



# MONASH University

**Technology Enhanced Assessment and Feedback among Educators  
across Disciplines in High Ranked Public and Private Higher  
Educational Institutions in Malaysia**

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## ABSTRACT

The Malaysia Education Blueprint 2013-2025 reported although Malaysian students have the capability to reproduce subject content, this skill is much less needed in the current age of technology. Parenthetically, Malaysian students also lack the soft skills that many prospective multinational employers are looking for. With UNESCO documenting that technology has the potential to improve education, higher education institutions (HEIs) in Malaysia are urged to transform learning and assessment through integration of educational technologies. However, with less emphasis being given to revamping current assessment and feedback practices, this effort could go to waste as the nature of higher education and its roles are changing. Thus, there is a need to rethink the way in which students are being assessed and provided with feedback in the online environment. As such, this thesis aims to (1) investigate the current assessment and feedback practices in two selected top HEIs in Malaysia, (2) identify the similarities and differences in these practices among educators across the Computer Science/Information Technology, Engineering, Education, and Psychology disciplines, and finally (3) develop a framework for technology-enhanced assessment and feedback (TEAF) in HEIs through proposing a more holistic interaction between the design of three key pillars: Assessment and Feedback, Learning and Teaching, and Content; within the Human-centered Technology and Pedagogy Design context. Findings generated from secondary data analysis based on publically available course outlines/unit guides, semi-structured interviews and online survey, indicated that educational technological tools were (1) integrated in a limited manner; (2) only within the assessment practices while feedback practices remain conventional; and (3) examinations were typically used as the main form of assessment. Findings also revealed that educators across disciplines operate under similar mindset that these tools seem minor in comparison to the human interaction within the learning and teaching context. The findings also pointed out the inconsistencies of information in the course outlines/unit guides as some disciplines only provided generic information to students. All of this provided some crucial insights on how the integration of educational technological tools in enhancing the assessment and feedback practices could still be far from the desirable level. Thus, this research proposed that with the development of the technology enhanced assessment and feedback (TEAF) framework, the emphasis could be to realign and refocus on the assessment and feedback, learning and teaching, and content design – with the incorporation of human-centered technology and pedagogy design as a binding agent between these three key pillars.

**Keywords:** Technology Enhanced Assessment and Feedback; Mixed Method; Multidisciplinary; Educators' Perspectives; Higher Education

## **DECLARATION**

This thesis is an original work of my research and contains no material which has been accepted for the award of any other degree or diploma at any university or equivalent institution and that, to the best of my knowledge and belief, this thesis contains no material previously published or written by another person, except where due reference is made in the text of the thesis.

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## **LIST OF ABBREVIATIONS AND ACRONYMS**

AF	Assessment and Feedback
AFD	Assessment and Feedback Design
APA	American Psychological Association
APS	Australian Psychological Society
BEM	Board of Engineers Malaysia
BPS	British Psychological Society
CD	Content Design
EAC	Engineering Accreditation Council
HCT	Human-Centered Technology
HEA	Higher Education Academy
HEIs	Higher Education Institutions
ICT	Information Communication Technology
LMS	Learning Management System
LT	Learning and Teaching
LTD	Learning and Teaching Design
MEB	Malaysia Educational Blueprint
MOE	Ministry of Education Malaysia
MOHE	Ministry of Higher Education Malaysia
MQA	Malaysian Qualifications Agency
PD	Pedagogical Design
PISA	Programme for International Student Assessment
PRS	Personal Response System
PRS2	Peer Review System
SPGF	Seven Principles of Good Feedback
TEAF	Technology Enhanced Assessment and Feedback
TEFA	Technology Enhanced Formative Assessment
TIMSS	Trends in International Mathematics and Science Study
TPACK	Technological Pedagogical Content Knowledge
UNESCO	United Nation Educational, Scientific and Cultural Organization

# CHAPTER ONE

## INTRODUCTION

### ***SETTING THE SCENE***

This chapter provides a summary background of what sparks an interest in this research, the underlying enigma of the current situation in the higher education context that this research aims to understand and address, the subsequently arising research questions that paved the direction of this research, and the underlying theoretical and conceptual framework of this research.

*Section 1.1* presents an overview of the educational landscape in the 21<sup>st</sup> century and *Section 1.2* discusses the problem statement of this research area in general. This is then followed by *Section 1.3*, which dives deeper into the Malaysian context of higher educational institutions (HEIs). Subsequently, *Section 1.4* introduces the research questions and *Section 1.5* illustrates the theoretical and conceptual framework. Lastly, *Section 1.6* summarises the overall thesis organization and the anticipated contribution of this research.

#### **1.1 The unveiling of the educational curtain**

In the current age of technology and rapid economic development, significant changes in the labour market of many developed countries have been paralleled by new skill demands for numerous jobs. While more technologically-advanced countries have shifted from agrarian-based economies to industrial-based economies, they are also now heading towards knowledge-based information economies. Developing countries are now moving in the same direction, although perhaps in a less even manner. This new economic shift requires new ways of thinking and new skills that in turn, demand a new educational ideology.

Historically, the focus of education in developed western societies has been strongly associated with this economical trend (Griffin, McGaw, & Care, 2012). As these developed nations continue to grow, a new educational ideology with mass education as a central tenet and policy emerged, demanding new education systems that produce graduates with



the new ways of thinking and skills that are essential to the modern economy. As the pressure on education systems to teach these new skills builds up, a different set of management and production skills focusing on increased digital literacy and numeracy, as well as new ways of thinking, is needed (Griffin et al., 2012). Hence, it is imperative that educational systems should adopt a fresh perspective and adjust to develop in their students the crucial ability to learn, collaborate and solve problems in a digital information environment.

Garrison and Kanuka (2004) argued that with the increased use of information and communication technology (ICT) across different industries and across societies, it is without a doubt that technological tools will also be used to transform higher education in the 21<sup>st</sup> century. This is aligned with a recent declaration from the United Nations Educational, Scientific and Cultural Organization (UNESCO, 2011) that ICT has great potential to improve education, drive growth and promote empowerment. As the revolution of ICT continuously impacts enormously on society, it would be unthinkable for any modern society to attempt to function without ICT. Hence, just as learning institutions are an integral part of any society, it is expected that the use of ICT in these learning institutions will be indispensable as well (UNESCO, 2010). With the use of ICT being gradually implemented across different higher educational institutions (HEIs), a new criterion is required to shift the previous standard of basic skills and knowledge with which a student is ought to be equipped.

According to Binkley et al. (2012), in the 21<sup>st</sup> century, regardless of profession or position in society, success is being defined as the ability to communicate, share and use information to solve complex problems, and the ability to adapt and innovate in response to new demands and constant changing circumstances. With these momentous transformations and advances in ICT, jobs that were non-existent previously are now emerging. Consequently, youths of the 21<sup>st</sup> century ought to be taught and equipped with skills and knowledge that are relevant and useful for the current era. The new challenge for HEIs is how they are going to successfully provide these new and much needed skills and knowledge to better equip youths of the 21<sup>st</sup> century to meet the demands of the new era.

## 1.2 Today's challenge: the demands of technology and knowledge-based economy

UNESCO (2010) stated that observations of the integration of ICT into pedagogy revealed that ICT was more like enrichment activity, as textbooks still dictated instructions as observed in a New Zealand case study, offers some significant pointers for countries in the Asia-Pacific region. UNESCO noted that while there were some exciting ICT projects being incorporated into pedagogy,

*“the extent to which the choice of particular ICT, and the ways in which they are used in classes, are consistent with and between the pedagogies philosophies, orientations and intentions of the teacher and the learning styles, abilities and motivations of the students” (p.22),.*

With the advancements in ICT since UNESCOs 2010 report, textbooks are no longer considered to be the most important element of knowledge acquisition, as learning activities can now be completed through electronic platforms. As such, ICT has now become the main means of imparting knowledge and gathering of information in the context of higher education. Therefore, the usage of ICT in different learning environments (i.e. *classrooms, lecture halls, teaching labs*), is changing the way how students learn (i.e. *moving from content-based curricula to competency-based curricula*) and also changing the way how educators teach (i.e. *teacher-centred to student-centred*) across the Asia-Pacific region (Oliver, 2002; UNESCO, 2010).

These changes suggest that new criteria are required for the skills and knowledge that students should develop. Educators are compelled to re-evaluate and to make fundamental changes in *what* needs to be learned and *how* learning has to take place (Voogt, Erstad, Dede, & Mishra, 2013). It is also stated by Voogt et al. (2013) that there is a significant gap between how traditional and formal classroom learning and the concept of e-learning and mobile learning, and how the use of these technological tools are exemplified in educational practice. On the same note, Lai, Khaddage, and Knezek (2013) reasoned that a change is needed in the education structure, stressing that this change is imperative as it is in line with the shift of technology, learners' expectations and educators' roles. While the nature of education and its' roles are changing, there is a need to rethink how education is measured and monitored as well.

This is further supported by Higher Education Statistics published by The Malaysian Ministry of Education (2018) in which where one in five fresh graduates need at least six-months to find a job when there are more than 290,000 students graduating each year (Study International, 2019). This article expands further on how with the evolution of technology, the demands of current job available also changed drastically; creating more job opportunities which did not even exist five to ten years ago. As such, the focus of aligning the needed skills among graduates and the industries remains as the core concern for all stakeholders, especially with the roles in which HEIs play in assisting the graduates to be work-ready.

### **1.2.1 The Malaysian context**

According to UNESCO (2010), although the government bodies of various developed countries have responded swiftly to the advances in ICTs and have encouraged their introduction in the respective HEIs, this is not the case for developing countries such as Malaysia. The Malaysia Education Blueprint 2013-2025 produced by the Ministry of Education Malaysia (MOE) (2013a) noted that while Malaysian students in general have always been great in reproducing subject content, this is a skill is much less needed in the current age of technology and rapid economical development of the labour market. Similarly, the Trends in International Mathematics and Science Study (TIMSS) and Programme for International Student Assessment (PISA) have also confirmed that Malaysian students struggle with higher-order thinking skills. It was further emphasized in the education blueprint that surveys conducted nation-wide have indicated Malaysian students in general lack the soft skills for which many Malaysian and multinational companies, as well as prospective employers, are looking. To investigate this further, Chew, Kalavally, Tan, Low, and Mohd Zain (2015) surveyed employers, government accreditation bodies (councils) and educators with regard to their expectations of 21<sup>st</sup> century graduates in Malaysia. The top-five rated “*must have*” skills are shown in Table 1.

Table 1: Top five ‘must have’ 21<sup>st</sup> century graduate skills from the perspective of employers, government accreditation bodies/councils and educators in Malaysia

	1	2	3	4	5
<b>Employers</b>	Problem-solving skills Critical thinking	Communication skills	Analytical skills	Teamwork	Independence
<b>Government accreditation bodies/councils</b>	Problem-solving skills Critical thinking	Analytical skills	Decision making	Communication skills	Lifelong learning
<b>Educators</b>	Problem-solving skills Critical thinking	Communication skills	Lifelong learning	Teamwork	Independence

Apart from the slight mismatch across all stakeholders to the constitution of 21<sup>st</sup> century skills depicted in Table 1, the findings obtained from Chew et al.(2015) and Tan, Chew, and Kalavally (2017) also showed that from the employers’ point of view, graduates in Malaysia today are far from being able to demonstrate these skills, let alone being able to meet the minimum standards of these skills. Accreditation bodies, employers and educators who were interviewed suggested that perhaps there is some correlation between how graduates are being assessed in HEIs and the growing rate of unemployment due to the lack of these skills found in the graduates (Chew et al., 2015; Tan et al., 2017). The findings indicated that these three stakeholders believe that there is a need for HEIs to review the current assessment and feedback (AF) practices to establish whether these practices are equipping graduates with the skills that are needed in today’s technology and knowledge-based economy, or producing graduates with the skills fit for the yester-years of industrial-based economy. Although these studies were conducted within the Engineering discipline context, this research reckons that similar findings may be projected across other disciplines as well seeing how the unemployment rate are made-up of different disciplines which will be discussed in the later subheadings.

Similarly, Singh, Narasuman, and Thambusamy (2012) put forth a strong argument that there is a need to reflect upon the adequacy of the assessment procedures being used in HEIs today and their validity for assessing students’ competency levels in various critical skills such as: (1) communication and interpersonal skills, (2) problem-solving skills, and

(3) critical thinking, which are all essential in the workplace. They also argued that a balanced, comprehensive assessment would, by necessity, be multi-modular in nature and practice in order to do justice to the “*know*” and “*how*” in the graduates’ repertoire of skills. It should not focus on a single aspect of learning such as “*technical skills*” or “*authentic performance*”, nor to use a single mode of assessment, such as the year-end examination and so on.

Meanwhile, with the internet penetration rate in Malaysia currently standing at 67%, there is a need for Malaysia to move from a mass production delivery model to a technology-enabled innovation environment (Ministry of Higher Education Malaysia, 2015). In order for this to take place, blended learning models will become the principal pedagogical approach in all HEIs. However, as pointed out by Mishra and Koehler (2006) merely introducing technology to the educational process may not be sufficient. They argued that teachers (educators) are also required to know precisely what is needed in order to incorporate technology into their teaching.

The lack of understanding and consensus in the current AF practices in HEIs raises the question of whether Malaysia is at risk of not being prepared for a technology-mediated learning environment as the world continues to evolve and be seamlessly connected. The need to integrate ICT effectively is further emphasized in the e-Learning Guidelines recently published, where it is recommended that both public and private universities allocate 30% of the student learning time in the form of blended learning with an online component (Ministry of Education Malaysia, 2014). Leveraging on the usage of ICT was indicated as one of the eleven major shifts to transform the education system in the preliminary report of the Malaysia Education Blueprint 2013-2025 (Ministry of Education Malaysia, 2013b). As such, across Malaysia, the conventional method of imparting knowledge through face-to-face interaction – is slowly taking a step backwards while virtual classrooms, e-learning and blended learning are increasingly gaining momentum (Grapragasem, Krishnan, & Mansor, 2014). However, although ICT is being recognised as having tremendous potential to accelerate the learning experience through a wide range of knowledge and thinking skills, its potential has yet to be fully attained within the Malaysia context as the use of ICT remains low in both quantity and quality (Ministry of Education Malaysia, 2013c).

While Malaysia is still far from being the leader in creating a technology-mediated learning environment and initiatives have been taken to create a sustainable technology-mediated learning environment, currently there is still no clear indication as to when the Malaysian government and (or) the MOE will put together policies and guidelines to effectively incorporate ICT throughout all levels of the education system, especially in the higher education sector. To further resonate on this point, Garrison and Kanuka (2004) argue that a more formal approach to the development of policies and operations is needed to support the blended learning (technology-mediated learning) environment. Without the existence of such clear policies and guidelines from the higher-level authorities, educators are compelled to choose among the overwhelming numbers of educational technological tools available in the market in their search for the most effective and reliable ones. This '*pick, plug and play*' approach among educators may be the major barrier in the attempts to achieve the noted potentials of educational technological tools; as there is a separation between how these educational technological tools are being incorporated in the classroom and how students are being assessed and provided with feedback through the use of these educational technological tools.

### **1.3 Achilles heels of the higher education sector in Malaysia**

According to the Ministry of Higher Education Malaysia (MOHE, 2017), in year 2016 and 2017, there were approximately a total of 238,187 and 255,099 graduates from public universities and private HEIs. A more detailed breakdown of the unemployment rate of these graduates by disciplines is shown in the Table 2 below.

Table 2: Unemployment rate across disciplines in HEIs (source from MOHE, 2017)

Disciplines	Unemployment rate			
	Year 2016		Year 2017	
	No.	%	No.	%
<b>Arts and Social Sciences (i.e. Psychology, Languages)</b>	28,043	52	27,486	51
<b>Science (i.e. Health Sciences)</b>	8,911	16	9,386	18
<b>Technical studies (i.e. Engineering, Architecture)</b>	10,045	19	9,451	18
<b>Information and Communication Technology (i.e. Computer Science)</b>	4,397	8	4,011	8
<b>Education</b>	2,707	5	3,039	6
<b>Total</b>	<b>54,103</b>	<b>100</b>	<b>53,737</b>	<b>100</b>

From Table 2 above, it is observable that there was a reduction of 1% from the total unemployment rate in the Arts and Social Sciences and Technical studies disciplines while the unemployment rate in the Information and Communication Technology discipline remains unchanged. It was also detected in the Science discipline that there was an increase of 2% in the rate of unemployment. As such, the comparison noted between the unemployment rate in year 2016 and 2017, indicated that although efforts have been taken to ensure that graduates are equipped with the skills that prospective employers are looking for, the unemployment rate do not seemed to be reducing in a significant manner. Therefore, as industries continue to develop, demands and new requirements for skilled workers may have also change over time (refer to Table 1). As such, the underlying question of whether HEIs in Malaysia are producing and assessing graduates with the right skill sets remains.

Employers from various disciplines in the 21<sup>st</sup> century having higher expectations of graduates, and not only expect the required technical skills; but also require the ability to think critically, to communicate effectively and to handle or manage unfamiliar problems. Apart from that, they are also expect graduates to have an understanding of societal, ethical, economic and legal knowledge (Guilbeau & Pizziconi, 1998; Nguyen, 1998; Wye & Lim, 2009). In addition, as pointed out by Hanapi and Nordin (2014), the main reason as to why there is a noticeable growth in graduate unemployment is that they are below par and

mediocre in the global market's requirement rather than an earlier deduced assumption of the lack of job opportunities.

In 2002 and 2004 respectively, surveys conducted by the Central Bank of Malaysia (Hanapi & Nordin, 2014; Husain, Mokhtar, Ahmad, & Mustapha, 2010; Musa, Mufti, Latiff, & Amin, 2012) found that Malaysia graduates in general, lacked the fundamental skills to function effectively in the workplace and they were less skilled in comparison to international graduates. Specifically, Quah, Nasurdin, Guok and Ignatius (2009) reported that Malaysian employers consider international graduates to be more accomplished in both oral and written English, to demonstrate a higher level of self-confidence, creativity and innovation in their jobs, and often carry a more positive mindset than Malaysian graduates. All these contributed to a more successful job performance that eventually leads to larger numbers of employers in Malaysia to select international graduates rather than local graduates in the hiring process. Another report written by Leong (2019) also stated that the current economy and workforce has yet to create sufficient high-skilled jobs to absorb such a large number of graduates. Leong further explains in her report that the reason for the high unemployment rate could be partly due to the lack job experience and/or skills needed. In other words, this reflects that high unemployment rate remains as a major concern to all stakeholders across all HEIs in the Malaysian context.

As a result, the question as to whether HEIs in Malaysia are producing large numbers of quality of graduate lingers on. Consequently, the questions of whether the current AF practices are: (1) aligned with the newly adopted ICT in education and (2) able to measure students' performance in a holistic manner; remain unsolved as well. Unlike in the manufacturing industries, identified defective products would stimulate the recall of a product batch; however, the recall of substandard graduates (a human product) is simply not possible. Hence, educators in Malaysia have been apprehensive as the growing rate of unemployment is an imperative and substantial indication that there should be a careful consideration to revamp the way in how knowledge is being conveyed and measured in the learning and teaching process. Quah et al. (2009) also stated that without a doubt, there is a need for Malaysia to develop an education system that is both market-drive and able to cultivate and impart work-ready graduates with the necessary 21<sup>st</sup> century attributes and skills.



Echoing that, Singh, Thambusamy, and Ramly (2014) rationalized that as these 21<sup>st</sup> century attributes and skills become increasingly more important in ensuring graduates' employability, the focus should be placed on the capability of HEIs in Malaysia to prepare undergraduates with such attributes and skills. They also noted that recent research findings indicated that there is a clear mismatch between the many HEIs in Malaysia and employers' expectations in terms of these graduate attributes. Given the nature of the current unemployment rate among graduates, Singh et al. (2014) stated that there could be an association with some form of disparity in what is being imparted to undergraduates and employers' expectations. Hence, they also further highlighted the urgency of investigating this issue in order to understand the expected graduate attributes that many of the employers are seeking. Employers are also constantly comparing these attributes to what is being generated by the HEIs and only by understanding these expectations among employers and educators can a change be proposed.

Aligned with that, Kong (2014) highlighted that creating digital classrooms in the education settings in the 21<sup>st</sup> century provides the much needed opportunities to nurture students' information literacy and critical thinking skills through day-to-day learning class time. She also stated that with the convenient access to appropriate, sufficient and extensive sharing of useful resources and information, students are able to progressively develop a deep understanding of knowledge. Subsequently, as blended learning approaches are being gradually adopted by many HEIs, changes in the daily practice are therefore notable, especially in terms of how students and educators gain access to information and communicate with each other. These changes were also noted by Chew, Jones, and Blackey (2010) who suggested that educators ought to be actively involved in providing scholarly support and feedback for both formative and summative assessments. As asserted by Rowntree (1987), *"if we wish to discover the truth about an education system, we must look into its assessment procedures"* (p.1). Hence, the rethinking, redesigning and transforming of assessment through the use of educational technological tools, inevitably becomes part and parcel of an educator's expertise and knowledge.

In other words, as Elton and Johnston (2002a) put it, that *"if one changes the method of teaching, but keeps the assessment unchanged, one is very likely to fail"* (p.4). As such, there is a need for HEIs in Malaysia to find the synergy between implementing the blended learning approaches and the current AF procedures. In addition to that, Chew et al. (2010) also pointed that *"an individual staff's engagement in technology enhanced assessment*

*and feedback is often driven by one's own educational beliefs, epistemology or disciplinary differences, attitudes working with technological tools and self-efficacy" (p.1).* Hence, it is imperative that more attention be given to understanding how current AF practices in HEIs are being shaped to support the implementation of ICT in the education system. This subsequently leads to the development of a versatile framework that serves as a guide for educators, HEIs, policy makers and relevant key personnel to rethink and redesign the current AF practices with a more thoughtful blend of educational technological tools in Malaysia.

#### **1.4 Research questions**

In order to have a clearer picture of what this research seeks to understand and investigate in greater depth, it is crucial to clarify that it was guided by three major research questions, as indicated below:

**Research Question 1:** How are the forms of educational technological tools being integrated into current assessment and feedback practices across disciplines in HEIs in Malaysia?

As the term of AF is generally broad by nature, this research seeks to explore whether or not the current AF practices in HEIs in Malaysia are adopting any form of educational technological tools. On top of that, if educators do incorporate some form of educational technological tools, this research aims to understand what technological tools are used, and how these technological tools are being integrated into the AF practices.

**Research Question 2:** What are the similarities and differences among educators across disciplines in the design of assessment and feedback practices in HEIs in Malaysia?

This research is particularly interested in identifying the way in which educators design their AF practices, and this may or may not include forms of educational technological tools. Apart from that, this research also seeks to understand the perception of educators in HEIs in Malaysia in relation to the adoption of educational technological tools and if these technological tools are useful in enhancing the AF practices in HEIs.

**Research Question 3:** How a proposed technology enhanced assessment and feedback framework (TEAF) would facilitate the usage of educational technological tools in enhancing the assessment and feedback practices in HEIs in Malaysia?

The findings from the first and second research questions subsequently guided this research in investigating the needed elements which will then facilitate the development of a holistic framework of technology enhanced AF. This proposed framework would then serve as a guide for educators, HEIs, policy makers, and key personnel in adopting educational technological tools and thus enhancing the AF practices. This research aims to address the research question through adopting the mixed-method approach. The outcome from this approach will then be translated into the development of a technology enhanced assessment and feedback (TEAF) framework. The details of practical application in LT instruction and AF practices for TEAF framework will be further discussed in the later chapters.

### **1.5 Theoretical and conceptual framework**

The main objective of this research is to explore and investigate educators' perception of the current practice of AF in HEIs in Malaysia, with(out) the adoption of educational technological tools. Therefore this research was build upon two different conceptual frameworks, namely (1) Technological Pedagogical Content Knowledge (TPCK) by Mishra and Koehler (2006) and (2) Seven Principles of Good Feedback (SPGF) practice by Nicol and Macfarlane-Dick (2006).

