor disagree	◯ Somewhat disagree	◯ Strongly disagree
SN02	I use social networks to do research.	◯ Strongly agree	◯ Somewhat agree	◯ Neither agree nor disagree	◯ Somewhat disagree	◯ Strongly disagree
SN03	I use social networks to communicate with my friends to prepare for exams.	◯ Strongly agree	◯ Somewhat agree	◯ Neither agree nor disagree	◯ Somewhat disagree	◯ Strongly disagree
SN04	I use social networks to seek help from my teachers.	◯ Strongly agree	◯ Somewhat agree	◯ Neither agree nor disagree	◯ Somewhat disagree	◯ Strongly disagree
SN05	I use social networks to share new ideas.	◯ Strongly agree	◯ Somewhat agree	◯ Neither agree nor disagree	◯ Somewhat disagree	◯ Strongly disagree
SN06	I find it difficult to find accurate information about academia on social networks.	◯ Strongly agree	◯ Somewhat agree	◯ Neither agree nor disagree	◯ Somewhat disagree	◯ Strongly disagree

SN07	I usually postpone my academic task to spend more time on social networks.	◯ Strongly agree	◯ Somewhat agree	◯ Neither agree nor disagree	◯ Somewhat disagree	◯ Strongly disagree
SI1	People who are important to me think I should use the university's systems.	◯ Strongly agree	◯ Somewhat agree	◯ Neither agree nor disagree	◯ Somewhat disagree	◯ Strongly disagree
SI2	I use the university's systems because of the proportion of students who use them.	◯ Strongly agree	◯ Somewhat agree	◯ Neither agree nor disagree	◯ Somewhat disagree	◯ Strongly disagree
SI3	The teachers help me use the university's systems.	◯ Strongly agree	◯ Somewhat agree	◯ Neither agree nor disagree	◯ Somewhat disagree	◯ Strongly disagree
SI4	People who use the university's systems have more prestige than those who do not.	◯ Strongly agree	◯ Somewhat agree	◯ Neither agree nor disagree	◯ Somewhat disagree	◯ Strongly disagree
ACQU01	I am always actively looking for new knowledge.	◯ Strongly agree	◯ Somewhat agree	◯ Neither agree nor disagree	◯ Somewhat disagree	◯ Strongly disagree
ACQU02	I can easily identify what new knowledge is most valuable.	◯ Strongly agree	◯ Somewhat agree	◯ Neither agree nor disagree	◯ Somewhat disagree	◯ Strongly disagree
ACQU03	I collect information through informal means such as talking with students, industry professionals or mentors.	◯ Strongly agree	◯ Somewhat agree	◯ Neither agree nor disagree	◯ Somewhat disagree	◯ Strongly disagree
ACQU04	I regularly approach teachers, tutors or other staff.	◯ Strongly agree	◯ Somewhat agree	◯ Neither agree nor disagree	◯ Somewhat disagree	◯ Strongly disagree

ASSM01	I frequently share my new knowledge with other students.	◯ Strongly agree	◯ Somewhat agree	◯ Neither agree nor disagree	◯ Somewhat disagree	◯ Strongly disagree
ASSM02	I translate new knowledge in such a way that students understand what I mean.	◯ Strongly agree	◯ Somewhat agree	◯ Neither agree nor disagree	◯ Somewhat disagree	◯ Strongly disagree
ASSM03	I maintain relevant knowledge over time.	◯ Strongly agree	◯ Somewhat agree	◯ Neither agree nor disagree	◯ Somewhat disagree	◯ Strongly disagree
TRNS01	I can turn existing knowledge into new ideas.	◯ Strongly agree	◯ Somewhat agree	◯ Neither agree nor disagree	◯ Somewhat disagree	◯ Strongly disagree
TRNS02	I record and store new knowledge for future reference.	◯ Strongly agree	◯ Somewhat agree	◯ Neither agree nor disagree	◯ Somewhat disagree	◯ Strongly disagree
TRNS03	I am proficient in repurposing existing knowledge for new uses.	◯ Strongly agree	◯ Somewhat agree	◯ Neither agree nor disagree	◯ Somewhat disagree	◯ Strongly disagree
EXPL01	I constantly consider how I can apply new knowledge to improve my work.	◯ Strongly agree	◯ Somewhat agree	◯ Neither agree nor disagree	◯ Somewhat disagree	◯ Strongly disagree
EXPL02	I clearly know how activities within their course should be performed.	◯ Strongly agree	◯ Somewhat agree	◯ Neither agree nor disagree	◯ Somewhat disagree	◯ Strongly disagree
EXPL03	I have difficulty implementing new knowledge.	◯ Strongly agree	◯ Somewhat agree	◯ Neither agree nor disagree	◯ Somewhat disagree	◯ Strongly disagree

IWP1	I take into account my teacher's wishes in my work.	◯ Strongly agree	◯ Somewhat agree	◯ Neither agree nor disagree	◯ Somewhat disagree	◯ Strongly disagree
IWP2	I am able to cope well with difficult situations and setbacks.	◯ Strongly agree	◯ Somewhat agree	◯ Neither agree nor disagree	◯ Somewhat disagree	◯ Strongly disagree
IWP3	I handle assignments without much supervision.	◯ Strongly agree	◯ Somewhat agree	◯ Neither agree nor disagree	◯ Somewhat disagree	◯ Strongly disagree
IWP4	I complete my assignments on time.	◯ Strongly agree	◯ Somewhat agree	◯ Neither agree nor disagree	◯ Somewhat disagree	◯ Strongly disagree