By definition, the TPCK framework emphasizes that knowledge about content, pedagogy, and technology is essential for developing good teaching (Mishra & Koehler, 2006). It is also a framework that presents the relationship and complexities between the three basic components of knowledge (Schmidt, Baran, Thompson, & Mishra, 2009). It also highlights that each of the components needs to be viewed in pairs rather than looking at each of them in isolation. As such, the framework includes seven components labelled as:

1. **Content Knowledge (CK)** – “knowledge about the actual subject matter that is to be learned or taught” (Mishra & Koehler, 2006, p. 1026).
2. **Pedagogical Knowledge (PK)** – knowledge about the methods and processes of teaching and learning and how it encompasses with overall educational purposes, values and aims. This includes “knowledge in classroom management, assessment, lesson plan development, and student learning” (Schmidt et al., 2009, p. 125).
3. **Technology Knowledge (TK)** – knowledge about various technological tools and skills required to operate particular digital technological tools (such as the Internet, interactive whiteboards, videos, and software programs).
4. **Pedagogical Content Knowledge (PCK)** – knowledge on how to blend both content and pedagogy with the aim to develop better teaching practices that includes knowing what teaching approaches fit the content and knowing how elements of the content can be arranged for better teaching.
5. **Technological Content Knowledge (TCK)** – knowledge about the manner in which technology and content are reciprocally related. Teachers (educators) need to understand that by using a specific technology, they can change the way learners practice and understand concepts in a particular content area.
6. **Technological Pedagogical Knowledge (TPK)** – knowledge about the existence, components, and capabilities of various technological tools, and how they can be used in teaching and learning settings. Teachers need to understand how teaching might change as the result of using technology.
7. **Technological Pedagogical Content Knowledge (TPCK)** – knowledge that is essential for teachers (educators) to have in order to integrate technology into their teaching in any content area. It is necessary for educators to have an understanding of the representation of concepts using technological tools; pedagogical techniques that use technological tools in constructive ways to deliver content; knowledge of what makes concepts difficult or easy to learn and how technology can help redress some of the problems that students face; and knowledge of how technological tools can be used to build on existing knowledge and to develop new epistemologies or strengthen old ones.

This TPCK framework acronym was later on renamed TPACK and was originally built on Shulman's construct of Pedagogical Content Knowledge (PCK) to include technology knowledge (Schmidt, Baran, Thompson, & Mishra, 2009). The diagram below provides a better illustration of how each of these components interacts with one another and at the same time, provides a more holistic view on this theoretical framework.

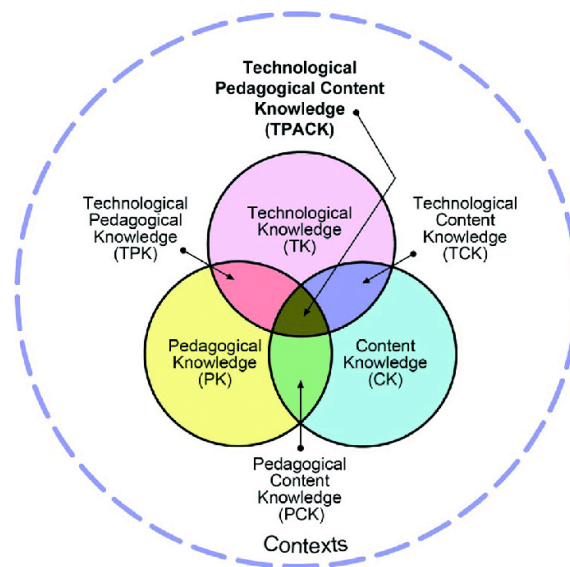


Figure 1: Technological Pedagogical Content Knowledge (TPACK)

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The second theoretical framework that helps to build this research is the Seven Principles of Good Feedback (SPGF), which is mainly derived from the conceptual model of processes of self-regulation, and internal feedback. According to Nicol and Macfarlane-Dick (2006), the SPGF practice was defined as anything that may reinforce the students' capacity to self-regulate their own performance in general.

These seven principles are as stated below:

1. Helps clarify what good performance is (goals, criteria, expected standards);
2. Facilitates the development of self-assessment (reflection) in learning;
3. Delivers high quality information to students about their learning;
4. Encourages teacher and peer dialogue around learning;
5. Encourages positive motivational beliefs and self-esteem;
6. Provides opportunities to close the gap between current and desired performance;
- and lastly,
7. Provides information to teachers (educators) that can be used to shape teaching

Each of the identified principles was then provided with rationales on how specific strategies can be adopted by teachers (educators) to assist in the development of self-regulation among students. Nicol and Macfarlane-Dick (2006) explains that in order for educators to help clarify what good performance is (point 1), there is a need for educators to apply strategies that harmonise written materials and simple verbal explanations. One way recommended by the authors is to provide students with exemplars as they provide an overt indication of what is required, and this helps students to evaluate their own work.

Apart from that, the authors argue that to facilitate the development of self-assessment in learning (point 2) is equally important and educators can assist by constructing more structured opportunities for self-monitoring and evaluation of progression to goals. However, literature indicates that more research is required to adequately understand external feedback in terms of how educators should frame feedback comments and the context in which the feedback is given (Nicol & MacFarlane-Dick, 2006). This would further assist in delivering high quality information to students about their learning (point 3).

Nicol and Macfarlane-Dick (2006) also (4) encourage teacher (educators) and peer dialogue about learning (point 4) and pointed out that this may be difficult for educators with large class sizes to achieve with their students. As such, they recommend that either; educators form smaller groups in class for feedback discussions; or to utilize educational technological tools, which can help to pull together student responses so that these responses can then be used to prompt peer discussions. On the same note, Nicol and Macfarlane-Dick (2006) reasoned that in order to encourage positive motivational beliefs and self-esteem (point 5), feedback should be geared to provide information about students' progress and achievement, instead of a one off summative assessment where the only information made known to students is whether they succeed or failed and often, or how they fared among their peers (i.e. through final grades).

Nicol and Macfarlane-Dick (2006) also argued that students in the higher education sector have insufficient opportunities to make full use of the feedback that they receive in order to level the performance gap. As such, to provide opportunities to close the gap between current and desired performance (point 6), Nicol and Macfarlane-Dick (2006) pointed out that greater emphasis should be given to providing students with feedback on their work-in-progress instead of at the end of the assignments. Lastly, to provide information to teachers that can be used to help shape the teaching (point 7) a pro forma (unit

guide/course outline) with published criteria of assessment tasks should be used. It should set out assessment tasks and be developed by picking up on questions that students ask in class and by observing their behaviour. It is also important to highlight that these strategies can be modified across any classroom settings or discipline (Nicol & MacFarlane-Dick, 2006).

Therefore, through the integration of these two theoretical frameworks, this research proposes the conceptual framework to be depicted as below:

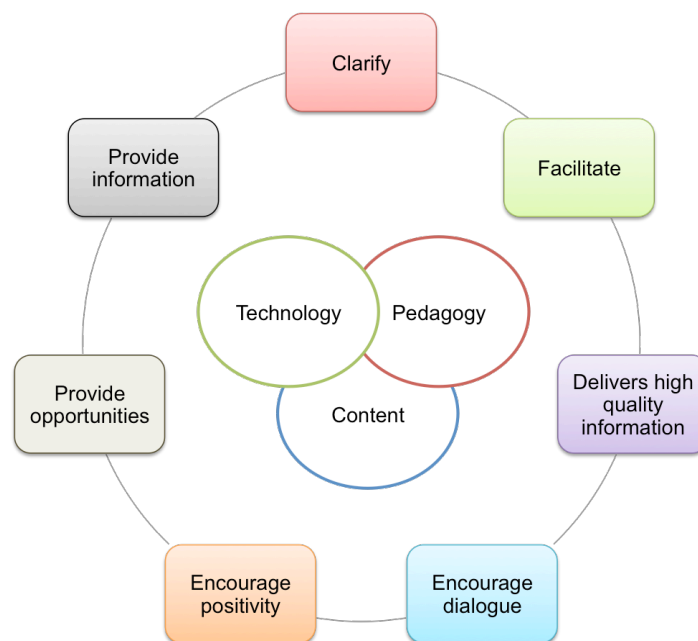


Figure 2: Conceptual framework

This research proposes that if educators are in favour of the SPGF and incorporate these principles into their day-to-day learning and teaching settings, it will subsequently guide them into adopting educational technological tools to further enhance the AF process of their subject matter (content). The theoretical framework of TPACK further supports this adaption. To further illustrate this point, take for example Principle 4 as stated in SPGF. If an educator would like to have dialogue sessions with students or to facilitate peer dialogue with a large cohort of students, one would consider the adoption of Personal Response System (PRS) or Peer Review System (PRS2) in enhancing the AF process as it might be a herculean task for an educator to be assessing and providing feedback to hundreds of students in a conventional manner.

However, if educators who are in support of the SPGF principles but are found to not incorporate educational technological tools this in turn add to the value of this research, as this phenomenon is not in line with the literatures found in the area of technology enhanced AF as indicated by TPACK. It is also important to note that there could be a possibility in which educators who are adopting educational technological tools may not be using it for the purpose of enhancing the AF process. This in turn would guide and lead to even more interesting findings as to what exactly are the perceptions of educators in HEIs on the adoption of educational technological tools. The answer to the question of whether educators in HEIs in Malaysia are aware that incorporation of educational technological tools would require more than just simply '*pick, plug and play*' concept as explained in the TPACK framework, could be revealed.

In a nutshell, the TPACK framework typically collects information on educators' knowledge required for appropriate pedagogical methods and effective technology integration within the learning environment through the use of questionnaire. On the other hand, the SPGF principles requires a better understanding on educators' rationale and experiences on these 7 principles through the use of interview sessions. As a result from these two different theoretical bases, this research adopts a mixed method approach in combining the works from these two different theoretical frameworks.

This research also reckons that these two existing frameworks do not adequately incorporate technology usage in AF practices whereby TPACK only informs educators on their knowledge in regards to technology integration and SPGF do not include principles aligning with the usage of technology. Although the TPACK framework have been adopted by a number of studies in the area of technology-based AF, both the TPACK and SPGF principles do not provide educators with flexibility in applying the technology integration knowledge and effective AF principles into real life instruction in accordance to the nature and needs of various disciplines. As such, a versatile framework is needed to address these gaps recognized from these two existing theoretical frameworks. In the following chapter, previous researches conducted in the area of AF, as well as technology-enhanced assessment and feedback will be reviewed.



## 1.6 Thesis organization and contribution

The organization of this thesis is presented in the following:

In the current chapter – **Chapter One** depicted the context of this research and provided an overview of the current educational landscape in the Malaysia context, the research questions posed and subsequently explored and the significance of all these to the context of this research.

Following that, **Chapter Two** provides a systematic literature review on the empirical use of technology in enhancing assessment or (and) feedback in educational context. The review also discusses the strengths and weaknesses of the research methodological methods used in understanding or (and) integrating educational technological tools in learning and teaching, specifically AF practices.

**Chapter Three** presents the research methodological approach of the concurrent mixed-method convergent parallel design of collecting data, and the selection of the participants for the analysis of data.

**Chapter Four** presents the results from the analysis of qualitative data. It consists of secondary data analysis (based on course outlines/unit guides) and also semi-structured interviews with educators from various disciplines. The quantitative data consist of collected educators' responses from online survey. These two forms of data then merge and integrated via triangulation and qualitative dominant crossover mixed analysis.

Subsequently, **Chapter Five** presents the proposed TEAF framework that emerged as a consequence of merging the qualitative and quantitative data together. Discussion on how the relevant stakeholders in the HEIs context would be able to learn and make use of the knowledge in integrating educational technological tools from this TEAF framework will be included as well.

Finally, **Chapter Six** draws out the conclusions that came from this research and relate them to the research questions. This is then followed by the discussion on the implications, limitations and suggestion on future works pertaining to this area of research. With that, the contribution, significance and limitation of this thesis are stated as below:

1. The findings from this research will provide a contribution in terms of new knowledge and perspective that might further enhance on the AF practices gap. This is with respect to the area of enhancing AF through the incorporation of educational technological tools. The most noticeable gap in the existing and current literatures is that there has not been a supportive framework when it comes to integrating educational technological tools to enhance the AF practices. Also currently, literature has shown that the areas of AF have not really been given much new emphasis, especially from the aspect of integrating course outlines/unit guides (to look at how AF process works on the ground level). Literature has mentioned that future studies should look into providing and capturing ground evidence on the process of AF, but the much-needed breakthrough is still far-away. As this research addresses the gap in AF practices through the use of course outlines/unit guides, the findings will be able to provide a new perspective and knowledge contribution in this aspect. However, this research is also well aware of the effects of a small sample size in both the interview and survey data. As such, the findings may not be a conclusive result but would serve as an indication that further studies on this area are needed.
2. As this research also focuses on investigating the disciplinary differences in the AF practices, the findings will also contribute in terms of how disciplinary differences may require different usage and integration of educational technological tools to enhance AF. Literature indicates that there are indeed differences when it comes to the types of AF being used in the learning and teaching process. Due to the limitations in terms of research feasibility, this research was only able to look at these differences across four disciplines in two top HEIs in Malaysia.

3. Another important contribution of this research comes in the aspect of customization of culture, as the existing and current literature is mostly based on works done within the western context. As such, there may be a need for a framework underpinning areas that may be more relevant to the Asian context. This customization of culture may very well shed some light on certain skills that are demanded in the Asian context that need to be developed based on the need of the growth of the country.

The following chapter explores the past and recent literature in the area of educational technology, especially in the area of AF. This provides a greater understanding of what facilitates educators in HEIs across disciplines in their attempt to integrate the usage of educational technological tools in enhancing the AF practices.

## CHAPTER TWO

### LITERATURE REVIEW

***“If one changes the method of teaching, but keeps the assessment unchanged, one is very likely to fail” – Elton and Johnston (2002)***

In this chapter, the review of literatures pertaining to the areas of AF, as well as the usage of educational technological tools in these areas is reported. The chapter aims to provide an overall background on AF in education.

*Section 2.1* provides background on assessment in education, followed by *Section 2.2* on feedback in assessment and *Section 2.3* on AF in higher education. This is followed by *Section 2.4* that discuss on AF in higher education across disciplines. *Section 2.5* presents a systematic literature review of technology enhanced AF reported in peer reviewed research journal publications, which outlines how others have chosen methodology focusing on enhancing AF in higher education through the integration of technology, and their findings. *Section 2.5* also provided an overall discussion of the challenges and gaps in the literature on enhancing the process of AF with the use of educational technological tools. The chapter closes with *Section 2.6* by briefly expanding on the opportunities for research that are addressed in the remainder of this thesis.

#### **2.1 Assessment in education**

As the terms of assessment in higher education are being use interchangeably, it is crucial that this research captures the evolution of assessment through reviewing the past literature involving the conventional concept of assessment. Having that said, the basic understanding when it comes to the concept of assessment is that it is an important part and pillar of support to any learning and teaching processes, as well as educational settings (Anderson, 2007; Biggs, 1998; Brown, 2004; Elton & Johnston, 2002b; Evans, 2013).

Gibbs and Simpson (2004) proposed that there are 10 different conditions under which assessment supports students' learning. These 10 conditions, as shown below, are divided into two categories: (A) influences of assessment; and (B) influences of feedback:

A. Influences of assessment (*consists of condition 1-3*)

1. Sufficient time and effort are allocated
2. Equally distributed amount of time and effort across topics and weeks of classes
3. Appropriate and productive learning activity – orienting towards deep learning approach

B. Influences of feedback (*consists of condition 4-10*)

4. Is sufficient, often and detailed enough
5. Is clear and focuses on students' learning and actions – instead of personal characteristics
6. Is immediate for students to pay attention to further learning or to receive further assistance
7. Focuses on learning instead of marks/grades and is linked to assessment criteria
8. Is appropriate and makes sense to students on what is required to be done
9. Is received and attended to by students
10. Is acted upon by students

Although assessments have been commonly divided into formative and summative assessment, Broadfoot and Black (2004) highlighted that more research is greatly needed in the areas of supporting a positive linkage between formative and summative assessment. Brown (2004) argues that a learner-centered assessment, which reflects the learner-centered curriculum, ought to be enforced in order to ensure that assessment is part of the learning process. She also emphasized that assessment methods need to revolve around evidence of achievement and not the ability to regurgitate information. In other words, this approach calls for a lesser emphasis to be given to traditional written assessment, and greater importance placed on assessment tools that will not only measure a student's ability to recall facts, but also their ability to use the information learnt during their daily learning activities and situations.

Apart from that, findings from Reimann and Sandler (2017) also pointed out that there were a substantial variations in regards to the teachers' (educators') personal understanding of assessment. The emergence of these variations subsequently confirms the complexity of the thinking and practice in relation to assessment. As such, in order to enhance assessment in HEIs, a better understanding is needed in which how are these assessment practices and activities being directly translated in instruction as the understanding is different for each educator. On the other hand, Carless (2015) reckons that the fundamental challenge for educators in regards to assessment is to develop effective assessment practice that focus on enhancing students' learning process and also consist of the double duty criteria; in which encompasses formative assessment for learning and summative assessment for certification. As such, the following subsections describe on the differences between formative (FA) and summative assessment (SA), followed by reviews on feedback.

### **2.1.1 Formative assessment**

Black and William (1998a, 1998b) first introduced the idea that improving classroom assessment would subsequently improve students' learning through a careful review of literature on FA used in classroom. This review documented evidence of examples as to how the design of assessment will lead to improved classroom learning through feedback, a concept that is crucial to FA (Black & William, 1998a). Following that, Black and William (1998b) then pointed out that educators can strive to improve FA through three ways, namely (1) *the self-esteem of students* – in which when educators provide the message that they believe that all students can achieve, this creates a culture of success, thus improving students' self-esteem; (2) *self-assessment by students* – stating that students need to be involved in self-assessment in order to fully grasp the main notions of what they need to do through a proper understanding of their learning and thus lead to a more productive FA; (3) *the evolution of effective teaching* – noting that the selection of class assignments needs to be in accordance with the learning aims and that students are able to express their understanding in each of these assignments and through the feedback and discussions in class.

Yorke (2003) explained that although the idea behind formative assessment is relatively simple, it is a concept that is much more complex than one would perceived it to be. He put forth the idea that are three underlying intentions of FA: (1) giving credit for what has been done to the expected standard; (2) correcting what is wrong; and (3) encouraging the learner by liberating them with the possibilities that he or she may have yet to discover. Yorke continues by explaining that FA can be both formal and informal. Formal FA is defined as any activities of assessment that are guided by a specific curricular assessment framework which students are required to do and the assessor will assess the work and provide feedback. On the other hand, an informal FA refers to assessments that are not specifically required by the curriculum, for example, immediate feedback while the students participate in a learning activity. Similarly, other studies further defined the formative assessment process as the specifically intended means to provide feedback on performance to improve and accelerate learning (Nicol, 2009; Nicol & MacFarlane-Dick, 2006; Nicol & Milligan, 2006).

López-Pastor and Sicilia-Camacho (2017) further explained that the term formative assessment was primarily used as a counterpart to summative assessment. Following that, formative assessment has been thus referred to as continuous formative learning, assessment for learning or learning-oriented assessment. Findings from their research indicated that the process of shared assessment – students' involvement in the assessment and learning practice could improve the learning process. As such, they recommend that research and experiences at the university (HEIs) level need to: (1) provide students with clear learning goals; (2) guide students in their learning process through feedback; (3) students involvement in the learning and evaluation process; (4) promote dialogue through feedback, and (5) finding an equilibrium between workload and conditions in which the subject area is taught.

### 2.1.2 Summative assessment

According to Anderson (2007), SA is “a powerful tool for measuring or grading whether a student has achieved all the course objectives” (p. 471). He further emphasized that it is fundamental for educators to first establish the course objectives, both in terms of knowledge and skills that they would like their students to learn and develop. Echoing this, Carless (2015) stressed that SA could be learning-oriented, especially when it constantly encourages and promotes deep approaches to learning while involving a high level of cognitive engagement. Hence, a well-designed SA can be effective in motivating appropriate student learning behaviours and provide opportunities for formative assessment strategies.

On the same note, the review done by Black and William, Biggs (1998) also argues that SA could very well be a positive form of assessment as well, in which reflective learning takes place and subsequently provides an information-rich form of assessment. He then highlighted that with proper usage of the both FA and SA, a broader picture of the learning and teaching context could be presented due to the reciprocal relationship between these two forms of assessment. He then further proposed to view FA and SA as an entity in the teaching context, rather than two separate pillars. This will then enhance the multidimensional view of the instructional process as a whole.

### 2.2 Feedback

Echoing on that, Black and William (1998b) stated that in order for learning to take place, the following three element on feedback about the effort must be understood. These three elements are being identified as (1) recognition of the *desired goal*; (2) evidence about the *present position*; and (3) some understanding on how to *close the gap* between these two.

Hattie and Timperley (2007) defined feedback as a form of information that students have about their own understanding on the content made from the learning experience. Hence, in order for feedback to be effective – it needs to be clear, purposeful, and meaningful. It should be able to provide a logical connection, and to be compatible with students’ prior knowledge of the learning content. Contrary to the popular belief and usage of feedback being only to highlight incorrect responses, feedback has been found to be more effective when information provided is on correct responses instead (Hattie & Timperley, 2007). It is



also important to note that, in order for educators to allocate more time and emphasis on feedback, many of the other tasks in the classroom need to be automated, and educators will also need to provide a rich learning environment and opportunities for all students so that they may also have the time and resources to attend to the feedback provided (Hattie & Timperley, 2007).

In reference to a more recent research on feedback, Mulliner and Tucker (2017) defined feedback as a continuum ranging from conventional to sustainable feedback practices – in which the purpose of feedback is to assist students to have a better understanding of the learning contents, their current status in achieving the goal of the learning contents and finally, their ability to bridge the gap between these two. As the majority of the older literatures focuses on the qualitative aspect in understanding more about feedback, this research provided a breath of fresh air, because the authors adopted a quantitative approach to investigate the effectiveness of different forms of feedback. The results from this research showed that individual and personalised feedback in the form of verbal, typed or written, were perceived to be the most effective in comparison to group feedback and peer evaluation/discussion.

### **2.3 Assessment and feedback in higher education – *the metamorphosis***

As the realm of higher education continues to evolve in response to pressure and transformation from economic, social, political, and cultural forces, a fundamental change in the area of assessment is strongly required. The Higher Education Academy, HEA (2012) provided some key points as to how stakeholders in the educational settings may be of support and benefit from this inevitable phenomenon. HEA highlighted four main benefits, which consists of:

1. Improved potential for student learning
2. Increased student satisfaction
3. Improved value for money
4. Assessment methods and approaches that are able to better assess the outcome of a 21<sup>st</sup> century education – focusing on a more dependable and fairer representation of student achievement and further confidence in academic standards and improved safeguarding of the reputation of higher education.

Out of these four benefits, the spotlight is on the fourth outcome as most HEIs in the United Kingdom and Asian countries are currently still unable to deliver (Higher Education Academy, 2012). Echoing that, Voogt et al. (2013) indicated in their study that in the actual educational settings and practice, teaching strategies for 21<sup>st</sup> century skills and competencies are often not well implemented. As such, a lack of integration of the 21<sup>st</sup> century competencies in the current assessment and feedback practices, along with the lack of systematic strategies in adopting innovative learning and teaching practices have been identified as some of the reasons for this shortcoming. This is further supported by the findings in a study conducted by Chew et al. (2015) which revealed that there is a mismatch between the perceptions of the 21<sup>st</sup> century graduates attributes among relevant stakeholders namely (1) industry experts, (2) accreditation councils, (3) academics/educators, and (4) students in Malaysia.

In order to have a better understanding on the AF area, Table 3 below summarizes the some key AF principles and models as explained by Gibbs and Simpson (2004), Nicol and Macfarlane-Dick (2006), and the Higher Education Academy (2012).

Table 3: Comparison of three main assessment and feedback principles and models

Categories	Focus	10 conditions (Gibbs & Simpson, 2004)	7 Principles (Nicol & MacFarlane-Dick, 2006)	HEA (2012)
<b>Assessment</b>	Time and effort	Not represented	Sufficient and equally distributed	Not represented
	Learning activities	Not represented	Orienting towards deep learning approach	Not represented
	Work relevant	Not represented	Not represented	Involving employers or experts in the assessment process
	Using technology	Not represented	Not represented	Technology enhanced learning
	Variety	Not represented	Not represented	Offers a variety of assessment approaches
	Engagement	Not represented	Not represented	Devising assessment tasks and criteria to promote student engagement and participation
<b>Feedback</b>	Clarity	What good performance is	Clear and focuses on learning and actions	Not represented
	Dialogue	Encourages teacher and student dialogue	Received, attended to, and acted upon by students	Among students and students; and between staff and students
	Opportunities	To close the gap between current and desired performance	Immediate for students to improve further learning or to receive further assistance	Ensure consistent practice and help students to use feedback as an aid to learning

A closer look at Table 3 indicates these key AF principles and models have adopted different approaches and are all operating under on a different understanding as to what is needed to transform the AF processes. The differences captured in the Table 10 above indicated that only Nicol and Macfarlane-Dick (2006) placed a greater emphasis to the time and effort and learning activities under the category of assessment. As for HEA (2012), the emphases were on assessment being work relevant, using technology, consist of a variety form of assessment and engagement. While Gibbs and Simpson (2004) focused mainly on feedback alone, Nicol and Macfarlane-Dick (2006) and HEA (2012) expanded their focus on including feedback as part of their key focus as well. These differences could be the missing parts of the puzzle that help revolutionize the existing knowledge and framework on AF. This will subsequently also prepares the foundation for the birth of a contemporary framework which will be explained in Chapter 6 Technology Enhanced Assessment and Feedback, which will further facilitates the usage of educational technological tools to enhance the AF practices in HEIs in Malaysia.

On the same note, Hattie and Timperley (2007) pointed out that most of the forms of assessment used in classrooms today, provide minimal and insufficient feedback due to their dependency on only testing on students' ability to recall information and are often used as external evaluation tools. The gap between AF lies in how many educators overlooked the fact that feedback is just as an important aspect of the teaching and learning process as assessment itself. Hence, there is a need to integrate both AF into today's learning and teaching context.

## **2.4 Assessment and feedback in higher education across disciplines**

As this research seeks to identify similarities and differences in how educators across disciplines design their AF practices, reviewing literatures that encompasses samples from various disciplines will provide a clearer perspective on this. Recent research pertaining to this subsection, was conducted by Planas-Lladó et al. (2018) on the use of peer assessment as a form of assessment to evaluate teamwork in the discipline of Social Sciences, Humanities, Science and Engineering. The findings indicated that this form of assessment have been well received by students as it allows students to not only have full autonomy and freedom to allocate the marks but also allows students to obtain feedback on their strengths and weaknesses (Planas-Lladó et al., 2018).

Echoing that, Bennet, Dawson, Bearman, Molloy, and Boud (2017) also stated in their studies that some forms of assessment are more suitable to be used in some disciplines than others and while online quizzes seems to be the more preferred form of technology-facilitated assessment; it was only deemed as satisfactory in terms of pedagogical. Therefore, when academics (educators) focused on this pedagogical concerns, it becomes challenging as the tools available were unsuited for their design.

As such, in a separate study conducted by Timmis, Broadfoot, Sutherland and Oldfield (2016), have acknowledged that working across disciplinary in the AF area is challenging as computer scientist, educators, psychologists and commercial software designers all have diverse functions and studies in this area were mainly still confined to a particular discipline. As such, these silo mentality have resulted in lack of studies on the use of technology for enhancing assessment. Similarly, Li and De Luca (2014) also highlighted in their research that a framework which will be able to guide the practice of AF in assessing writing across different discipline is very much needed. As such, they recommended that future studies in AF area should look at the possibility of exploring whether there is any difference in AF provided in hard science and in the humanities. Studies on how the use of educational technological tools can affect the practice of AF are also needed (Li & De Luca, 2014).

On the other hand, Boud and Molloy (2013) look into developing and analysing two models of feedback using academics (educators) from Engineering and Biology discipline. In their research, they reckon that in order for feedback practices to improve, a shift in how educators think about the importance of AF within the curriculum is needed. It is also important to note that the key component for effective feedback to thrive in the necessary learning context is the one where dialogue is encourage. However, the summative assessment role adopted by many educators in HEIs is most likely an example of where dialogue may be hampered (Boud & Molloy, 2013).

Based on these related studies, it is clear that the gap indicated in the area of AF across disciplines lies in the lack of a fundamental framework that encompasses general AF principles applicable to all disciplines; and yet is versatile enough cater to the different nature and needs of each disciplines. Thus, this perhaps indicates that the development of a more applicable and versatile framework is supported and worth exploring.

## **2.5 Technology enhanced assessment and feedback**

As conventional AF needs to be automated to make more room and time for thoughtful blending of AF in today's context of learning, the following subsections will look at some of the existing literature that focuses in understanding why and how an all-encompassing educational technology framework is needed to achieve that goal. The next subsection will also present a systematic literature review that concentrates on how and if the integration of technology could enhance this integral aspect of learning and teaching.

One of the most significant advances in the area of educational technology was the development of the TPCK framework by Mishra and Koehler (2006). This framework attempted to encapsulate the necessary qualities of teacher (educator) knowledge in incorporating technology to teaching and was built upon Shulman's construct of pedagogical content knowledge (PCK) which included technology knowledge. The argument presented by Mishra and Koehler (2006) in their research was that emphasis had always been given to what and which technologies to use, but not to how the integration of these technologies into the educational process will take place. As such, the TPCK framework allows the concept of teaching with technologies to be integrated and urges educators to think (rethink) about the current learning environments. Often, it is more beneficial when the learning environments are able to provide both students and educators the freedom and capacity to explore technologies in relation to the subject matter (Mishra & Koehler, 2006).

After the emergence of the TPCK framework, Koehler and Mishra (2009) then renamed the framework to TPACK. Since then, numerous other studies have been conducted using this framework as the fundamental framework that underpinned the basis of their research and to test the applicability of the framework in other contexts. The different foci were generally on (1) the development and validation of the framework in isolation or an assessment instrument (Chai, Koh, & Tsai, 2010; Kabakci Yurdakul et al., 2012; Kopcha, Ottenbreit-Leftwich, Jung, & Baser, 2014; Schmidt, Baran, Thompson, & Mishra, 2009); (2) how the framework could support educators in conducting online distance courses, lesson plans and construction of knowledge (Archambault & Crippen, 2009; Jang & Tsai, 2012; Ling Koh, Chai, & Tay, 2014; Olofson, Swallow, & Neumann, 2016); and (3) in theoretical considerations and reviews of literature in regards to the framework (Graham, 2011; Voogt, Fisser, Pareja Roblin, Tondeur, & van Braak, 2013).

A noticeable trend has been that these studies conducted on the TPACK framework has mainly been conducted in the western context, and only a handful have been conducted in the Asian context. This observation may indicate that there is a need for further knowledge related to the practical contribution of technology enhanced assessment and feedback area in the Asian context as well. The reason for this is that there might be a slight difference in educators' skills and content knowledge in comparison to what is really needed by educators' to truly support students in their learning process.

Apart from that, the level of technology usage in developing countries may very well also be different as they may still be at the infancy stage – in comparison to the more developed countries (Western context) in terms of level of technology usage. UNESCO (2011) further supports this by stating that there are three productivity factors that connect education policy with economic development and these factors are: (1) Technology Literacy – increasing the usage of new technology by students, citizens and workforce through incorporating the needed technology skills into education curriculum and plans; (2) Knowledge Deepening – increasing students' ability to use value-adding knowledge through solving complex, real-world problems; and (3) Knowledge Creation – increasing students' ability to not just benefit from this new knowledge, but to also innovate and produce other new knowledge.

As such, the need for a contemporary technology enhanced assessment and feedback framework that is tailored-made for the Asian context is an imperative next moves forward. To ensure that the foundation for this contemporary framework is based on solid grounds, a clearer view of this area is needed. Hence a systematic literature review was conducted to explore the current trends in how a variety of educational technological tools have been adopted and integrated to further enrich the AF process in higher education. The *Subsections 2.5.1* and *2.5.2* presented crucial information in regards to how this systematic literature review was carried out. Following that, *Subsection 2.5.3* further described the observable trends such as the countries in which these papers were based on, the selected discipline and also the research methodologies adopted. With that, *Subsections 2.5.4* to *2.5.6* consists of an overview and discussion derived from categorizing these papers into qualitative, quantitative and mixed research methods to allow a better understanding in how each of these research methods benefited the AF area and also to identify the challenges and gaps of these research methods.

### **2.5.1 Introducing the archive**

Petticrew and Roberts (2006) defined a systematic literature review as a process of systematically analysing all available studies in order to answer specific research questions. The systematic nature of reviews carried out in this manner ensures that the review is thorough and fair, providing an opportunity to synthesise existing work in a scientific manner. The review presented here aimed to identify, to the best of the researcher's knowledge, all the available studies on how Technology Enhanced Assessment and Feedback has been applied in the Higher Education context.

This systematic literature review was built upon the main source of using the Web of Science Core Selection online database. The initial search terms/keywords used for the first level of screening were *Assessment and Feedback*; *Technology Enhanced Assessment and Feedback*; and *Higher Education*. These terms/keywords were selected, as they were crucial in addressing the research questions that guided this research (refer to Chapter 1). There were a total of 147 results found from this first level of screening.

### **2.5.2 Inclusion and exclusion criteria**

Adapting similar methods used in Thurlings, Ever, and Vermeulen (2015) and Shute, and Rahimi (2017), from the 147 results found, journal articles published between the years of 2008 to 2019 were searched. This is in accordance to the 10 years gap, which would ensure that this research was able to include articles that were up-to-date. Apart from that, this research omitted articles on (1) conference proceedings citation index and (2) books citation index. These two indexes were excluded from this systematic literature review due to the nature of this research. As this research aims to ultimately propose a new framework that would guide educators in higher education to better integrate and enhance the AF process through the use of educational technological tools, a systematic literature review of journal articles that involves rigorous process of peer review by experts within these areas would be more suited. Hence, the conference proceedings and books citation indexes were excluded.

A total of 70 journal articles were identified through the first round of filtration. Out of these journal articles, the second round of filtration short-listed the most relevant journal articles in response to the targeted research areas. This batch of retained journal articles were further searched and categorised in accordance to the Web of science categories. The following categories were then omitted as they were deemed to have the least relevance to the research scope of this study:

1. Emergency medicine;
2. Health care sciences services;
3. Nursing;
4. Political science;
5. Public environmental occupational health;
6. Surgery;
7. Dentistry oral surgery medicine;
8. Ergonomics; and
9. Medicine general internal

On top of that, the retained journal articles were also filtered through to remove any duplications and non-journal related articles. After the second round of filtration, a total of 44 journal articles remained. The inclusion criteria also included related keywords as indicated by the authors in the returned articles. A total of 27 journal articles remained based on the related keywords as listed below:

1. online assessment;
2. online feedback;
3. technology enhanced;
4. educational technology;
5. higher education; and
6. undergraduates;



The Image 1 below is a sample of the reviewing and filtration process, which then leads to the 27, selected journal articles used as a basis of the systematic literature review.

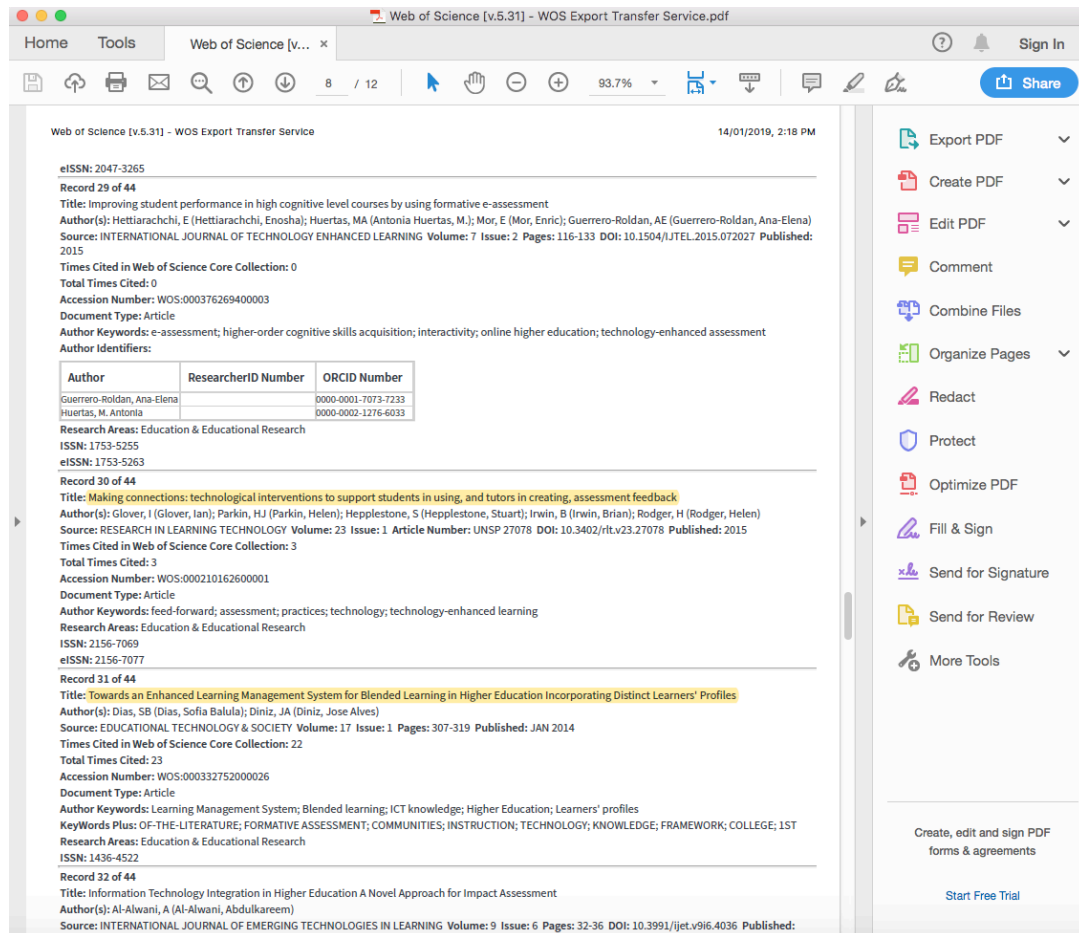


Image 1: Process of reviewing and filtering journal articles

### 2.5.3 Overview of the journal articles collected

Upon conducting the systematic literature review, a few observable trends could be identified and these trends are presented in this subsection for further discussions and elaboration. Firstly, Figure 3 below summarises the countries in which the relevant journal articles originated, while Figure 4 illustrates the focus of the journal articles in the aspect of the discipline of study. Figure 5 presents the research methodologies adopted by these studies.

## COUNTRIES

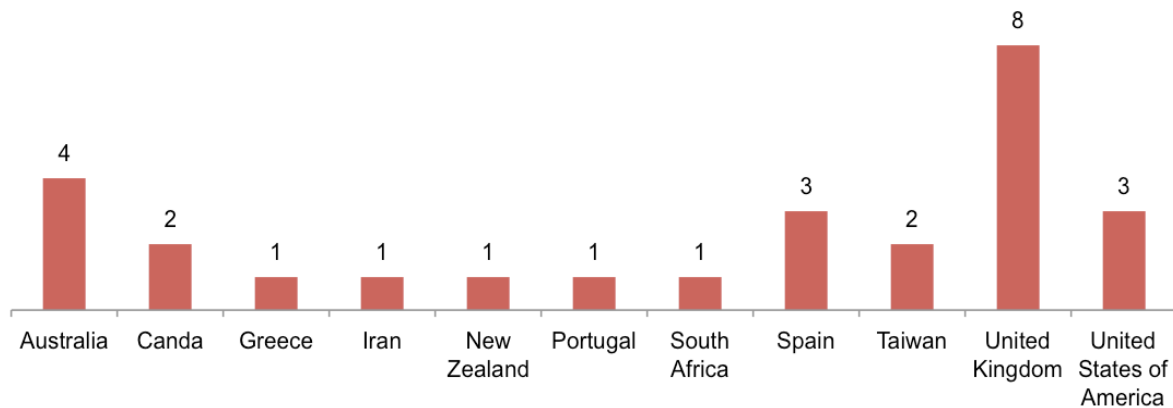


Figure 3: Summary of the relevant journal articles based on countries

As illustrated in Figure 3, the majority of the research conducted in this area comes mainly from the United Kingdom. Taiwan (the closest to the Asian countries context) was the source of just one study. This could possibly indicate a need for similar research to be conducted in the Malaysian context because not much of the current AF practices are known in the context of Asian countries, let alone the incorporation of educational technological tools in this area.

Figure 4 below demonstrates that in general, the selected journal articles conducted their research across various disciplines. This could possibly suggest that there is an important aspect to take note of, as the AF practices are typically a crucial part of the learning and teaching process regardless of disciplines.

## DISCIPLINES

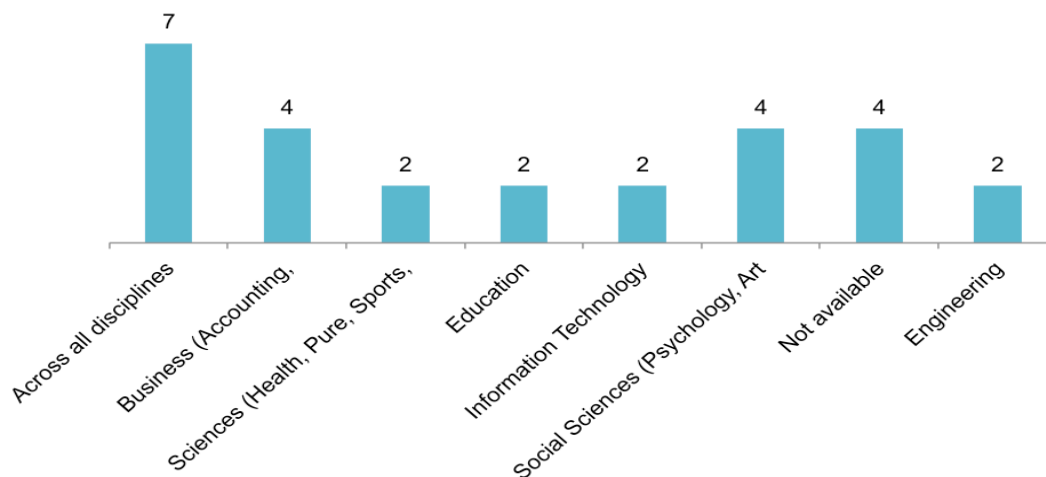


Figure 4: Summary of the relevant journal articles based on disciplines

## RESEARCH METHODS

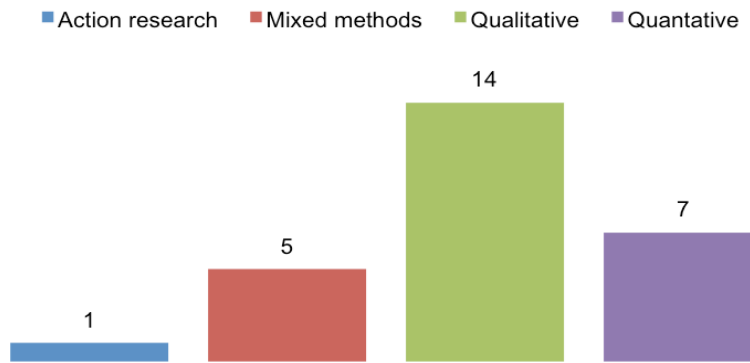


Figure 5: Summary of the relevant journal articles based on research methodologies adopted

It was also indicated from the systematic literature review that majority of these articles (as shown in Figure 5 above) were more inclined to utilize the qualitative research methodology in their efforts to understand the fundamentals of *what*, *why* and *how* to incorporate educational technological tools in the hope of providing answers to the existing real-life problems and gaps, as well as to further enhance the knowledge in the area of technology enhanced AF. A closer look on the types of research methodologies that were used based on the years in which the studies were conducted, further indicates that newer studies are gradually moving towards incorporating mixed methods and quantitative research as shown in the Table 4 below:

Table 4: Types of research method adopted according to the years in which the research was conducted

RESEARCH METHODS				
Year	Mixed method	Qualitative	Quantitative	Total
2009		2		2
2011		2		2
2012		1		1
2013		1	2	3
2014	1			1
2015	2	3	2	7
2016	1	3		4
2017	1	1	1	3
2018	1	1	1	3
2019			1	1
				27

## 2.5.4 Qualitative research method

A total of 14 papers were found to be using the qualitative research method to further understand and capture the essence of integrating technology in enhancing AF. Table 5 below categorizes these studies into three major qualitative data collection methods.

Table 5: Data collection method used by authors who adopted the qualitative research method

Authors and Year	Data collection method
Deeley (2018); Tuffley, & Antonio (2015); Mostert & Snowball (2012)	Case study
Bennett, Dawson, Bearman, Molloy, & Boud (2017); Chew, Snee, & Price (2016); Meadows et al. (2016); Glover et al. (2015)	Semi-structured interviews
Timmis, Broadfoot, Sutherland, & Oldfield (2016); Yuan & Kim (2015); Hsu, Ho, Tsai, Hwang, Chu, Wang & Chen (2012); Gikandi, Morrow, & Davis (2011); Hepplestone, Holden, Irwin, Parkin, & Thorpe (2011); Beatty & Gerace (2009); Hatzipanagos & Warburton (2009)	Systematic literature review

### Case study

Each of the three case study papers in Table 5 opted to explore and provide an insight in terms of how the enhancement of AF process could be achieved through a well-designed course and also through the use of technology. In their case studies, Deeley (2018) utilised various technological tools (i.e. Mahara, Echo360 System and Google Glass and Camtasia) to facilitate the AF process, while Tuffley and Antonio (2015) and Mostert and Snowball (2012) decided to explore the efficiency of providing assessment and delivering feedback through the application of these functions in LMS.

Deeley (2018) reported that although her paper revealed how using these technological tools may facilitate and enhance the AF process, there were also several barriers identified while using these various technological tools. One of the major barriers reported in her paper was student resistance, which might be due to technology-driven AF methods being perceived as cynically and uncomfortably. Also, her findings indicated that staff may initially perceive technological methods in AF as a form of hindrance as allocation of extra time is required to learn, but eventually it may save more time. All in all, her paper provided the insight that more effective AF processes using technology in higher education can be achieved. However, it is also imperative to note that she pointed out that as much

as technology is a useful and beneficial tool, it will only be of great use when it is aligned with the purpose and aims of AF (Deeley, 2018).

Similarly, Tuffley and Antonio (2015) reported that computer-mediated methods of delivering detailed AF have a strong potential for delivering a more effective and quality feedback that is guided by best practices as it (1) is more detailed, (2) provides more opportunities of feedback with no additional effort required, and (3) is delivered in a more timely manner because it reduces the amount of time needed. Mostert and Snowball (2012) also found that technological methods provided the advantage of anonymity and speed in delivering efficient and constructive feedback through online peer assessment activities in LMS. Although it was also captured in their research that there were some negative experiences during the process (i.e technical problems in using the system), the overall findings revealed that 58% of those who participated in the peer assessment activities concurred that it helped to improve the quality of their work.

Hence, as much as the findings from case studies may be limited and the generalizability rates might be low, the findings from these three papers nonetheless provided a consistent piece of information in how technology can be used to further enhance the AF process. Although there were also some notable hiccups in the process of integrating these technological-driven methods, the main takeaway from all these papers would be that with proper design and alignment of how these technological methods could be used alongside with the intended course outcome and aims – is the key to a greater potential.

### ***Semi-structured interviews***

The four papers shown in Table 5 that used semi-structured interviews explored the experiences of the selected samples and how the findings could address the missing gap in understanding how improvements can be made to the AF in higher education through the use of technology.

Bennet et al. (2017) highlighted in their research that technology-supported assessment poses both solutions and challenges, in that there are some forms of assessment that are more suitable in some disciplines than others, some have better technological resources provided, and(or) others have more skilled support staff, alongside with effective technological policy and management in place. The findings also pointed out that generally

participants found themselves to be in the predicament of having to generate efficiencies in assessment and at the same time, meet the need to implement innovative pedagogies. Another key finding highlighted in this research is that academics often experienced challenges whereby the tools available were either inept or unable to bring out the intended pedagogical considerations in their design. Findings from Bennet et al. (2017) also pointed out that strategies to advocate more thoughtful assessment design are very much needed to ensure that the adopted technology-supported assessments do not get fizzed out in the next commencement of a unit.

In a separate research conducted by Chew, Snee, and Price (2016), a positive affirmation that relative to the customary assessment methods (i.e. examinations), PeerMark –, the selected technological-supported peer assessment method, enhances students' understanding via critical thinking and understanding of assessment criteria during the process. The findings also encouraged educators to move beyond using conventional assessment in order to enhance international students' learning experience through a meaningful and relevant integration of computer-supported collaborative educational settings.

Meadows et al. (2016), on the other hand, found that on a bi-annual Institutional Student Survey, educational practitioners appeared to misconstrue students' experiences of learning, teaching and assessment on units studied. This subsequently leads to educational practitioners to therefore find it challenging to address what students would like to see improved, in an effective manner. One of the main disparities between student expectations and educational practitioners' perceptions pointed out in the research is the sense of disconnection in interactive lectures. Students perceived technology-led interactive lectures to be a way for them to have the opportunity to be more verbally engaged in class, as opposed to a form of hindrance to learning. Conversely, educational practitioners concerns over this type of interactive lectures revolved mainly on the idea of control. They perceived that when students are given the opportunity to use learning technological tools in class, it would lead to a sense of lack of control over the class as the students will no longer be engaged in class. As such, the key themes derived from this research highlighted a sense of fear among educators when it comes to integrating technological tools and designing the appropriate approaches to learning and teaching.

While the previously discussed papers explored the area of technology-supported (enhanced) forms of assessment, Glover et al. (2015) learned that educational practitioners in general actively avoid using technology-supported methods of marking (i.e. Microsoft Word's 'Track Changes' feature, annotating PDF documents) as it is not user-friendly or too limiting in comparison to the conventional method of marking on hardcopies – although the students' interview pointed out that they generally preferred electronic feedback for its ease and flexibility when it comes to storing their work and the received feedback. As such Glover et al. (2015) recommended that the stipulation of electronic methods of marking or(and) providing feedback, in which these integrated technological tools possessed more similar usability and functionality as the conventional methods, could bridge the gap. The findings also suggest that efficient electronic workflows can help to offset any prospective negative impact in the quantity and quality of feedback. Having said that, it was also revealed that educational practitioners often do not have the complete picture of the types of assessments that students are undertaking on a particular programme. This resulted in educational practitioners being unable to assist students in making full use of the given feedback and subsequently lead to the inability to make a clear association between providing feedback for a specific AF that is relevant and applicable.

Papers utilising semi-structured interviews generally indicated that as much as there were notable enhancements in the AF process in higher education through the integration of various forms of learning technological tools; educators tend to be more inclined to put off the effort in making the shift from conventional methods of assessing and providing feedback to students, as opposed to tapping into the benefits offered by these learning technological tools. Fundamentally, an aversion trend was observed among educators and it was deemed most likely to be from the lack of understanding in how to pertinently choose the appropriate forms of educational technological tools that blend in perfectly with the design and purpose of AF, which is also then, aligned with the philosophies of learning and teaching pedagogies.

## ***Systematic literature review***

In this subsection, there were altogether seven papers that conducted a systematic literature review in hopes to address and discuss the missing gap in the area of technology enhanced AF, and to subsequently provide some clues as to how educators can rethink and realign the purpose of AF in the context of student learning in higher education.

The review carried out by Timmis et al. (2016) provided seven noticeable prospects of educational technological tools and how these areas of opportunities could further enhance the transformation in assessment. These areas are:

1. *New forms of representing knowledge and skills* – allowing various forms of assessments to be designed and enabling students to progress in a diversified manner;
2. *Crowd sourcing and decision-making opportunities in assessment* – learners now have increased control as to what is assessed through the extension of decision-making in assessment, thus allowing them to participate effectively;
3. *Increasing flexibility* – enables assessment to be less time and location specific whereby learners have the power in choosing when, where and how the information is assessed. Formative and summative assessment data could also be integrated along with how feedback from students and on their results are combined;
4. *Supporting and enhancing collaboration* – provide the platform for peer assessments where it encourages the collaborative construction of knowledge through sharing of data and working together in different contexts of the learning environment, making assessment more relatable to real-world problem-solving;
5. *Assessing complex problem-solving skills* – the application of simulations and game-based environments served as a means to assess complex skills that is otherwise difficult to create in the conventional classroom settings;
6. *Enhancing feedback to students* – the notion that improving assessment for learning lies in the quality of feedback given and how it was delivered. Hence, it is now possible for relevant stakeholders to better sustain learning through the means of various techniques made possible by integrating educational technological tools; and
7. *Exploiting learning analytics locally and nationally* – this could be achieved through combining different datasets that are offered by educational technological tools in which stakeholders from all levels are able to access different sets of data, which may include other institutional performance. Feedback derived from this could suggest



improvements and recommendations for all the relevant stakeholders within the higher education settings.

It is also important to take note that educational technological tools are more often than not, being perceived to be a disruption of the social and institutional status quo, roles and boundaries. As such, the need for radical changes in assessment practice remains gradual, and the practices and research boundaries of different disciplines comprise their own set of challenges. Working in isolation and on different *modus operandi* resulted in scarce opportunities for collaboration and dialogue session which is clearly necessary for greater progression (Timmis et al., 2016).

Yuan and Kim (2015) reviewed the effectiveness of feedback through adopting freely available educational technological tools. They proposed using three types of technological tools (i.e. VoiceThread for multimedia sharing, Wikis for collaborative, and Jing for screencasting tools). These were chosen for the reasons of: (1) popularity, (2) affordance, and (3) minimal effort is needed to install and maintain the system. The characteristics of effective feedback identified in this review included: (1) content, (2) timing, (3) dialogue through, (4) sources, and (5) students following-up with the given feedback. The paper also emphasized that although educational technological tools can be used to provide effective feedback, it does not warrant that the feedback given through the integration of these educational technological tools is always helpful. Without a sound and thoughtful underlying philosophical reasoning in accordance to the learning and teaching pedagogies, choosing an educational technology tool just for the sake of its innovation may be insufficient to enhance students' learning and to maximize the educational technology's ultimate potential.

Hsu et al. (2012) included research on technology-based learning from 2000 to 2009 in their review. The evolution of these trends mainly stemmed from a few directions such as (1) technology comparison to technology-based learning related pedagogical theory development; (2) from students' motivational issues to the educators'; (3) from learning systems to individualized and collective learning experiences; and (4) from domain-general to domain-specific contemplations. The findings revealed that technology-based learning context is fast becoming a common setting in which educators are required to deliver their instructions through the integration of educational technological tools regardless of learning groups or academic disciplines. In easing the transition, teacher education or

training programs are encouraged to impart knowledge on how these educational technological tools should be used to enhance students' learning and to embody good quality of technology-based learning instructions. This review also highlighted how the development of the TPACK model, in a way, is being viewed as an important effort in addressing such essential requirements.

The review conducted by Gikandi, Morrow, and Davis (2011) focused on the key themes and findings derived from the online formative assessment in higher education research area. The findings indicated that formative assessment in online higher education settings is an important strategy that requires support from and professional development for faculty in various disciplines. This strategy still requires further research and this could be carried out with educational technology models, which educators can draw upon and be inspired to develop for their practice. Overall, the review provided the implications that there is a need for online educators to place their emphasis on the value of integrating assessment within the learning processes.

Hepplestone et al. (2011) in their review found that in the literature the use of technology to support and enhance feedback processes and practices to be limited in comparison to the use of technology in supporting and enhancing student learning and assessment. Hence, as much as there are significant benefits captured in the review such as how through the use of technology, feedback could enhance students' engagement, provide students' with a level of flexibility and convenience, as well as how time is now saved on administrative processes for the educators – the review also indicated that the current feedback practices do not work. Hepplestone et al. (2011) also pointed out how the review highlighted that there is a lack of reported day-to-day practices when it comes to effective AF practices. Therefore, it is equally important to report on the effective strategies as to how technology can be used to support the feedback processes and practices, alongside with the general trend in focusing on the loopholes of AF.

In a more related literature review on technology enhanced formative assessment (TEFA) conducted by Beatty and Gerace (2009), it was found that through embedding TEFA in classroom response systems, improvements should be observed in the usage and how it can help teachers to bridge the gap between theoretical findings from educational research and the practicality as well as flexibility of classroom strategies for science instruction. It was also noted that in conducting a TEFA type of class, this in turn

suggested that educators would need to start developing skill-sets that were previously not developed. This would require high quality-dialogical discourse and pervasive meta-level communication – a role that were not accustomed to by many.

Hatzipanagos and Warburton (2009) similarly conducted a comparison review of emerging technological tools of social software (e.g.: blogs and wikis) and how these technological tools would best support and encourage effective feedback processes and practices. Blogs and wikis seemed to have much more potential in addressing the formative assessment areas such as timeliness, autonomy and ownership, dialogue, visibility, and reflection. However, it was also noted in the review that because blogs and wikis are open systems, issues surrounding the aspects of privacy and control arise. Subsequently, these tools capacity to improve the quality of feedback is moderate, the reason being as Hatzipanagos and Warburton (2009) pointed out, that the attributes of effective feedback are not solely dependent on a particular technology but more on the educators' role in providing the feedback through the use of these emerging technological tools.

In a nutshell, these systematic literature review papers come to a consensus that as much as educational technological tools adopted today may be able to provide more effective and quality assessment feedback, the exercise may be futile without the appropriate and thoughtful underlying philosophical foundation built in accordance with the learning and teaching pedagogies.

### 2.5.5 Quantitative research method

Seven papers using the quantitative research method to further understand and captured the essence of integrating technology in enhancing AF were found.

Table 6: Studies adopting the quantitative research method

Authors and Year	Data collection method
Mohamadi (2018); Karvounidis, Chimos, Bersimis, & Douligeris (2018); Taylor, Ryan, & Pearce (2015); Lemus-Zuniga et al. (2015); Lin & Lai (2013)	Experiment
McCarthy (2017); Han, & Finkelstein (2013)	Survey

## ***Experiment***

The papers presented in Table 6 conducted experiments to investigate the effects of innovative teaching methods, online formative assessments and computer-mediated feedback on students' learning experiences.

Mohamadi (2018) found that the implementation of engaging technology with well-designed assessment strategies, has an impact of making learning efficient. As such, the study derived that important implications for improved pedagogical practices and instructional outcomes would revolve around how educational technology designers could take into consideration collaborative learning in designing and producing these technological tools.

Echoing that, Karvounidis, Chimos, Bersimis, and Douligeris (2018) investigated the effects of a web 2.0 learning environment on students' performance. Findings from the study highlighted the importance of a suitable and functional educational framework that focuses on technology as well as approaches since the implementation of technology contributes to learning effectiveness and enhances students' interest.

On the other hand, Taylor, Ryan, and Pearce (2015) found that through online peer-marked assessment, feedback is possibly the most important part of the assessment process given its ability to affect future learning and student achievement. The main takeaway from this research is that the findings provided evidence that innovative assessment designs do have the ability to bridge the gap between educators and students.

Similarly, Lemus-Zúñiga et al. (2015) also reported that technological tools enables feedback to be more interactive and immediate in comparison to the conventional feedback method. Most importantly, findings from this research indicated that with the use of LMS, students are able to have interaction and are also aware of their own progress. As such, timely and elaborated feedback has a significant impact on student learning.

In a different context, Lin and Lai (2013) found that even in the a virtual collaborative learning environment, students preferred to ask for help (from educators) with whom they have the closest friendship offline (in the real world).

Through the utilization of experiment research method, these papers presented a similar trend – focusing on the importance of having a general, fitting, and grounded framework that would be able to guide: (1) educators on how to apply and integrate these available educational technological tools into their chosen learning and teaching philosophies and pedagogies; (2) educational technology developers and designers to take into consideration in developing and designing a tool that is able to support the organic growth and to take into account the complexity and diversity of the learning and teaching process.

### **Survey**

Out of the 27 papers identified, only two studies conducted by McCarthy (2017) and by Han, and Finkelstein (2013) utilized the survey research method to explore the effects of pedagogical development using educational technological tools on students' learning experiences.

As much as a majority of students would still prefer to receive feedback from educators, findings from McCarthy (2017) also illustrated that students benefited more from the opportunity to provide feedback to their peers through an online environment in comparison to face-to-face. This form of online interaction enabled students to overcome language barriers and other learning obstacles. The findings also showed that generally students were provided with a more flexible learning environment in which they were given the opportunity to interact in both in-class and online learning environments – accommodated the needs of different students in large classes (McCarthy, 2017).

Findings from Han, and Finkelstein (2013) on the other hand, showed that although it was suggested that pedagogical development may have an impact on educators adopting educational technological tools in class, there were not many studies on how to design and implement these educational technological tools. Hence, it is suggested that educators and educational developers need to start designing and delivering strategies on adopting these educational technological tools aptly.

Although there were not many papers incorporating survey research method to explore on the area of pedagogical development in relation to educational technological tools, the insights derived from these two papers offered a different view and provided the understanding that in order to provide students with an effective and flexible interactive

learning environment; educators would need to first be mindful and thoughtful in how they are going to integrate these technological tools into the assessment feedback process. Rather than just for the sake of keeping up with the trend, it is even more imperative to be insightful and reflective when it comes to making the shift from conventional methods of assessment feedback to enhancing this process through the use of educational technological tools.

### 2.5.6 Mixed methods

Table 7: Authors who adopted the mixed method

Authors and Year	Data collection method
Poth (2018); Sit & Brudzinski (2017); Rodriguez-Gomez, Quesada-Serra & Ibarra-Saiz (2016); Carruthers et al. (2015); Hettiarachchi, Mor, Huertas, & Guerrero-Roldan (2015); Dias & Diniz (2014)	Combination of survey or (and) experiment with semi-structured interviews, observations, or (and) reflections

All of the six papers in Table 7 above adopted the mixed method to investigate the effectiveness of technology-enhanced AF strategies. Poth (2018) points to educational technological tools being a crucial component in creating meaningful learning experience. Sit and Brudzinski (2017) also found that while educators initially find that it is time consuming to implement feedback and reattempts options for assignments through LMS, it is actually more efficient and effective in the long run.

All in all, the structure of the online course ultimately encourages students to achieve greater mastery in learning activities and the online environment provided further improvement in student learning (Sit & Brudzinski, 2017). Echoing this, Rodríguez-Gómez, Quesada-Serra and Ibarra-Saiz (2016) highlighted that although challenges may arise as to how it often does when paving a new way in doing things, the use of technology could ease some aspects of the assessment process. In relation to providing audio feedback, Carruthers et al. (2015) found that in general, students preferred audio feedback over written feedback as it offers convenience and accessibility for students to retrieve the feedback provided. In their study, Hettiarachchi et al. (2015) pointed out that with the TEA system, educators are now equipped with the opportunity to make the shift from the conventional assessment methods to the formative e-assessment model under an online learning environment. Similarly, finding from the study conducted by Dias and Diniz (2014) identified that there is a need to rethink the online learning environment structures which

would in turn provide: (1) a more flexible and organic flow that could be integrated into different interactive learning activities; (2) ability to facilitate educators' ICT knowledge and nurture their intrinsic motivation; and the (3) ability to also support students' learning strategies that would enable them to have a more meaningful learning experience.

These papers points to the path in which as much as there are noticeable resistances among educators and hiccups in implementing educational technological tools as an effort to provide a more effective and meaningful learning experience for students, the ultimate solution for the underlying root cause is the need to design and develop an educational technology framework that provides practical guidelines in helping educators to find the balance between the need to stay relevant without compromising the fundamental philosophies that guided their path as an educator.

#### **2.5.7 Challenges and gaps in TEAF**

In a nutshell, upon reviewing the selected 27 papers, a much clearer picture arises, indicating that there are strengths and challenges in the effort of enhancing AF practices through the use of various readily available educational technological tools. Some notable issues that arises with usage of these educational technological tools were often viewed as a hurdle by many educators due to (1) their lack of understanding in integrating suitable technological tools with their fundamental learning and teaching philosophies; and (2) that the effort of integration itself takes up too much time. Apart from that, the systematic literature review also illustrated a need for an all-encompassing and versatile educational technology framework, which will help guide educators in their efforts of enhancing AF through educational technological tools. It was also clear from the conducted systematic literature review that the majority of papers were from the western context and only 2 out of the 27 selected journals were from Taiwan (an Asian country). As such, this might reflect that there is a need to further investigate how technology is being integrated into learning and technology process within the Asian context.

From the two issues mentioned above, a need to understand educators' understanding on the integration between educational technological tools and their fundamental learning and teaching philosophies through the use of TPACK and educators' perspectives and opinion on technology integration through interview sessions. Thus, the systematic literature review conducted using research methods as a criteria to delineate, this research was able

to gather some information on how these papers provided a consistent finding in which educational technological tools can be integrated to enhance the AF process. Although this may be the case, educators were deterred in a way when it comes to integrating these tools due to lack of understanding on how to blend the readily available tools with their AF practices. Educators were also uncertain on how these tools could best be integrated in accordance with their chosen LT pedagogies. As such, educators were encouraged to be thoughtful in their ways of integrating these tools into the AF practices.

## **2.6 Summary**

In summary, this chapter provided an overview of the findings on the previous studies conducted in the AF area, which facilitated the emergence of a few consistent trends.

This research was able to capture on how a handful of studies conducted previously in the area of integrating educational technological tools to enhance AF have a tendency to overlook the feedback aspect. These studies generally placed more emphasis on the assessment aspect as a much clearer definition of technology enhanced assessment was explored and a more in-depth understanding on how these tools could assist in supporting and enhancing assessment were investigated. Apart from that, these studies also operate under a similar understanding of how these tools would only be able to unlock their fullest potential through appropriate and thoughtful LT philosophies and pedagogies. The existing and highly advocated TPACK framework was able to assist educators in narrowing the existing gap of seamless integration but this research also provided an alternative and refreshing point of view on how a new and versatile framework could guide educators with not just how to bridge the gap in integrating educational technological tools in their LT process but also to incorporate these tools to enhanced the current AF practices.

The comparison table provided in this research also places attention on how the existing key AF principles and models projected an absence in terms of capturing the multidimensional aspect of educational technological tools incorporation to enhance current AF practices in the HEIs context. This absence indirectly conveys a crucial message on how a more versatile framework will then serve as the much-needed necessity in the area of educational technology. The systematic literature review conducted in this research also highlighted the opportunity for this research to work on the customization of the final outcome – development of a more customizable framework,



which will also benefit the HEIs in the Asian context as the existing principles, models and frameworks were all based on the Western context.

The next chapter explores the methodological approach of this research in seeking to understand what facilitates educators across disciplines in the usage of educational technological tools in enhancing the AF practices.

## **CHAPTER THREE**

### **RESEARCH METHODOLOGY**

The ontology and epistemology perspectives that this research has adopted will be discussed in this chapter. This research has chosen a concurrent mixed-method convergent parallel design strategy to collect both quantitative and qualitative data simultaneously.

*Section 3.1* provides an insight into the research paradigm that this research undertakes, followed by *Section 3.2* that explains more on the data collection procedure and *Section 3.3*, which presents information on ethical considerations. *Section 3.4* provides more explanation of the data analysis through the use of convergent parallel mixed method strategy. *Section 3.5* provides information on the integration of both qualitative and quantitative data.

#### **3.1 Research Paradigm**

To understand the research paradigm approach that this research has adopted, it is crucial that firstly, an understanding of the ontological and epistemological assumptions and perspectives, as well as the methodology used that is consistent with the research strategy chosen is provided. The philosophical assumption used in this research, otherwise known as worldview, will then serve a guide in investigating and answering the mentioned research questions in Chapter 1.

According to Punch (2014), in simple words, ontology refers to what the reality is like; while epistemology on the other hand attempts to explain the relationship between the researcher and that reality – and finally, methodology points to the methods that can be used to study that reality. Creswell and Plano Clark (2011) also mentioned that there are four worldviews and these worldviews, although having common elements, at the same time take on very different stances. Bryman (2012) mentioned that objectivism and constructivism were positioned respectively in the aspect of ontological considerations. This research takes on the position of constructivism. Unlike its counterpart, objectivism, this research believes in the notion that social interaction not only produces social phenomena but it also produces an on-going process of reforming (Bryman, 2012, 2016).

However, after much consideration, a pragmatism worldview would be better suited for this research as understanding of the problem, knowing “*what works*”, and being able to put the findings into real-world practice (Creswell & Plano Clark, 2007, 2011), is the main goal. As such, this research views reality as both singular and multiple in which there are existing theories that explains a phenomenon, but at the same time, emphasis is also given on individual input into the nature of this phenomenon as well.

Echoing that, Gray (2004) stated that it is important to have an epistemological perspective as it can help to clarify issues of research design and it will also assist researchers to further recognized which research design will work out. Meanwhile for the epistemological considerations, this research positioned itself towards practicality in addressing the research questions (Creswell & Plano Clark, 2007, 2011). With the positions spelt out clearly, the pragmatism paradigm will be chosen as the main paradigm of this research because it seeks to find “*what works*”, through various approaches while appreciating what both objective and subjective knowledge has to offer.

Bryman (2012) explains that research is often carried out in an attempt to answer questions presented by theoretical considerations. However, alternatively, one can also regard theory as an aftermath of data collection and analysis. Hence, it was important to understand more as to how one can imply the relationship between theory and research – deductively or inductively. The main difference between a deductive and inductive approach is that deductive approach requires a researcher to construe a hypothesis based on what is known and what is relevant in a particular area through the use of theory. On the other hand, an inductive approach involves analysing the careful observations and(or) findings which leads to the outcome of proposing a theory (Bryman, 2012, 2016). Hence, the process of research applied in this research also reflects the pragmatism philosophy in which a combination of both deductive and inductive thinking, through the mix of both qualitative and quantitative data gathered in this research.

The summary of the main differences between a deductive and an inductive approach is shown in Table 8 and Figure 6 below:

Table 8: Differences between a deductive and inductive approach of research

Categories	Deductive	Inductive
<b>Approaches</b>	General to more specific Top-down approach; experiment and affirmation of theories	Specific observations to broader generalizations and theories development Bottom-up approach
<b>Nature</b>	More narrow and specific in nature Concerns with testing or confirming of hypotheses	More open-ended and exploratory
<b>Empirical</b>	More likely to be quantitative	More likely to be qualitative or a mixed-method
<b>Data</b>	Mainly numerical or measurements	Mainly words or descriptive in nature

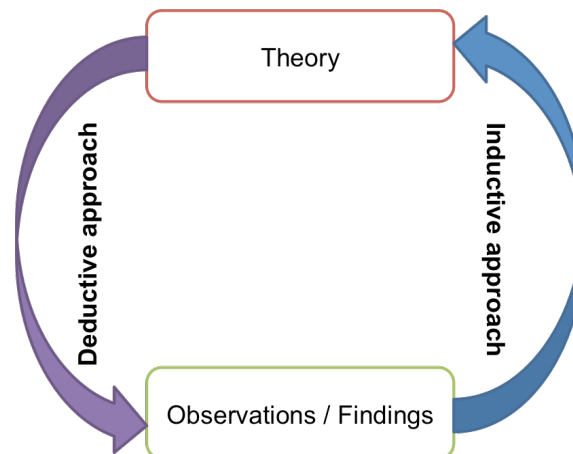


Figure 6: Deductive versus Inductive approach (Bryman, 2012)

However, as much as this research is leaning towards the mixed-method approach; a closer look at the previous studies conducted in this area of research would be able to provide a more concrete justification as to whether a quantitative, qualitative or a mixed-method research design would be better suited in today's era.

Based on Figure 6, it was observable that the majority of the published articles in this area adopted a qualitative research design (14) followed by quantitative research design (7). Punch (2014) stated that combining these two methods would in turn offer the possibility of having the strengths from both of these designs and subsequently compensating the weaknesses. Therefore, this research adopted a mixed-method design; in which case studies with comparative methods in which multiple sources of data and multiple data

collection methods (i.e. interviews, narrative reports and questionnaire) were utilized. Details about both the qualitative and quantitative aspects of this research will be discussed in the next subsections.

### **3.1.1 Mixed methods approach**

Fraenkel, Wallen, and Hyun (2012) defined a mixed-methods approach to be a design in which both quantitative and qualitative methods are applied alongside one another. The reason for this research to be adopting this approach is to cross validate if the findings from both the qualitative and quantitative aspects of this research converge on a single interpretation of a phenomenon – which in this case, would be the integration of educational technological tools in the AF process in higher education settings.

Presently it has been noted that there are six types of mixed-methods design, namely: (1) the convergent parallel design, (2) the explanatory sequential design, (3) the exploratory sequential design, (4) the embedded design, (5) the transformative design, and (6) the multiphase design (Creswell & Plano Clark, 2011; Fraenkel et al., 2012). As this research seeks to develop a complete understanding of the current AF practices across disciplines in HEIs; the different but complementary data collected on this topic will then provide a better understanding of the research problem. This will in turn, then lead to the development of a framework, which could be used in real-world practice. Thus, it will be more appropriate to apply the convergent parallel design, echoing the pragmatism worldview adopted in this research.

This convergent parallel design is characterized by the intention of bringing together qualitative and quantitative methods to synthesize the complementary results in order to develop a more holistic understanding (Creswell & Plano Clark, 2011). This mixed-methods design strategy enables the researcher to collect and analyse both qualitative and quantitative data during the same phase of the research process and then merge the two sets of results into an overall interpretation. In other words, both qualitative and quantitative methods are used to study the same phenomenon to determine if the two converge upon a single understanding of the research problem being investigated (Fraenkel et al., 2012). Both methods are also being given equal priority and all data are being collected simultaneously. Figure 7 illustrated below shows the level of priority of the phases undertaken in this research based on the convergent parallel design.

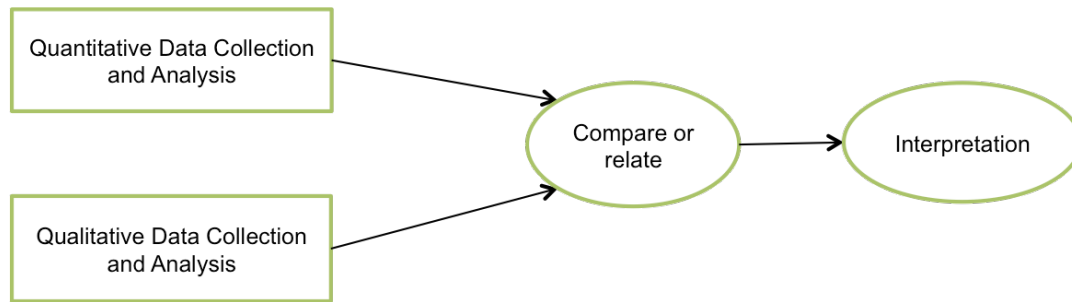


Figure 7: Convergent parallel design (Creswell & Plano Clark, 2011)

The strength of using this mixed-method design is that it is considered to be one of the more efficient designs, in which both types of data (qualitative and quantitative) are collected simultaneously during the data collection phase. However, it is also important to note that the predicament that comes with this design is that it can be quite challenging to merge two sets of different data and their results in a meaningful way (Creswell & Plano Clark, 2007). Similarly, Hesse-Biber (2010) pointed out that the parallel design is also used in triangulating qualitative data with the quantitative data to verify the predominately qualitative findings. As such, effective strategies were used to facilitate the merging and triangulation of the data sets and this will be discussed in the next few subsections below.

### 3.1.2 Qualitative phase

For the qualitative part of this research, this research collected and extracted information on the types of AF provided to students manually through the readily available course outlines/unit guides from four different disciplines, namely (1) Computer Science/Information Technology; (2) Education; (3) Engineering; and lastly, (4) Psychology in HEIs in Malaysia. This research argues that the information gathered from the secondary data provides the much-needed concise insight into the current AF practices in HEIs. It is also important to note that the choice of the disciplines used in this research was based on information extracted manually from previous studies conducted in the area of AF. As such, Image 2 below depicted a systematic literature review database of AF literatures gathered from Q1-Q3 ranked journals. Thus, it was found that these papers typically include one or more of the four selected disciplines as the scope of their studies. Therefore, this research adopted all four of these highly used disciplines as the scope of research as well.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
11	Q2- STUDIES IN HIGHER EDUCATION	The contentious element: Reconsidering the role of assessment feedback in student learning	Higgins, Hartley & Sefton	2002	- Adopting aspects of a constructivist theory of learning, it is seen that formative assessment feedback is essential to encourage the kind of 'deep' learning desired by tutors	Mixed method: Qualitative and Quantitative	Survey and interview	NO	19 students from 2 different institutions	England	Emerging trends and themes	Business & Humanities		
12	Q2- STUDIES IN HIGHER EDUCATION	Reconceptualising assessment feedback: a key to improving student learning	Beaumont, O'Doherty & Shannon	2011	- results show that students experience a radically different culture of feedback in schools/colleges and higher education - in schools/colleges provide extensive formative feedback and guidance - in higher education focus upon independent learning judged summatively	Mixed method: Qualitative and Quantitative	Survey and interview	NO	29 staff and 145 students in 6 schools/colleges and 3 english universities across 3 disciplines - psychology, education studies, performing arts	England	Thematic analysis	Psychology, Education studies, Performing arts		
13	Q3- ASSESSMENT & EVALUATION IN HIGHER EDUCATION	Redesigning models of feedback for learning: the challenge of design	Soud & Morley	2013	- identifies the importance of curriculum design in creating opportunities for students to develop the capabilities to operate as judges of their own learning - findings focus on those reported practices consistent with a framework for sustainable feedback	Conceptual paper	Review of literature - propose two models	NO	Past 50 years	Australia	N/A	Engineering, Biology		
14	Q2- STUDIES IN HIGHER EDUCATION	Developing sustainable feedback practices	Carlson, Sutton, Yang & Lam	2011	- programme continued to focus on assessment and design around student learning, student will not only have the opportunity to apply their knowledge in a practical context, they will also be maximising their personal learning outcomes with the added advantage of being better equipped to compete in an increasingly competitive marketplace - proposes that teachers should strive to incorporate four different types of assessment tasks throughout a programme of study, namely diagnostic, formative, integrative and summative tasks, and that the outcomes and reward mechanisms for different assessment types be explained more clearly to students	Qualitative	Case studies, interviews, Review of literature	YES	10 award-winning academics	Hong Kong	Content analysis	N/A		
15	Q3- ASSESSMENT & EVALUATION IN HIGHER EDUCATION	Assessment-guiding learning: developing graduate qualities in experiential learning programme	Clements & Cord	2013	- e-taps, learning modules, reflective journal	N/A	N/A	YES	N/A	Australia	N/A	Internship / Experiential learning programme		
16	Q3- ASSESSMENT & EVALUATION IN HIGHER EDUCATION	Integrative assessment: reframing assessment practice for current and future learning	Crisp	2012	- feedback landscape informed by institutional and sociocultural perspectives is developed and presented as a valuable framework - findings suggest that the most frequent assessment methods are written tests, oral presentations in group and project work	Conceptual paper	Review of literature - propose principles	NO	N/A	Australia	N/A	N/A		
17	Q1- REVIEW OF EDUCATIONAL RESEARCH	Making sense of assessment feedback in higher education	Evens	2013	- participants who are assessed by methods which require their active involvement view assessment as a fairer and more effective process than students who are assessed by more traditional methods such as examinations and written tests - however the idea of conflict in assessment emerged as a key distinctive feature associated with learner-centred assessment methods such as project work and portfolio	Qualitative	Systematic review of the literature	NO	N/A	London	N/A	N/A		
18	Q2- STUDIES IN HIGHER EDUCATION	Perceptions of effectiveness, fairness and feedback of assessment methods: a study in higher education	Ramos, Viega Simoes, Barros & Pereira	2015	- group assessment denotes student learning; we describe the innovative assessment tasks that were implemented to enhance student learning, provide the rationale for the design of these tasks as supported by the current literature, and reflect on	Quantitative	Survey	NO	378 undergraduates from 2 different universities	Portugal	Multivariate analysis	Health sciences, Psychology, Education, Engineering		
19	Q3- IEEE TRANSACTIONS ON EDUCATION	Redesigning the assessment of an entrepreneurship course in an information technology degree	Parabede & Lyons	2012		Qualitative	Case studies	NO	N/A	Australia	N/A	Information technology		

Image 2: Systematic literature review database table

Meanwhile on the other hand, this research also understands that with just the information gathered from the secondary data (course outlines/unit guides), it may not provide a full representative of the actual circumstances of how the AF practices are being executed. As such, the qualitative part of this research also consists of semi-structured interviews from the educators from the four selected disciplines. The sampling methods that were chosen were purposive and snowballing sampling method. Chua (2012) explained that purposive sampling is used when there are certain characteristics that need to be fulfilled by the respondents and without these characteristics, they will not be chosen.

Therefore, the inclusion criteria are listed as followed:

- Educators in the higher education sector;
- Educators from either one of these four disciplines – (1) Computer Science/Information Technology, (2) Education, (3) Engineering, and (4) Psychology.

Due to the nature of this research, the feasibility of obtaining a full list of the members in this population with similar characteristics was somewhat diminished, hence the snowball sampling method was also used in this research. A sample of the interview questions can be found in Appendix D.

### 3.1.3 Quantitative phase

Meanwhile, for the quantitative part of the research a questionnaire was used to collect data. According to Saunders, Lewis, and Thornhill (2009), questionnaires are particularly useful from providing simple demographic information to gathering opinions as it helps in identifying and describing various aspects of a particular phenomena.

The main questions for the questionnaire for this research were adapted from TPACK as a means to capture educators' understanding on the relationship between three basic components of knowledge required for appropriate pedagogical methods and effective technology integration within the learning environment (Koehler & Mishra, 2009; Mishra & Koehler, 2006; Schmidt, Baran, Thompson, & Mishra, 2009). The origination of TPACK have been widely adopted in the United States, with reliability and validity rate of this TPACK instrument reported to have good to excellent internal consistency with the Cronbach's alpha of between 0.75 and 0.92 for all of the seven constructs (Koehler, Mishra, Kereluik, Shin, & Graham, 2014; Schmidt, Baran, Thompson, & Mishra, 2009). Echoing that, Archambault and Crippen (2009) also reported the internal consistency of this instrument to be 0.70 to 0.91 for each of the constructs. This is further supported with the use of TPACK in the Middle East, conducted by Sahin's (2011) research of which the internal consistency was reported to be ranging between 0.88 and 0.93 for all seven constructs. In the same study, Sahin also conducted a test-retest reliability in which it was reported to be ranging from 0.79 to 0.86 on the seven constructs. Heading towards the east, a research conducted in Singapore by Chai, Koh, Tsai et al. (2011) utilizes TPACK for meaningful learning with ICT.

However, instead of using just the 28 survey items found in Schmidt et al.'s (2009) survey, this research decided to adapt the survey questions from Chai, Koh, Tsai, and Tan's (2011) survey. The reasons for this is that the items in Chai et al.'s (2011) survey were generic enough to support the diversified nature of the educators' disciplines without the need for extensive modifications, and that Chai et al.'s samples (Singapore teachers) closely resembles the proposed samples (Malaysia educators) for this research. Their version of TPACK also consists of items from the domain of Pedagogical Knowledge for Meaningful Learning (PKML) which aims to better address the pedagogical emphasis (Chai et al., 2011). This version of TPACK is more aligned with the findings from the systematic literature review conducted in the previous chapter, which suggested the need



for a greater emphasis to be placed on the pedagogical aspects of learning and teaching processes. Apart from that, this research also used items from Archambault and Crippen's (2009) version of TPACK such as: '*My ability to use online assessment to modify instruction*' from the Technological Pedagogical Content Knowledge domain and '*My ability to adjust teaching methodology based on students performance/feedback*' from the Pedagogical Knowledge domain. The reason for this is to ensure that the TPACK survey used in this research would better capture the essence of enhancing AF practices with the use of technology. A sample of this questionnaire can be found in Appendix E.

### **3.2 Selection of participants**

The targeted population in this research comprises of educators from the two top HEIs in Malaysia. The selection of these institutions was based on the world rankings of available public and private institutions in Malaysia. This research also takes into consideration how there might be some slight differences between a full-fledged research HEIs and HEIs that may be focusing more on the teaching aspect. As such, the two highest ranking institutions in Malaysia as indicated in the QS World University Rankings (QS Quacquarelli Symonds, 2018a, 2020), were chosen as considerations on both the teaching and research aspects of the educators within the institutions' itself are being taken into account. The selected institutions are (1) University A – ranked 58<sup>th</sup> and (2) University B – ranked 70<sup>th</sup>. These two institutions were chosen based on the following six indicators listed by QS Quacquarelli Symonds (2018b, 2020):

- 1. Academic reputation (40%)**

Consist of collated expert opinions of over 80,000 individuals in the higher education space in regards to teaching and research quality at the world's universities, based on the QS Academic Survey.

- 2. Employer reputation (10%)**

Assessing how successful institutions are in preparing the student community for the employment market. Employers were also asked to identify those institutions from which they source the most competent, innovative and effective graduates.

- 3. Faculty/Student Ratio (20%)**

Assesses the extent to which institutions were able to provide their students with meaningful access to lecturers and tutors and at the same time recognizes that a high number of faculty members per student will reduce the teaching burden on each individual academic.

#### 4. Citations per faculty (20%)

Although there is no doubt that teaching is an important pillar of an institution's mission, so too is research output.

#### 5. International faculty ratio and International student ratio (5% each)

Demonstrates the ability to attract faculty members and students from across the world, which in turn suggests that the institution possesses a strong international brand.

With these six indicators (QS Quacquarelli Symonds, 2018b, 2020), this research was able to take into account both research-driven and teaching-driven HEIs as an attempt to ensure that whatever results generated from the findings were able to be generalized to a larger population. Comparison information on the QS six indicators between this two chosen HEIs was compiled in the Image 3 below:

University A	Specifications	University B
1998	Established	1949
Private HEI	Geographic	Public HEI
58	QS World University Rankings (as of Year 2020)	70
Ranking criteria scores based on the six indicators		
88	Academic Reputation	68.2
91.9	Employer Reputation	72
17.1	Faculty Student	90.7
64.2	Citations per Faculty	41.5
100	International Faculty	62.8
99.9	International Students	57.2

Image 3: HEIs six indicators comparison

### 3.3 Ethical considerations and data collection procedures

Before proceeding with the data collection process, this research has applied for, and gone through a vigorous process and finally obtained approval from the Monash University Human Research Ethics Committee (MUHREC), with the project number: 2016-1198. A copy of the ethics clearance document can be found in Appendix A.

All the participants in this research were provided with an explanatory statement, which clarified that they were free to withdraw from both the questionnaire and interview sessions at any given time without being subjected to any forms of penalty. Figure 8 below illustrates the flowchart of how the entire data collection and data analysis procedure were for this research.

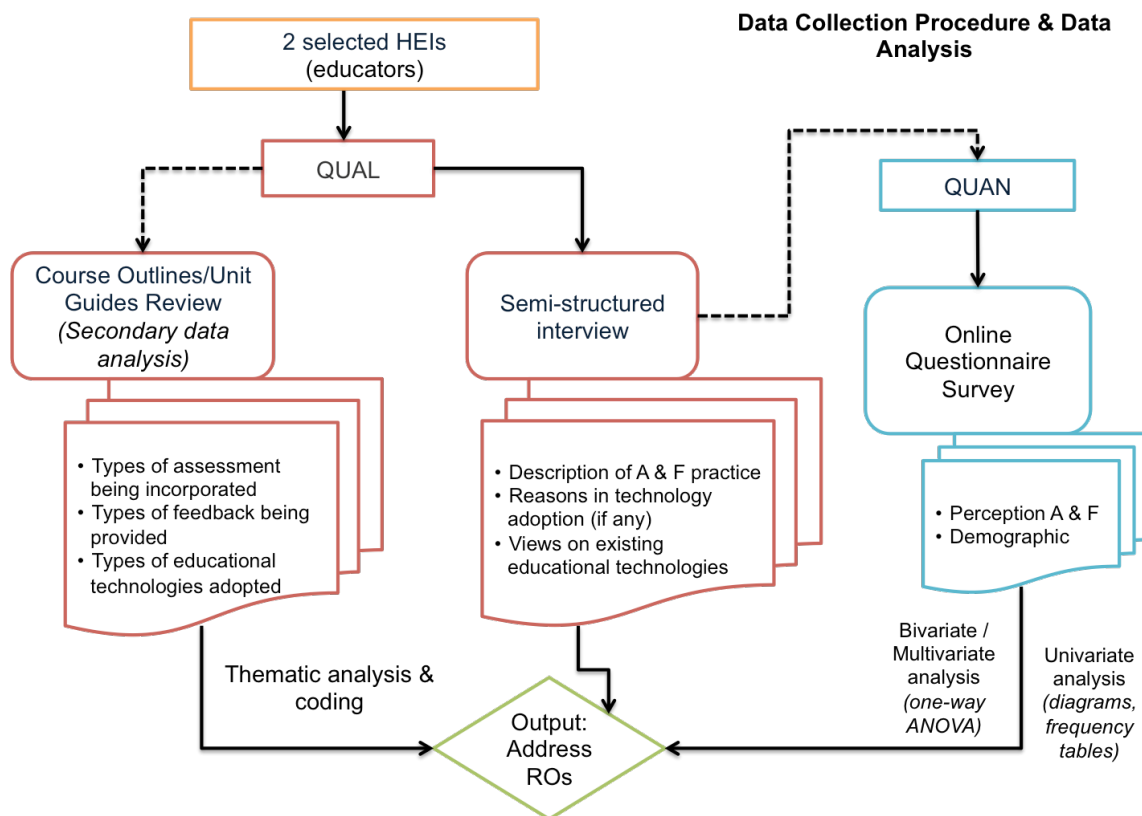


Figure 8: Data collection procedure and data analysis

### 3.3.1 Secondary data analysis

The first phase of this research as illustrated above in Figure 8, was conducted through a series of secondary data analyses. This dataset was gathered through available course outlines/unit guides from both of the HEIs on all the four chosen disciplines, to provide a general view of the current practices of AF process among educators. Information collected from these course outlines/unit guides includes information on the (1) types of assessment that are being used, (2) types of feedback being provided to the students, as well as if (3) any forms of educational technological tools being incorporated into the AF activities. This dataset came to a total of 2,751 data points from across two HEIs in all the four disciplines and more information on this secondary data analysis will be discussed in Chapter 4.

### **3.3.2 Interview**

The interview phase of this research was conducted through semi-structured interview sessions with educators from the two selected HEIs. This research also ensured that each of the disciplines selected had at least one-two participants to represent and to shed some light on what went on, on the ground when it comes to sharing their experiences and opinions on AF activities in HEIs. This research also understands that by utilizing the purposive and snowballing sampling method for these interview sessions, the participants may be more likely to express similar points of view as other educators who may or may not have a similar set of knowledge when it comes to incorporating educational technology tools, recommended them. Thus, this may be one of the limitations of this research and in an effort to reduce the impact of this limitation, this research was mindful to remind the interviewed participants to recommend others who may or may not use educational technology tools.

All the interview sessions were carried out in a face-to-face manner and were audio-digitally recorded using a recording device. The interview sessions were also conducted in a one-on-one basis as it involves participants' personal expressions of beliefs, opinions and experiences. This is to safeguard all of the participants' identities and also their confidentiality in relation to what was being shared (Fraenkel et al., 2012). This research also took extra precaution and labelled each of the sessions with an alphanumerical combination. Once the file had been transferred into the computer for transcribing purposes, the original file from the recording device was deleted.

### **3.3.3 Survey**

For the survey phase of this research, both online and self-reported questionnaires were handed out to as many educators across the four disciplines and two selected HEIs via numerous means (i.e: Facebook posting, the selected HEIs official broadcasting and staff communication email, face-to-face) to ensure that the sample size collected for this aspect of the research would be sufficient.

This research opted to use SurveyMonkey (2016), a free online survey tool to collect the needed data on educators' opinions regarding the use of technology in teaching, learning, AF processes using the adopted version of TPACK from Chai et al. (2011). Apart from

that, this research also prepared hardcopies of the questionnaire to be handed out to educators. However, this research faced a number of challenges when it comes to obtaining sufficient sample size, as a majority of the educators in both of the HEIs were not very keen and rather unresponsive to participate in the survey despite multiple attempts through various means. As such, the unequal sample size for the quantitative aspect of this research may well be a limitation of this research.

### **3.4 Data analysis**

Data analysis from the convergent parallel mixed method strategy is typically indicated by concurrently collecting data from both qualitative and quantitative data but analysing the information separately and then finally merging the two datasets again for interpretations (Creswell & Plano Clark, 2011). The following subsections below provided explanations on how the data analysis was conducted.

#### **3.4.1 Analysis of qualitative data**

In relation to qualitative data, Tables 9 and 10 below depicted a sample from each of the HEIs on how data was collected from the course outlines/unit guides (secondary data analysis). This data is then dissected into different segments and further analysed using descriptive statistics such as frequencies and cross tabulation analysis.

Upon reviewing the course outlines/unit guides, information such as which university the course outlines/unit guides belongs to, the discipline to which the document belongs, and the year cohort in which the course/unit was taught. This information was then further divided into whether it was a compulsory module or an elective.

Apart from that, information on the forms of formative assessment were taken into account and these were then further divided into the following categories for sorting purposes: (a) *Essay/Written/Annotated reviews/Bibliographies*; (b) *Examination*; (c) *Oral presentation/Other performance*; (d) *Portfolios*; (e) *Project work/Practical*; (f) *Self and peer assessment*; (g) *Work based learning/Work placement/Industrial experience*; and (h) *Not available*. Following that, information on whether these forms of formative assessment were technology based and if it is stated in the course outlines/unit guides as yes, details on which types of educational technological tools were incorporated were captured as well.

Likewise, information on the forms of summative assessment and whether they were technology based was also collected. Similarly, information on whether any forms of feedback were provided and what these forms of feedback provided were, also collected and further divided into: (a) *Written feedback*; (b) *Verbal feedback*; (c) *Informal feedback*; (d) *Announcements of marks and grades*; (e) *Moodle/Electronic/Clickers/Forum*; (f) *Formal/General feedback*; and (g) *Graded assignments with/without comments*.

As for the analysis of interview data, thematic analysis was used because its value lies in “*how data are segmented, categorized, summarized and reconstructed in a way that captures the important concepts within a data set*” (Maxwell & Chmiel, 2014, p.26). Apart from that Braun and Clarke (2006) also pointed that one of the values of using thematic analysis is the flexibility that it offers to researchers. Interestingly, thematic analysis also allows researchers to apply it across a range of theoretical and epistemological approaches where it serves as a tool that is capable of providing rich and detailed data (Braun & Clarke, 2006). With that, this research deemed that this method of qualitative data analysis would be best suited; given the nature of this research in which initial information on the current AF practices in HEIs in Malaysia are still unsaturated. Hence this data analysis method would be able to provide a more data-driven type of themes that emerge from the interview sessions, subsequently allowing a more in-depth understanding of the area of technology enhanced AF.

Table 9: Secondary data analysis (a sample from University A)

Universities	Disciplines	Programs	Year / Semester	Units / Courses	FA Assignment	Forms of FA	FA Technology based	Weightage FA	Forms of SA	SA Technology based	Weightage SA	Total weightage	Forms of feedback
University A	Engineering	1. Bachelor of Engineering (majoring in Chemical Engineering )	Year 2	3. CHM1051 – Chemistry I advance	Online assessment	Examination	Yes (Online quizzes – Moodle)	10%	Examination	Not available	50%	100%	1. Written comments on laboratory reports 2. Verbal feedback is also provided during tutorials
University A	Engineering	1. Bachelor of Engineering (majoring in Chemical Engineering )	Year 2	3. CHM1051 – Chemistry I advance	Laboratory work	Project work/Practical	Not available	40%	Examination	Not available	50%	100%	1. Written comments on laboratory reports 2. Verbal feedback is also provided during tutorials

Table 10: Secondary data analysis (a sample from University B)

Universities	Disciplines	Programs	Year / Semester	Units / Courses	FA Assignment	Forms of FA	FA Technology based	Weightage FA	Forms of SA	SA Technology based	Weightage SA	Total weightage	Forms of feedback
University B	Computer Science and Information Technology	1. Bachelor of Computer Science ( <i>majoring in Computer System and Networking</i> )	Year 2	4. WIA2002 – Software Modelling	Mid semester test	Examination	Not available	15%	Examination	Not available	50%	100%	1. Grade for continuous assessment t will be announced through LMS
University B	Computer Science and Information Technology	1. Bachelor of Computer Science ( <i>majoring in Computer System and Networking</i> )	Year 2	4. WIA2002 – Software Modelling	Group assignment report	Essay/Written/ Annotated reviews/Bibliographies	Not available	23%	Examination	Not available	50%	100%	1. Grade for continuous assessment t will be announced through LMS
University B	Computer Science and Information Technology	1. Bachelor of Computer Science ( <i>majoring in Computer System and Networking</i> )	Year 2	4. WIA2002 – Software Modelling	Assignment presentation	Oral presentation/ Other performances	Not available	2%	Examination	Not available	50%	100%	1. Grade for continuous assessment t will be announced through LMS





The results from the query indicated that words like *feedback*, *learning*, *technology*, *assessments*, and *outcomes* are some of the frequently used words by educators during the interview sessions. As an effort to further illustrate the relationship among these frequently used words and the derived codes in a clear and concise manner, this research also presented a thematic map in Figure 10 below (for a higher resolution image, please refer to Appendix F). To put it simply, thematic maps basically indicate the hierarchical structure of the coding tree of this research (Guest, MacQueen, & Namey, 2012). Therefore, the six phases of thematic analysis framework presented in Table 11 above lead to the formation of this thematic map. The results of this aspect of data will be discussed in the following Chapter 4 – Results and Discussion.

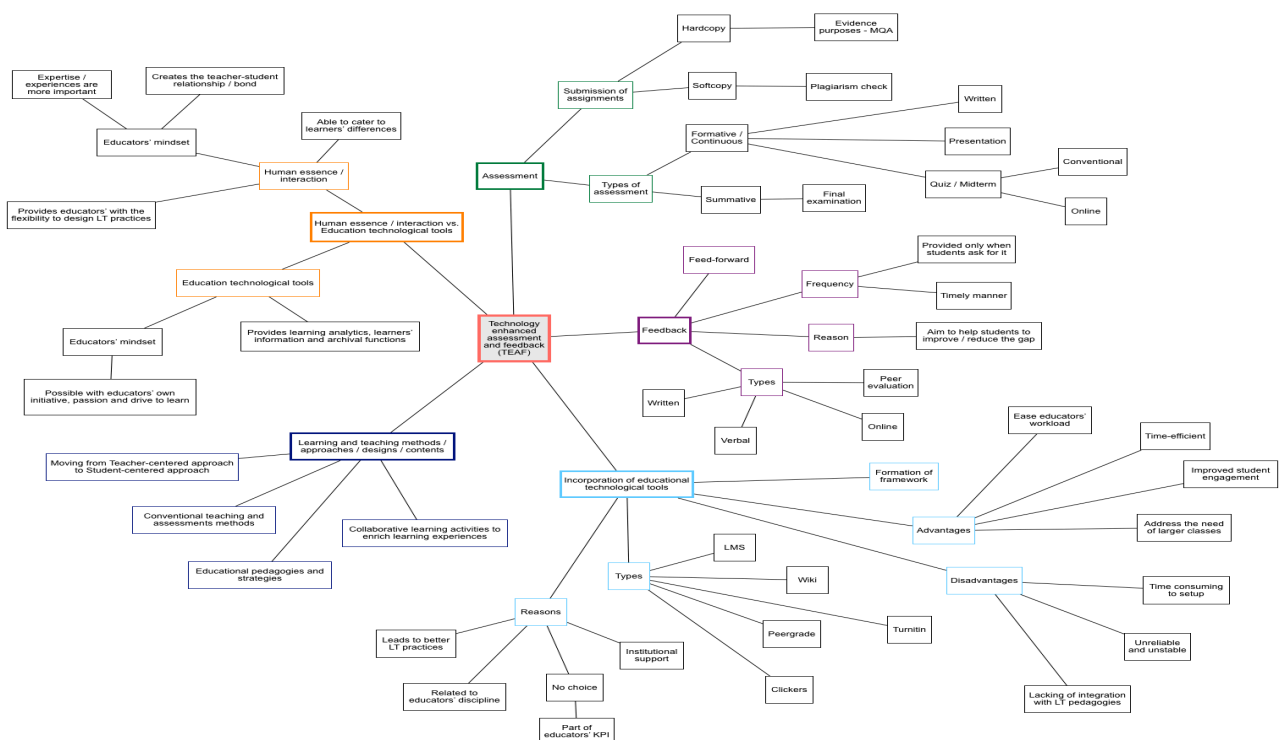


Figure 10: Thematic map

Taking a closer look at the presented thematic map in Figure 10 above (for a higher resolution image, please refer to Appendix F), the main themes that derived from the interview sessions were illustrated in Figure 11 below.

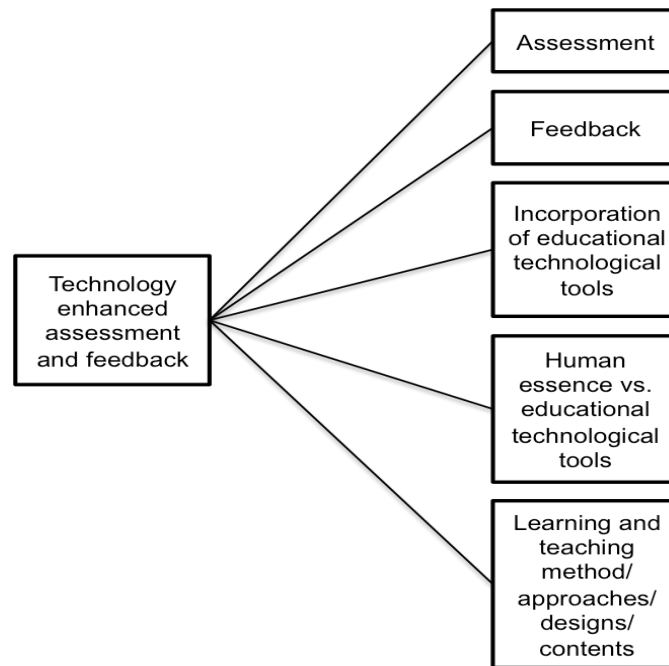
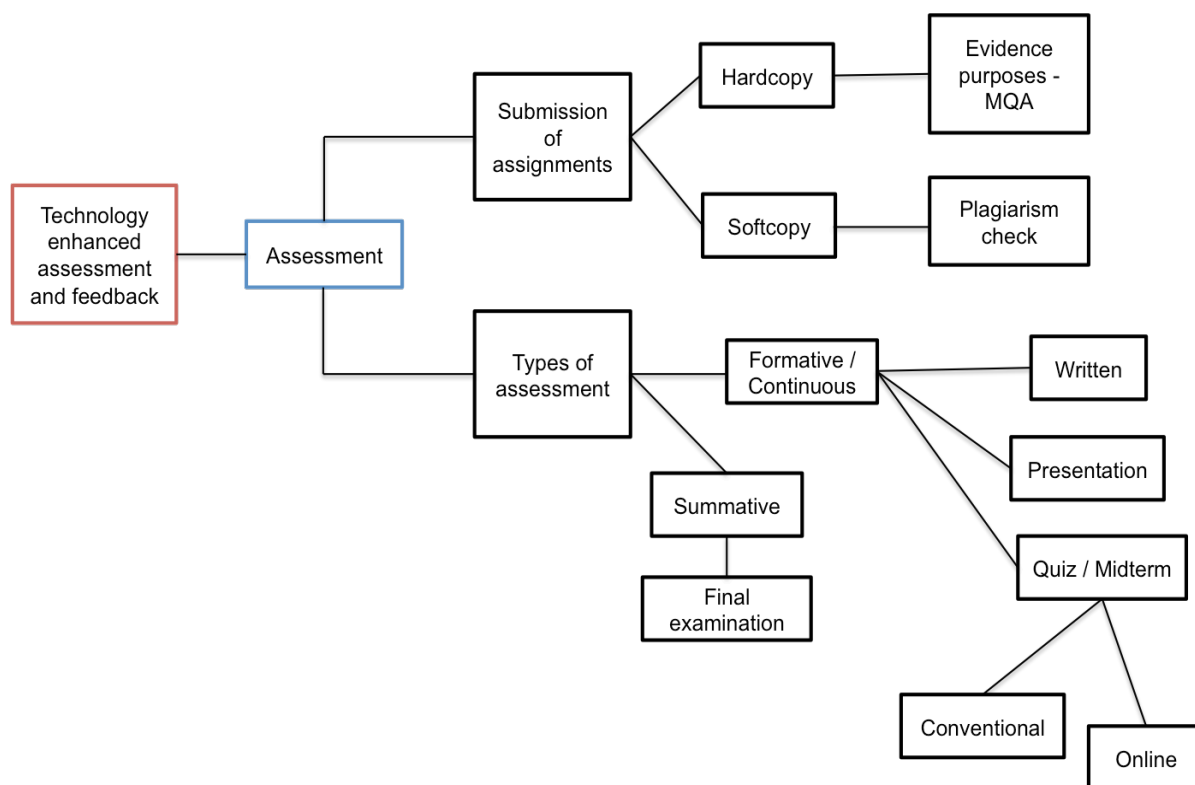


Figure 11: Overall themes

There were five themes that derived (as shown in Figure 11 above) from the interview sessions with educators from both universities across four different disciplines. These themes were then further supported by the subthemes as shown in Figure 12 – Figure 16.

Under the first theme of *Assessment* (as shown in Figure 12 below), this research was able to understand that in general the submission of assignments were still heavily focused on hardcopies; regardless of disciplines as this gave educators a piece of mind in case if the chosen educational technological tool malfunctioned. Educators also preferred the hardcopy submissions due to quality assurance and accreditation purposes as implemented by the Malaysian Qualifications Agency (MQA) using the Malaysian Qualifications Framework (MQF) (Malaysian Qualifications Agency, 2016a). Interestingly, a few of them also emphasized that it is much easier for them to mark the submitted assignments via hardcopies.



\*MQA – Malaysian Qualifications Agency

Figure 12: Theme and subthemes – Assessment

Apart from that, it is also important to note that for the purpose of plagiarism check; softcopies submissions were also encouraged. This research also picked up on how educators in the selected HEIs were generally in support of formative/continuous assessment and that some disciplines were more inclined to conduct quizzes and midterm examinations through online means; although the conventional (paper-pencil based examination) were obviously still the forerunner in the types of assessment being used by educators. Another important theme that was pick up from the interview sessions also indicated that educators are still very keen in using summative assessment (e.g. final examinations) as the main type of assessment. Table 12 below also provided some examples of the theme and subthemes based on the excerpts from the transcribed interview sessions.

Table 12: Examples of the interview excerpts based on the theme and subthemes on assessment

Theme	Subthemes	Sample of transcribed interview excerpts
<b>Assessment</b>	Types of assessment	...it consists of a <b>written assignment</b> , <b>recordings of podcast</b> , as well as <b>online quizzes</b> .
		As you know we do normal assessment tasks like <b>assignments</b> , <b>projects</b> , <b>online quizzes</b> and <b>final exams</b> ...
		...for the large classes, you want to organize and develop <b>online quizzes</b> .
	Submission of assignments	There are classes and <b>tutorials</b> , and <b>reports</b> and <b>assignments</b> . ...the students now have to <b>submit online</b> and it makes my life much simpler...
		Old-styled as in you write on the whiteboard and then you <b>mark using paper submissions</b> , <b>hardcopies</b> ...
		I don't see myself evolving to be teaching better, I still end up doing <b>conventional way of evaluation</b>  My purpose is so that I can collect and in case people come for <b>evaluation</b> and all that, I have the <b>hardcopies</b> , just in case if I can't access their softcopies.
	Summative assessment	...so I will ask them to submit their assignments there because there is a tool like <b>Turnitin</b> where you can <b>check for plagiarism</b> ... ...how you assess your students is how they learn. See if you want to assess them using <b>final exam</b> ; they are going to learn in that way.
		Again it all comes back to the exam because they have <b>final exams</b> ...

Following that, Figure 13 below presented the second theme – *Feedback*, which derived from the transcribed interview data. The second theme revolves around how feedback should be feed-forward and that it should be provided as often as possible to help students to bridge the gap in order to address the learning process. However, majority of the educators whom were interviewed, admitted that most of the time, they will merely provide personalised individual feedback to students only when they ask for it. Otherwise, it will be a general verbal feedback provided to all students, during class.

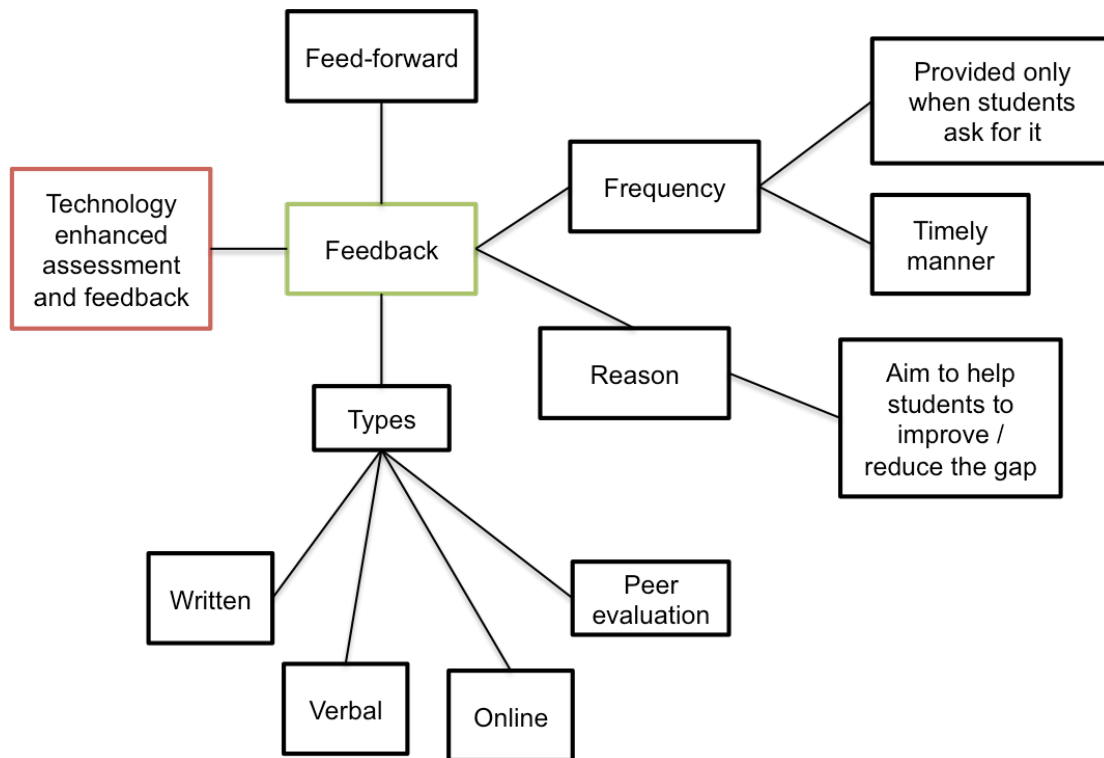


Figure 13: Theme and subthemes – Feedback

It was also observed from the transcribed interview data that educators across disciplines agreed that feedback is crucial in helping students to understand what needs to be done in order to reduce the gap from where they are to where they need to be. Figure 13 above also presented the types of feedback that was provided to students, namely: (1) Written; (2) Verbal; (3) Online; and (4) Peer evaluation. Echoing that, Table 13 provided some supporting examples of the feedback theme and subthemes, reflected through the excerpts from the transcribed interview sessions.

Table 13: Examples of the interview excerpts based on the theme and subthemes on feedback

Theme	Subthemes	Sample of interview excerpts
Feedback	Feed-forward	Feedback should be <b>feed-forward</b> ... So I think that also gives them a purpose, so they know what to work for and what I intend them to achieve...
		...only when the students <b>asked</b> me, if not <b>no feedback</b> .
	Frequency	We don't give feedback as a general now, but we will <b>give feedback</b> when the students <b>ask</b> . ...then I come to each individual students to check if they are ok... Yes, we see each individual student, even if it's a large class. ...that's the most direct way of you <b>communicating</b> with your students...
	Reasons	A feedback without an <b>interaction</b> is not a feedback. So this is your gap and what are you going to do to <b>minimize the gap</b> ...
		If their work is <b>not up to the standard</b> that I expect, then I give them some more input, so that they <b>can improve on it</b> . So with courses like lab, which is more hands-on, it will be a lot through <b>written feedback</b> ..
		But in terms of those courses where I have weekly classes then it will be <b>face-to-face</b> (feedback)...
	Types of feedback	As for feedback, usually we would mark things <b>online</b> , on a spreadsheet...those will be mapped directly back to their <b>GradeBook</b> in Moodle itself. So get the <b>peer to talk to one another and correct</b> each other's mistake...so they learn from one another and that feedback is <b>much more powerful</b> than your written feedback. ...if you want to do a forum, discussion, and you want the flow to goes on to a higher level of thinking...you have to probe and push them to a higher level. So that is another form of ( <b>verbal</b> ) <b>feedback</b> to them...

The third theme that emerged from the collected interview data was on how educators incorporated educational technological tools into their daily LT practices, as shown in Figure 14. The subthemes that emerged under this theme were advantages and disadvantages of incorporating educational technological tools, reasons to incorporate educational technological tools, and the types of technologies used. It is also important to note that as much there are numerous reasons, advantages, and disadvantages on the incorporation of educational technological tools; educators across disciplines do surprisingly share similar opinion on how it is paramount to have a framework that could guide educators in incorporating educational technological tools into their daily LT practices.

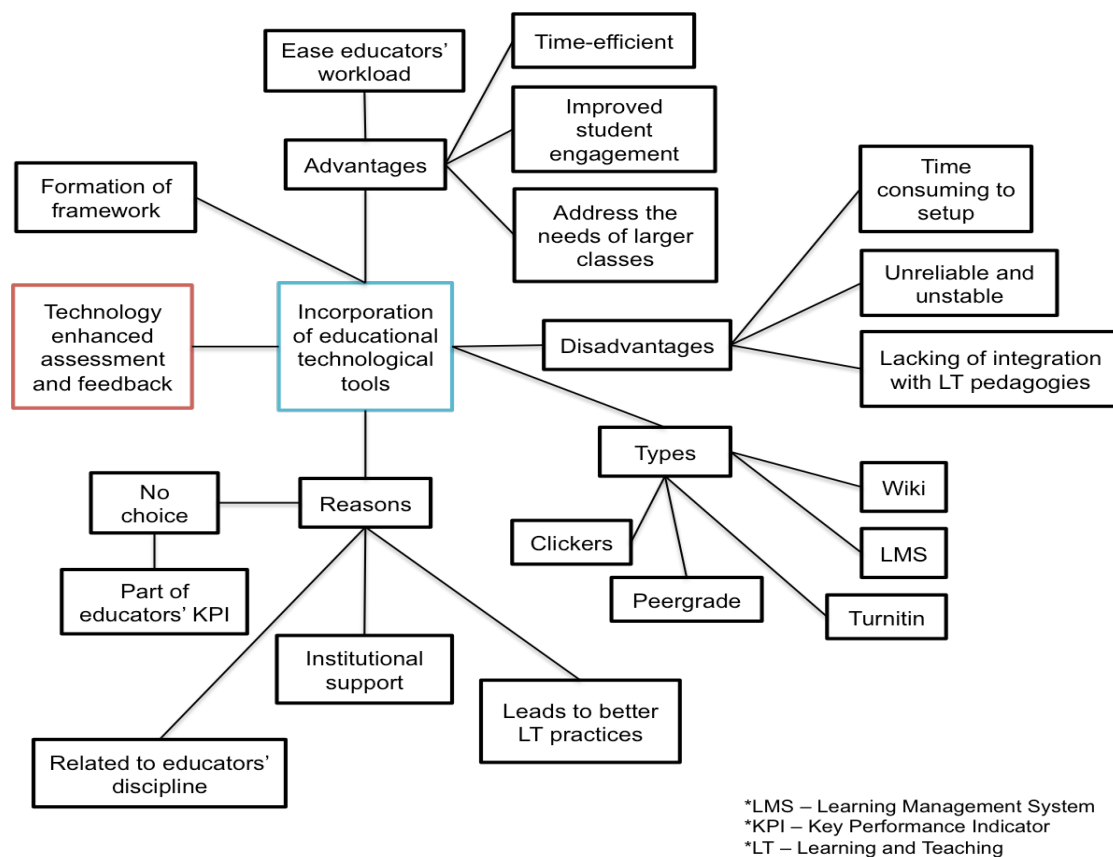


Figure 14: Theme and subthemes – Incorporation of educational technological tools

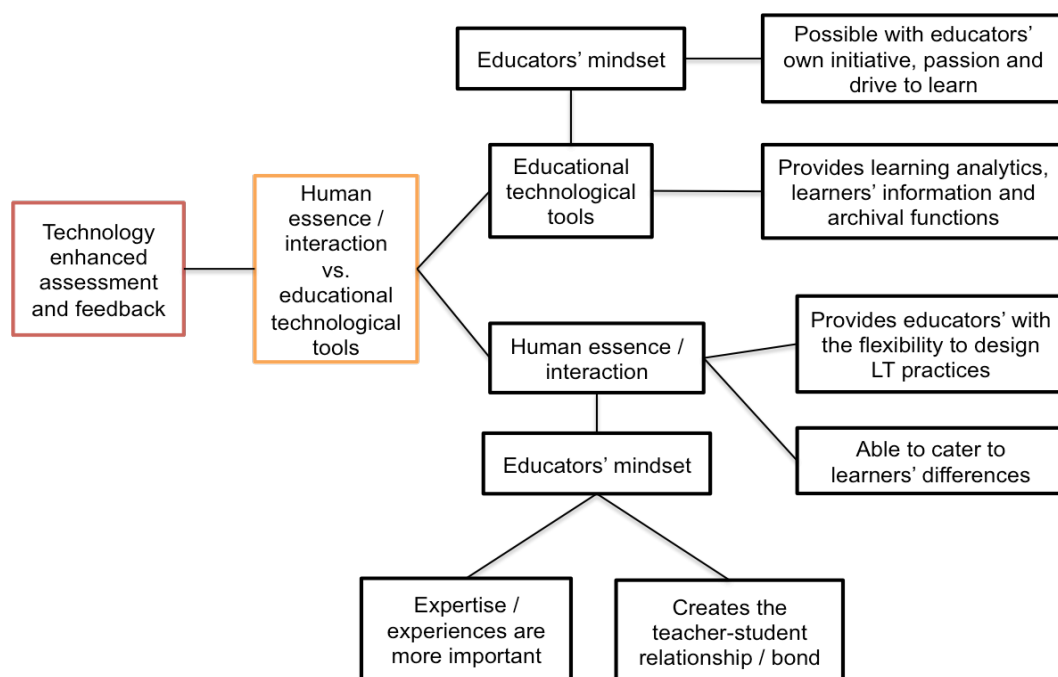
Table 14 below also mirrored the theme and subthemes on incorporation of educational technological tools based on some of the excerpts taken from the transcribed interview data. It is important to note that from the excerpts, educators expressed the need to have a fluid and holistic framework to guide the integration of educational technological tools into the LT process.



Table 14: Examples of the interview excerpts based on the theme and subthemes on incorporation of educational technological tools

Theme	Subthemes	Sample of interview excerpts
Incorporation of educational technological tools	Formation of framework	...coming up with the <i>framework would be much more useful</i> than coming up with a prototype or hardware technology.
		...look into a <i>more holistic view</i> , not just so technology-centric that you forget about all these things, the practicality part of it because humans are the one using it.
		...it is good with the framework, which is what I call the software part of the technology, then you can <i>design the hardware part of the technology according to the framework</i> ...
	Advantages	...but I think I see the <i>results better</i> because once they are excited about it then learning becomes easier for them, they are more excited.
		Yes, so I could use this term in which I am trying to <i>automate most of the bulk of my work</i> . So I am left with no choice but to use <i>technology to cut down on my time in providing useful feedback to them</i> .
	Disadvantages	Although it does take up a <i>little bit more of my time</i> in preparation.
		There is a <i>problem with the compatibility</i> between the Moodle and Turnitin. I always have this technical problem...
	Types of educational technological tools	I do mark most of their assignments on <i>Turnitin</i> . For the undergraduate, I have also use the <i>Wiki</i> ...
		<i>Clickers</i> have been mainly used just to get students to be engaged, to participate and then you kind of like facilitate...
	Reasons	...but mainly we are using <i>Moodle (LMS)</i> ...
		...in our university, we have our <i>KPIs</i> – I think all the universities also; where we have to fulfil certain criteria – how many resources have to be uploaded...so if I don't use it then of course <i>it's not reasonable</i> .
		...because this is <i>my field</i> , educational technology...
		...especially in higher education, I think we should spend a little bit more time on trying to get them <i>more engage using technology</i> .

Meanwhile, Figure 15 illustrated the fourth theme focusing on the educators' contradicting viewpoints when it comes to the benefits of maintaining the human essence / interaction while integrating educational technological tools or to fully rely on these tools in regards to develop a more effective LT practices. Both of these viewpoints interestingly consist of how the educators' mindset (perspectives) can influence each of the polarity in these viewpoints. In other words, to have a successful balance between human essence / interaction and the integration of educational technological tools; ultimately lies in the hands of educators as the tools will only be as mediocre as it is without the expertise / experiences of the educators and also the personal touch of teacher and student relationship.



\*LT – Learning and Teaching

Figure 15: Theme and subthemes – Human essence vs. Educational technological tools

Table 15 below presented some excerpts taken from the interview sessions. These excerpts interestingly reflects on how educators' mindset appears to influence their perceptions when it comes to taking a stand on either adopting educational technological tools or to focus more on the human essence / interaction of the student-educator relationship.

Table 15: Examples of the interview excerpts based on the theme and subthemes on incorporation of human essence vs. educational technological tools

Theme	Subthemes	Sample of interview excerpts
Human essence vs. Educational technological tools	Human essence / interaction	<p>So if you only rely on technology, that's not good. You should <i>rely on yourself</i> and <i>your expertise</i> and <i>your awareness</i>, that's the most important thing.</p> <p>Then coming back to the philosophy of teaching, I <i>like the interaction with the students</i>, I like to be friendly and make them excited and attracted.</p> <p>I would much rather prefer more face-to-face contact with students to work through things with them because that's where and how you <i>build a relationship between teacher and student</i>.</p> <p>I have the <i>right to decide how I want to assess the students...</i></p> <p>If the university doesn't allow the <i>flexibility</i>, then there is nothing much you can do...</p>
	Educational technological tools	<p>So I took some courses because we had to take electives, I choose the electives like developing webpages; I <i>wanted to learn</i> at that time.</p> <p>We also have online forums where students would have to keep a <i>logbook of what they are doing in their projects</i>. As for feedback, usually we would mark things online, on a spreadsheet. Once we have those feedback, be it positive or negative, those will be mapped directly back to their GradeBook in Moodle itself.</p> <p>...the students now have to submit online and it makes my life much simpler in terms of <i>I can monitor</i>, who have submitted, who has yet to submit...</p> <p>That's why for me, I am always very <i>passionate</i> about technology and I <i>believe</i> that technology can really move us forward and that is the reason why I incorporate technology into assessments.</p>

Figure 16 below explains on the fifth theme in which explains on the learning and teaching methods / approaches / designs / contents that educators perceived to be an important factor when it comes to the topic of TEAF.

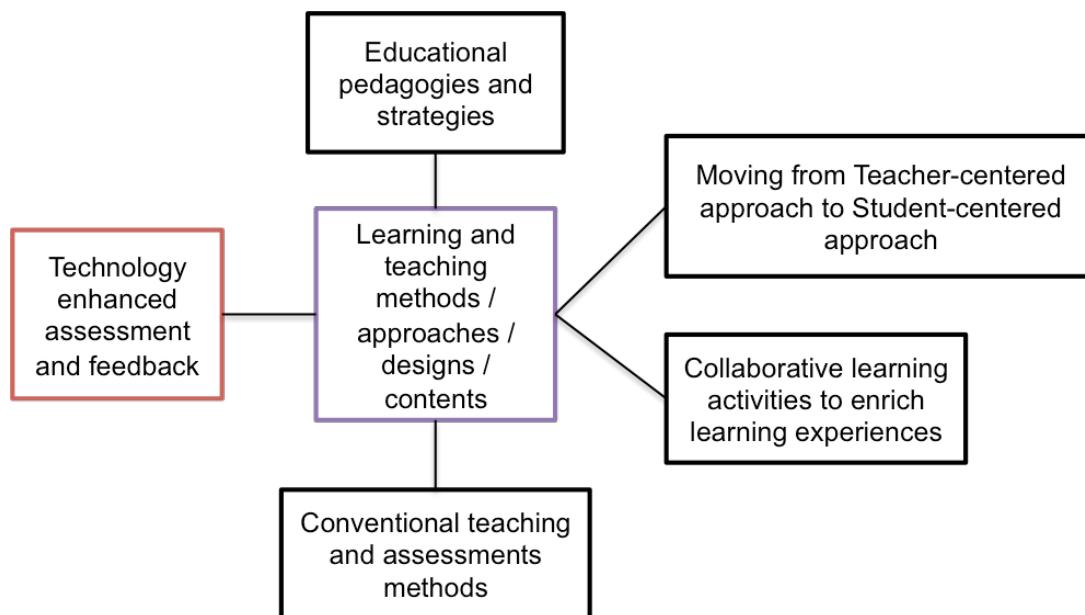


Figure 16: Theme and subthemes – Learning and teaching methods / approaches / designs / contents

Educators in general comes to an agreement in how it will be more beneficial if the readily available educational technological tools could be design to be more aligned to their choice of educational pedagogies and strategies or are able to support educators in terms of their LT practices that provides the flexibility or functionality similar to the conventional teaching and assessments methods. These tools also would need to be able to support collaborative learning activities, as well as the transition from moving the teacher-centered approach to the student-centered approach.

Table 16 below also presented some examples on the transcribed interview excerpts on learning and teaching method / approaches / designs / contents. It is also important to note that there were some discrepancies among educators whereby some of them preferred conventional teaching and assessments methods while others perceived that integrating technological tools is more efficient and helpful.

Table 16: Examples of the interview excerpts based on the theme and subthemes on learning and teaching methods / approaches / designs / contents

Theme	Subthemes	Sample of interview excerpts
<b>Learning and teaching methods / approaches / designs / contents</b>	Educational pedagogies and strategies	<i>Your <b>teaching method</b> doesn't fit into that Smart Classroom, no one actually tell them...</i>  <i>I would say I have the ability to see both, how to merge assessment that is normally done manually or in an old-school method and by looking at technology, I am able to integrate both.</i>
	Moving from teacher-centered approach to student-centered approach	<i>I do a very <b>student-centered approach</b>, so my assessment methods are also very student-centered...</i>
	Collaborative learning activities to enrich learning experiences	<i>That is something that we called as <b>collaborative thinking and learning</b>, so they learn from one another.</i>
	Conventional teaching and assessments methods	<i>Old-styled as in you <b>write on the whiteboard</b> and then you <b>mark using paper submissions, hardcopies</b>.</i>  <i>...getting them to write individual essays and <b>submit hardcopies</b> to me would be a torture because I have to <b>mark manually</b>...</i>

A more in-depth discussion on the results and findings analyses on the qualitative data will be further elaborated in Chapter 4 – Results and Discussion.

### 3.4.3 Analysis of quantitative data

On the other hand, the collected quantitative data was analysed using descriptive analysis. The data of frequencies of educators' gender; age groups; year(s) of teaching, and lastly, year(s) of involvement in designing AF; were all presented with the use of tables or bar charts.

Apart from that, one-way between-groups analysis of variance (ANOVA) were also conducted to explore the impact of the following variables: (1) disciplines; (2) age; (3) years of teaching experience; and (4) years of designing AF on levels of technology pedagogy content knowledge (TPACK). The detailed results of this aspect of data will be discussed in the following Chapter 4 – Results and Discussion as well.

### 3.5 Integration of qualitative and quantitative data

This research also explained on how the integration of both the qualitative and quantitative findings come together. According to Onwuegbuzie and Hitchcock (2015), the comparison of themes and results derived from both the qualitative and quantitative data can be integrated through a qualitative dominant crossover mixed analysis. There are three advanced qualitative-dominant crossover mixed analyses as identified by Onwuegbuzie and Hitchcock (2015), namely: (a) Correspondence Analysis, (b) Qualitative Comparative Analysis, and (c) Micro-Interlocutor Analysis (MIA).

As such, this research adopted the Qualitative Comparative Analysis whereby it is a technique that comprises a systematic analysis of similarities and differences across the datasets. This research was then able to conduct this analysis in which the derived qualitative themes were essentially used as the organizational framework in which the integration of the quantitative findings will be based upon the work from Poth (2018). This integration will subsequently leads to the development of the Technology Enhanced Assessment and Feedback (TEAF) framework that will be further discussed in the following next two chapters.

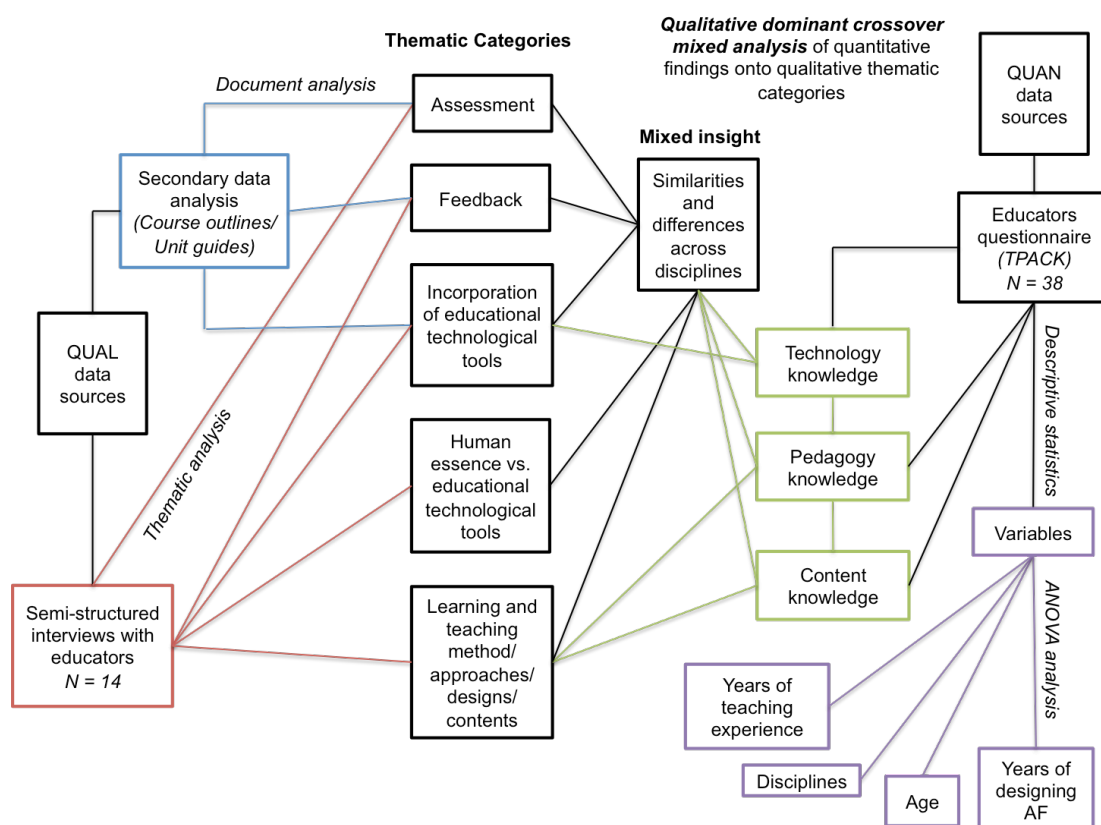


Figure 17: Overall data collection, analysis, and integration process

The Figure 17 above depicted the integration process between both qualitative and quantitative data collected for this research. The core of this integration lies on the 5 main themes derived from the qualitative data, in which the mixed insight derived from this integration will then be the similarities and differences among educators across the 4 selected disciplines. This insight will then guide the development of a more versatile framework that is more applicable in the Malaysian HEIs context.

A more in-depth discussion will be presented in Chapter 4 – Results and Discussion on the findings gathered from both qualitative (secondary data analysis and semi-structured interview sessions) and quantitative (online survey) data. These findings will be presented in a clear and concise manner as guided by the research questions. Flowcharts of how each of the research questions were answered will also be provided in the following chapter as an effort to better represent and link the results and discussion to the respective research questions.

## **CHAPTER FOUR**

### **RESULTS AND DISCUSSION**

Under this chapter, results obtained from various research analyses conducted will be discussed. As the design of this research is a multi-method approach, the results and discussions gathered were from the secondary data analysis (available course outlines/unit guides from the two selected HEIs), interview data and also from the online survey data collected from educators across the four identified disciplines, namely: (1) Computer Science/Information Technology; (2) Education; (3) Engineering; and lastly, (4) Psychology.

*Section 4.1* of this chapter provided the demographic information such as details of the course outlines/unit guides, the breakdown of interview participants based on disciplines and universities and online survey participants' gender, age groups, disciplines, year(s) of teaching and designing assessment and feedback. Following that, *Section 4.2* explained on how each of the research questions offered in this research were answered based on the data collected on summative and formative assessments. *Section 4.3* on the other hand provided explanation on the proposed framework based on the data collected and why it should be different from the current TPACK framework.

#### **4.1 Demographic information**

##### ***Secondary Data Analysis***

This research was able to obtain 2,751 data (details shown in Figure 18) from course outlines/unit guides that were publically available via the selected universities' official web portal. The data gathered consist of information on the courses/units from the four selected disciplines, ranging from Year 1 to Year 4 – inclusive of elective courses/units as well.



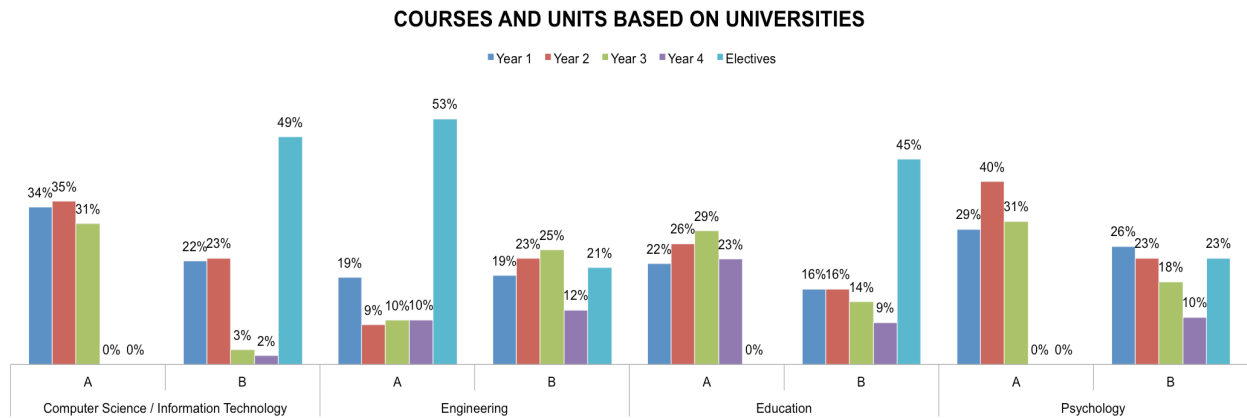


Figure 18: Distribution of the course outlines / unit guides available across year of study, disciplines and universities

### ***Semi-structured Interview Sessions***

The participants of the semi-structured interview sessions were educators from the two selected universities, namely *University A* and *University B*, across four selected disciplines. There were altogether 14 participants from the mentioned universities and the breakdown of the participants are as followed:

Table 17: Breakdowns of semi-structured interview participants by disciplines and universities

Disciplines	University A	University B
<b>Computer Science / Information Technology</b>	1	3
<b>Education</b>	2	1
<b>Engineering</b>	3	3
<b>Psychology</b>	0	1

Based on Table 17 above, this research acknowledged that the lack of representation from educators from the *Psychology* discipline in *University A* may served as a limitation due to the lack of responses and unavailability of these group of educators, as efforts have been exhausted in the attempts of securing an interview session.

## Online Survey

As for the online survey data, there were altogether 43 respondents. However, as some of the responses were incomplete and thus removed, this brings the total number of complete responses to 38. The demographics information collected from the remaining respondents consists of: (1) *Gender*; (2) *Age groups*; (3) *Year(s) of teaching*; and lastly, (4) *Year(s) of involvement in designing AF*. A more in-depth description on each of the demographic variables will be discussed in the subsections below:

### (1) Gender

As illustrated in Figure 19, educators who participated in the online survey from the *Computer Science/Information Technology* discipline and *Psychology* discipline were mainly female. On the same note, a different trend was observed for educators in the *Engineering* discipline – perhaps due to the fact that it is a field that is mainly dominated by males. Interestingly, it is also observable that educators from the *Education* discipline are mainly males – as opposed to the general perception where females are more likely to venture into the teaching profession.

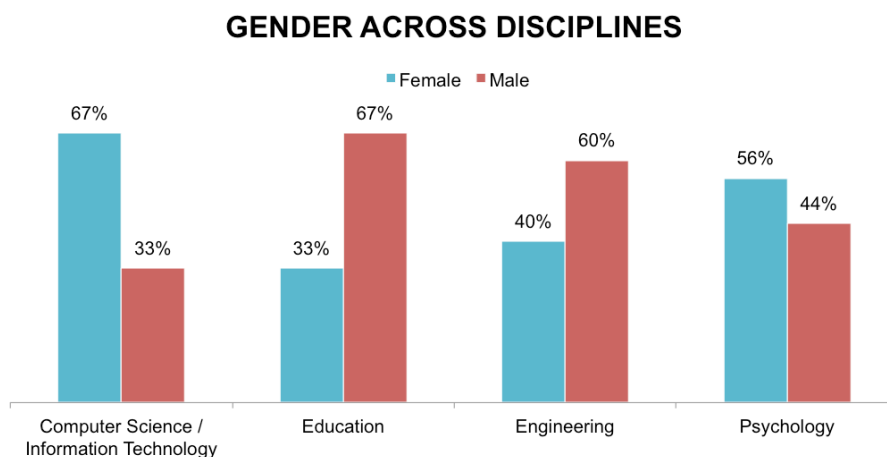


Figure 19: Gender of educators across disciplines

## (2) Age groups

As shown in Figure 20 below, majority of participants from the *Computer Science/Information Technology* discipline are within the age group of (b) 31-40 and (c) 41-50. Those from the *Education* discipline are in the age group of (d) 51-60. For the *Engineering* discipline, it is noticeable that the majority of them are in the age group of (b) 31-40, while a more equally distributed trend was observed for educators from the *Psychology* discipline.

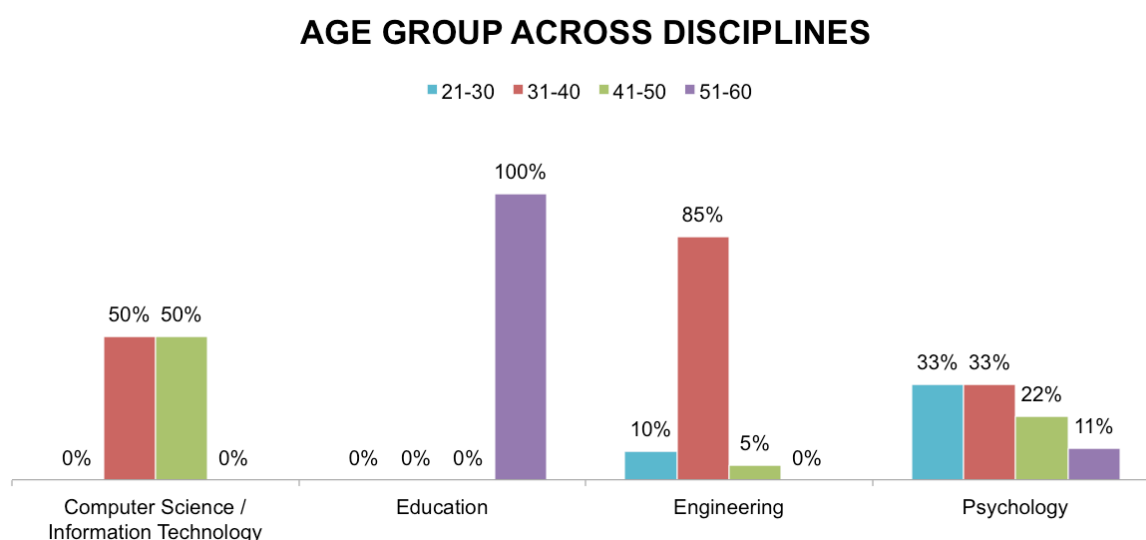


Figure 20: Age groups of educators across disciplines

## (3) Year(s) of teaching

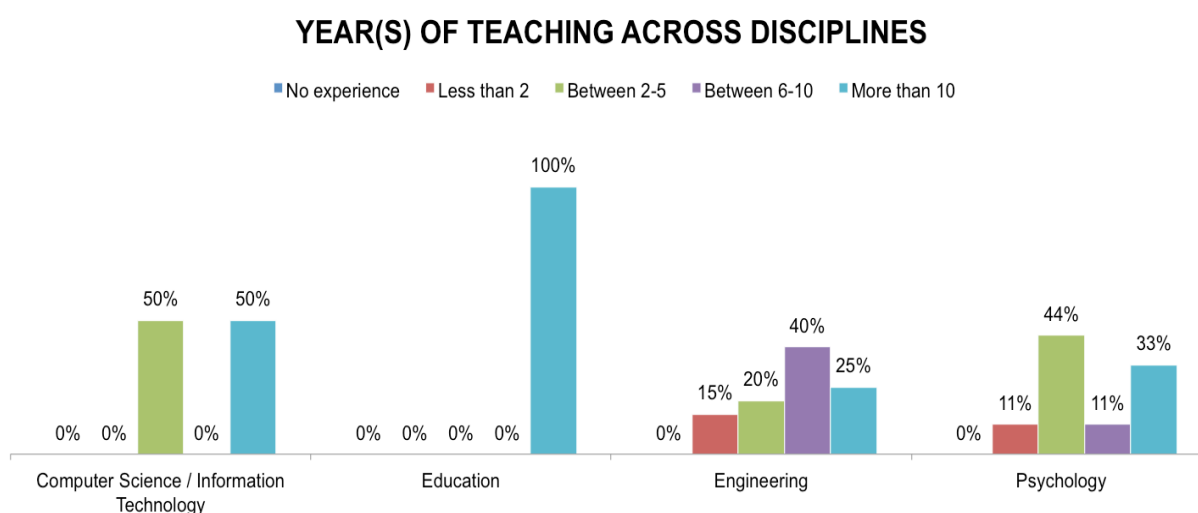


Figure 21: Educators' year(s) of teaching experience across disciplines

As shown in Figure 21 above, majority of educators from the *Computer Science/Information Technology* discipline and *Psychology* discipline have *between 2-5 years* of teaching experience as compared to those from the *Education* discipline. Majority of those from the *Education* discipline have *more than 10 years* of teaching experience. On the other hand, educators from the *Engineering* discipline have *between 6-10 years* of teaching experience.

#### (4) Year(s) of involvement in designing assessment and feedback

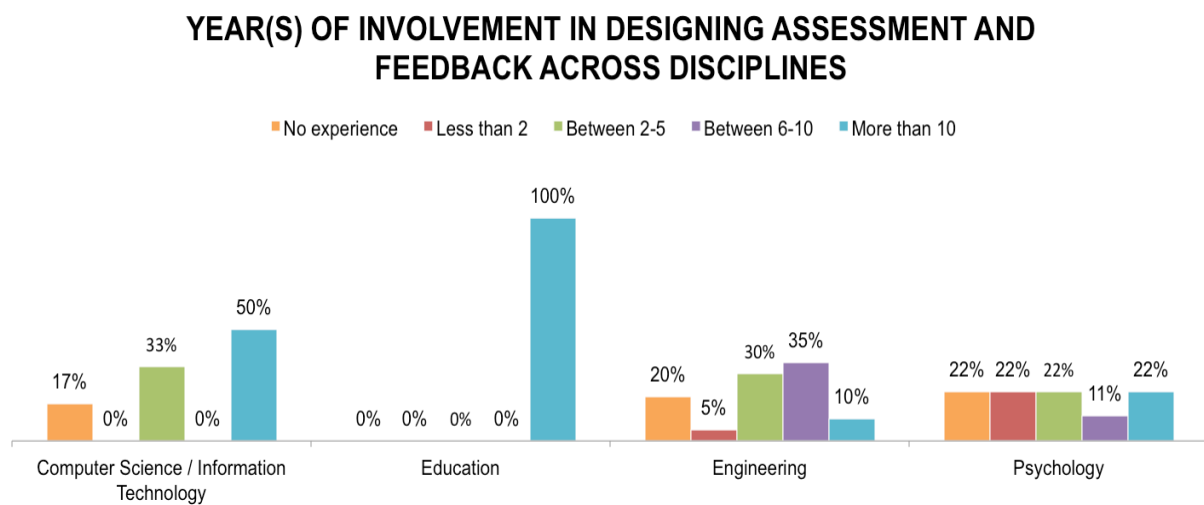


Figure 22: Educators' year(s) of involvement in designing assessment and feedback

As depicted in Figure 22, educators from the *Computer Science/Information Technology* discipline and the *Education* discipline mainly have *more than 10 years* of involvement in designing AF. Once again, a more equally distributed trend can be observed from educators in the *Psychology* discipline. As for educators in the *Engineering* discipline, a handful of them have *between 6-10 years* of involvement in designing AF.

An interesting trend can be observed from the data presented in Figure 20 and Figure 21, in which although the sample size collected from this online survey is small – deduction appears that as much as an educator can be very seasoned and experienced when it comes to teaching, the same may not be represented when it comes to their year(s) of involvement in designing AF. This aspect of determining and designing appropriate AF in the learning and teaching process may be proven to be more challenging, even for the most experienced educators. Thus, there seems to be a variation when it comes to the year(s) of teaching and year(s) of involvement in designing AF as an educator's year(s) of

teaching may not be reflective of their year(s) of involvement in designing assessment and feedback. This observable trend also seems to be giving away hints that there could be more as to why there appears to be such a difference among educators – which may be worth exploring.

In the following subsection, further descriptions and discussions will be provided as to how each of the research questions provided earlier will be answered. A more detailed explanation on how all these information come together and triangulates will also be presented in Chapter 5 – technology enhanced assessment and feedback (TEAF) framework, to further illustrate the importance of having a more versatile framework, which would allow educators to understand how the integration of educational technological tools in the LT process could be more effective.

## **4.2 Addressing the research questions**

The subsections below provided explanations on how each of the respective research questions as offered by this research were addressed. Flowcharts and diagrams were also presented to further assist in the visual representation of the merging and integration of the collected qualitative and quantitative data.

### **4.2.1 Research question 1 – How are the forms of educational technological tools being integrated into current assessment and feedback practices across disciplines in HEIs in Malaysia?**

As the first objective of this research is to investigate and to understand the current AF practices across disciplines in HEIs in Malaysia, it is crucial to look at the forms of: (1) *formative assessments*, and (2) *summative assessments* that educators in the selected universities typically used to assess their students' performance. This research also seeks to investigate whether the current AF practices were (3) *technological based*, and the forms of (4) *educational technological tools adopted* in these practices. Apart from that, it is also necessary to understand the forms of (5) *feedback provided* to students.

All of these data (collected from the secondary data documentations) will then provide this research with a much-needed big picture, as an attempt to understand the current educational landscape, especially in relation to the AF practices in HEIs in Malaysia. On the other hand, the data gathered from the semi-structured interview sessions will then served as an indication of whether such AF practices as stated in the course outlines/unit guides were implemented on the ground by educators in their LT process.

The Figure 23 below illustrated the workflow of this representation of the findings from the secondary data using the integration map.

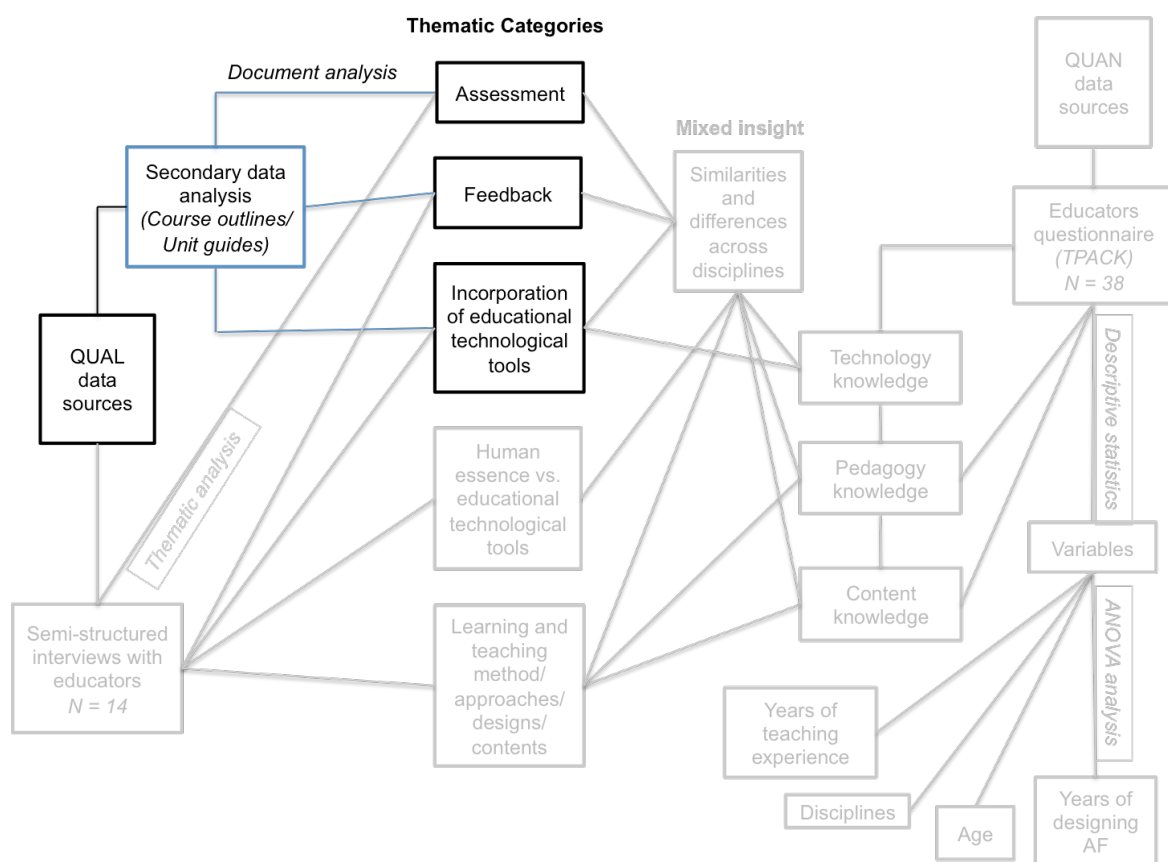


Figure 23: Representation of the findings from secondary data analysis (Phase 1)

As such, the use of assessment and feedback – inclusive of the integration of educational technological tools; will be explained in the next few subsections presented below.

## Forms of formative assessments

In Figure 24 below (for a higher resolution image, please refer to Appendix G), it was observable that educators from the *Computer Science/Information Technology* discipline in *University A* typically assessed their students' performance through forms of *Project Work/Practical*. Meanwhile educators from the Education discipline and Psychology discipline mainly assess their students through forms of *Essay/Written/Annotated Reviews/Bibliographies*. On the other hand, educators from the *Engineering* discipline adopted a combination of *Essay/Written/Annotated Reviews/Bibliographies* and *Project Work/Practical* forms of formative assessment.

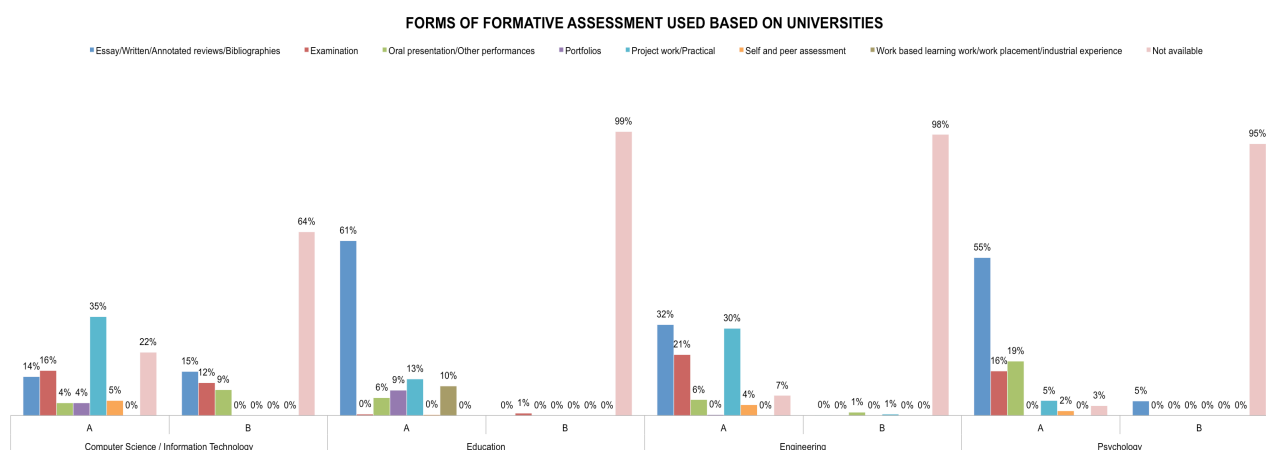


Figure 24: Forms of formative assessment used

On the contrary, educators from the *Computer Science/Information Technology* discipline in *University B* were more inclined towards the usage of *Essay/Written/Annotated Reviews/Bibliographies* and *Examination*. As for the other disciplines, various means have been exhausted in trying to get hold of such information – such as: (1) obtaining the course outlines/unit guides from the university's undergraduate students handbook, which was publically available, (2) through students who were enrolled in the related disciplines, and finally, (3) through students who were at the point of time, registered for the courses/units. Information gathered via face-to-face means and from the *University B*'s official webpage was found to be very limited, as students were also not well informed as to how they will be assessed throughout the semester. Information was only shared during the first day of the class and no other additional information can be found nor provided. Therefore, students in *University B* do not have the practice of reviewing the course outlines/unit guides in attempts to having a clearer understanding as to how they are going

to be assessed. Having that said, students also explained that scoring rubrics were mainly used as their source of reference as to how they will be graded.

Hence, although it was stated in most of *University B*'s course outlines/unit guides that continuous assessment are typically used as the form of formative assessment, in actual reality information on what and how the continuous assessment are being used and executed in class and whether if it is really practiced – remains unclear. Thus although it seems hazy with the limited information obtained, it was noticeable that *Engineering* discipline assessed their students mainly through forms of *Project Work/Practical* and *Oral presentation/Other performances*. For the *Education* discipline, students were generally assessed through *Examination*, while the *Psychology* discipline adopts *Essay/Written/Annotated Reviews/Bibliographies* forms of formative assessment.

The limited information on the forms of formative assessments generally used in *University B* was further expanded in this research through the transcribed interview data, gathered from the semi-structured interview sessions. The collected data portrayed that there may be some slight discrepancies in comparison to what was stated in the available course outlines/unit guides and to what was being executed by the educators during their LT process. For example: in the *Education* discipline in *University B*, although majority of the course outlines/unit guides stated that they students were typically assessed through *Examination*; this research was able to depict that there were some other forms of formative assessments being incorporated as well through the semi-structured interview sessions (e.g.: *Oral presentation/Other performances* and *Essay/Written/Annotated Reviews/Bibliographies*).

However, it is also important to note that the number of interviewed educators in *University B* were lesser than the number of collected course outlines/unit guides. As much as this piece of data might not be able to provide a strong indication that suggest the actual representation of any discrepancies; this might serve as an early indicator in which educators might consider looking into. This is to ensure that there is an aligned and mirroring effect of what was being stated in the course outlines/unit guides, to what was being delivered in the LT process.



## Forms of summative assessment used

It was observable in Figure 25 below that educators from most disciplines in both universities mainly use conventional (pencil-paper) final examination as the key form of summative assessment in measuring their students' performance at the end of the semester. It was, however interesting and important to note that educators in *University A* from the *Education* discipline mainly do not include summative assessment as a form of evaluation of their students' performance. Instead they placed more emphasis on imparting students with continuous formative assessments throughout each semester.

Similar trend was also observable from educators in *University B* from the *Education* discipline as well. However, the emphasis was still being placed on having final examination as the main form of summative assessment. As for the other three remaining disciplines, final examination was still the most-preferred form of summative assessment by educators in both universities – as indicated in the collected course outlines/unit guides.

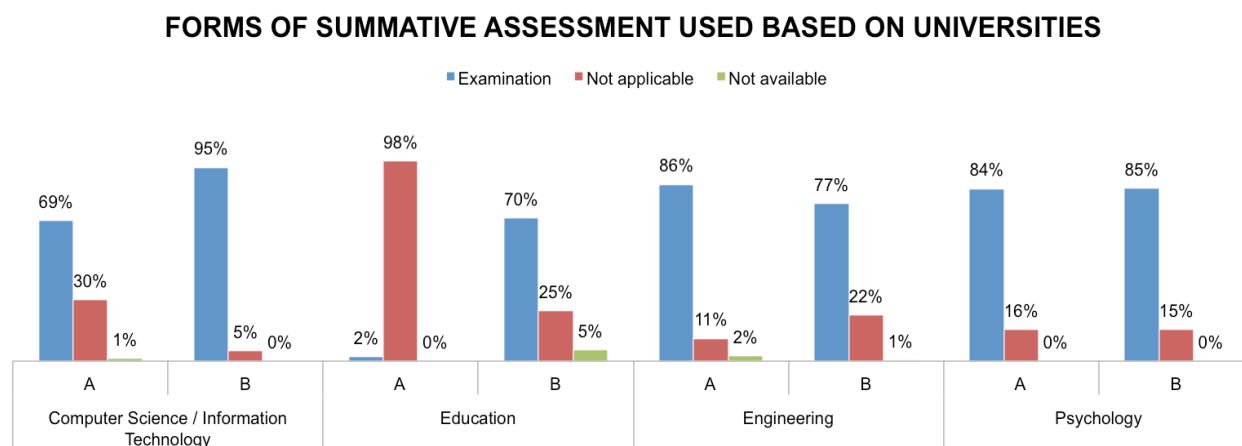


Figure 25: Forms of summative assessment used across disciplines and universities

Echoing on that, it was also notable that many of the educators regardless of disciplines and universities; placed a great deal of emphasis on the importance of final examination through the allocation of a higher percentage to this form of summative assessment – as stated in the collected course outlines/unit guides. In other words, students were mainly assessed and evaluated on their level of understanding based upon their skills and capabilities to regurgitate the information taught throughout the semester. This finding is aligned with the findings from the study conducted by Boud and Molloy (2013) in which they observed that the summative roles adopted by many educators in HEIs serves as a

primary indication that dialogue among student educator may be inhibited. Thus, as much as there were immediate steps taken to revolutionize the assessment methods to be more aligned in producing graduates with the much needed 21<sup>st</sup> century skills, it appears that HEIs in Malaysia may still have quite a long way to pave forward.

The research reckon that when lesser emphasis is being given to the final examination and more importance placed on the continuous formative assessments, the focus will be then need to be redirect and anchored towards the need of how students are being assessed and evaluated for their skills and capabilities on (1) Problem-solving and critical thinking; (2) communication skills; (3) analytical skills; (4) Teamwork; and (5) Independence – the very skill sets as stipulated by employers in terms of what they are looking for in a potential employee.

### ***Usage of technology based formative assessment***

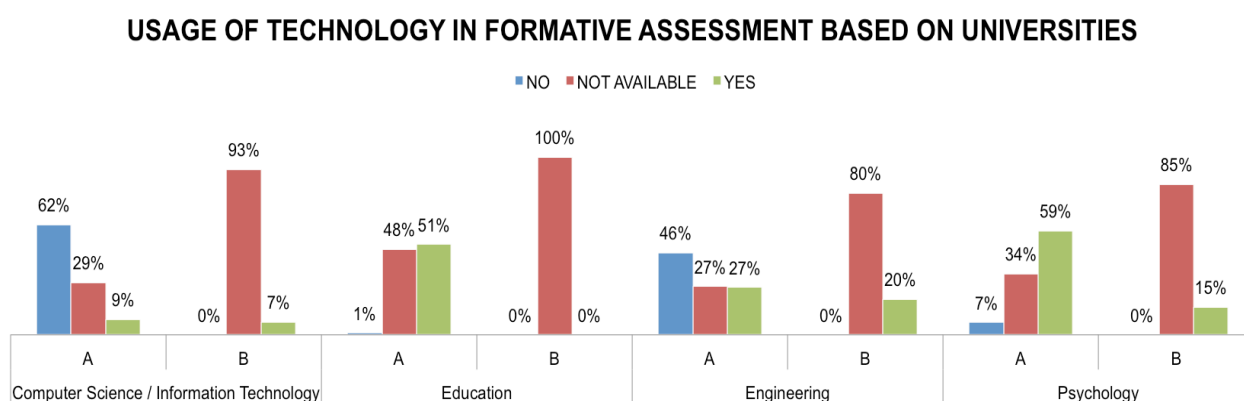


Figure 26: Usage of technology in formative assessment among educators across disciplines and universities

Figure 26 above depicted that educators in *University A* from the *Computer Science/Information Technology* discipline are not incorporating educational technological tools into their formative assessments as much in comparison to the to educators from the *Education* and *Psychology* disciplines. One would have perceived that educators from technology-related field would have been more technological-inclined to use educational technological tools, but information gathered from the course outlines/unit guides indicated otherwise. Perhaps, the data collected from the semi-structured interview sessions will be able to shed some light and understanding on this unusual situation.

As for *University B*, although the information was scarce, it was detected that educators from the *Computer Science/Information Technology*, *Engineering*, and *Psychology* discipline – do incorporate educational technological tools in their formative assessments. Unfortunately, this piece of crucial information was not indicated in all of the course outlines/unit guides available for the *Education* discipline in *University B*.

### Usage of technology based summative assessment

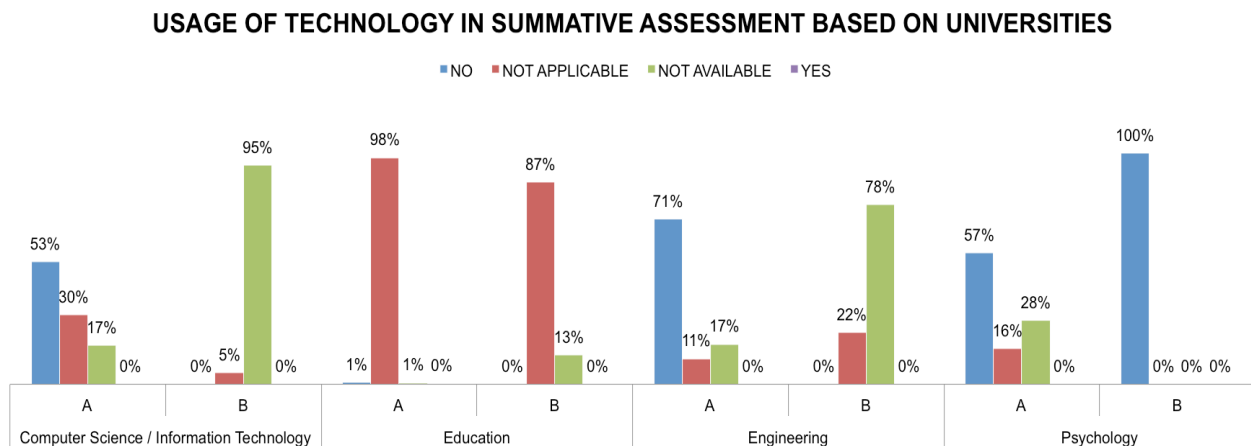


Figure 27: Usage of technology in summative assessment among educators across disciplines and universities

Figure 27 above illustrated that educators in *University A* from the *Computer Science/Information Technology*, *Engineering* and *Psychology* disciplines are not inclined to incorporate technology into their summative assessment. Similar trends can also be observed across the same disciplines in *University B*. In other words, the final examination is still heavily leaning towards the conventional method of assessment, otherwise also known as paper-pencil test. However, it is also important to mention that although educators in *University A* from the *Education* discipline did not incorporate technology in their summative assessment, they were also not keen on the idea of summative assessment. This can be seen in the Figure 25 above that 98% of the courses/units offered are not based on summative assessment but on continuous formative assessment alone. This is indeed very fascinating, as information gathered from the course outlines/unit guides have indicated that educators in both HEIs typically allocate a higher weightage to the final examination component, deeming it to be a crucial component in every course and unit – all with an exception of the *Education* discipline in *University A*.

Image 4 below is a sample of some of the information manually extracted from the course outlines/unit guides in both HEIs.

Universities	Disciplines	Programs	Year / Semester	Units / Courses / Modules	FA Assignment	Forms of formative assessment	FA relates to LO	Weightage FA	FA Technology based	Details	Forms of summative assessment	SA relates to LO	Weightage SA	SA Technology based	Details2	Total weightage	Forms of feedback
University A	Education	1. Bachelor of Education in Early Years Education	Year 1	1. EDF1303 – Learning and Educational Inquiry 1	Assessment task 1 – tutorial-based tasks Engagemt with learning portfolio	Portfolios	LO1, LO2	40%	YES	Online submission Moodle	NOT APPLICABLE	NOT APPLICABLE	0%	NOT APPLICABLE	NOT APPLICABLE	100%	1. Informal feedback on progress in labs/tutes 2. Graded assignments with comments
University A	Information Technology	4. Bachelor of Information Technology (majoring in Computer Networks and Security)	Year 3	6b. FIT3142 Distributed Computing	Assignment 2	Essay/Written/Annotated reviews/Bibliographies	LO2, LO6	15%	NOT AVAILABLE	NOT AVAILABLE	Examination	LO1, LO2, LO3, LO4, LO5, LO6, LO7, LO8, LO9, LO10	60%	NO	Closed-book	100%	1. Informal feedback on progress in labs/tutes 2. Graded assignments with comments
University A	Engineering	6. Bachelor of Engineering (Honours) (majoring in Software Engineering)	Year 2	1. MAT1830 – Discrete mathematics for computer science	Weekly assignments	Essay/Written/Annotated reviews/Bibliographies	LO1, LO2, LO3, LO4, LO5, LO6	30%	NOT AVAILABLE	NOT AVAILABLE	Examination	NOT AVAILABLE	70%	NO	Closed-book	100%	1. Informal feedback on progress in labs/tutes 2. Graded assignments with comments 3. Solutions to tests, labs and assignments
University A	Psychology	1. Bachelor of Psychological Science	Year 3	7. PSY1180 – Human neuropsychology: Developmental and	Short Answer Assignments	Essay/Written/Annotated reviews/Bibliographies	LO5, LO6	25%	NOT AVAILABLE	NOT AVAILABLE	Examination	NOT AVAILABLE	50%	NO	MCQ	100%	1. group feedback, individual feedback, peer feedback
University B	Education	1. Bachelor of Early Childhood Education	Year 3	6. PIC3005 – Statistics for Early Childhood Education	Continuous assessment	NOT AVAILABLE	NOT AVAILABLE	40%	NOT AVAILABLE	NOT AVAILABLE	Examination	NOT APPLICABLE	60%	NOT APPLICABLE	NOT APPLICABLE	100%	NOT AVAILABLE

Image 4: Course outlines/unit guides allocation of weightage

## Types of technology based formative assessment used

Apart from the above-mentioned subsection, it is also important to take a closer look in investigating the types of technology based formative assessment that educators across disciplines from universities are currently using. Figure 28 below illustrates an overview of the types of technology based formative assessment used.

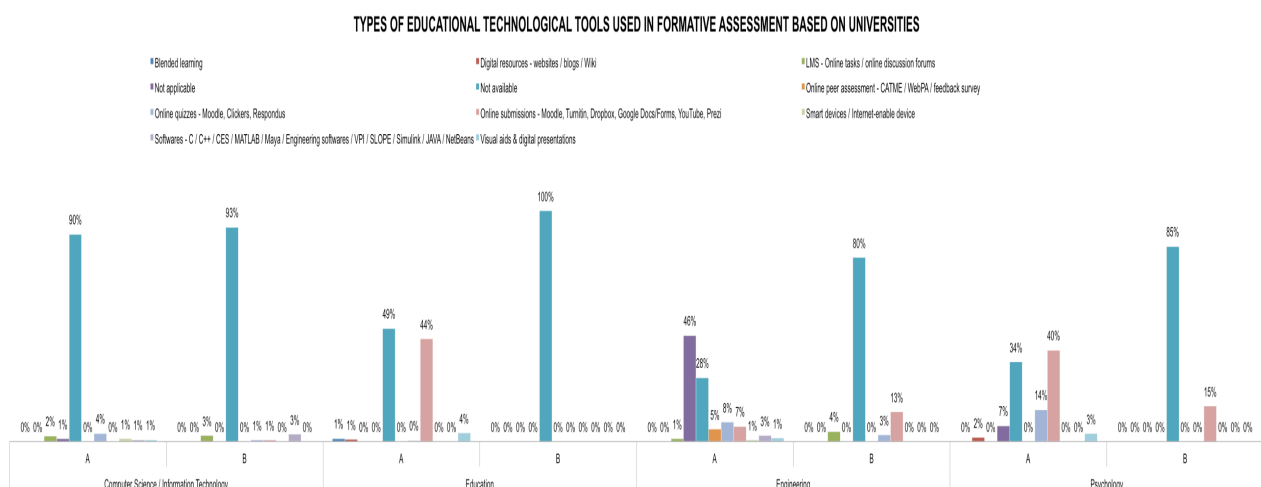


Figure 28: Types of educational technological tools used in formative assessment

Figure 28 (for a higher resolution image, please refer to Appendix H) provides a more holistic insight on this and indicated that educators from *University A* in both the *Education* and *Psychology* disciplines incorporated mainly *Online submissions* – *LMS, Turnitin, Dropbox, Google Docs/Forms, YouTube, Prezi* to further enhanced the formative assessment. Educators in the *Engineering* discipline on the other hand, incorporated technology mainly through (1) *Online quizzes* – *LMS, Clickers, Respondus*; (2) *Online submissions* – *LMS, Turnitin, Dropbox, Google Docs/Forms, YouTube, Prezi*; and (3) *Online peer assessment* – *CATME, WebPA, feedback survey* as well. However, the information on how educators incorporated technology in the formative assessment were not available from the *Computer Science/Information Technology* discipline as it was not specify in the available course outlines/unit guides.

Meanwhile in *University B*, with the modest information gathered, educators across the selected disciplines generally imply a preference on the usage of their university's LMS in the form of (1) *Online submissions* – *LMS, Turnitin, Dropbox, Google Docs/Forms, YouTube, Prezi*; (2) *Online quizzes* – *LMS, Clickers, Respondus*; and (3) *Online tasks/discussion forum* – *LMS*. The reason for this could be due the university's policies set by the higher management level, as mentioned by some other educators during the semi-structured interview sessions. This will be further revealed and discussed in the later subsections.

Findings observed in both *University A* and *University B* reflected a preference for online submission, online quizzes, online peer assessment and online tasks/discussion forum by educators across disciplines. All of these types of technology based formative assessment used were typically one of the many functions revolving around the HEIs own LMS. Similar finding have also been reported in the research conducted by Bennet et al. (2017) where online quizzes were found to be the most preferred form of technology-assisted assessment. However, in their findings, they also reported that this form of technology-based assessment was only deemed as satisfactory in terms of pedagogy. As educators found it tough to look for a more optimal form of technology-based assessment that fits their pedagogical level (Bennett et al., 2017), may be a result of why most of them resort to adopt the functions offered by the HEI's LMS despite lacking in terms of pedagogical level.

## Types of technology based summative assessment used

As all the disciplines across both universities do not rely on the usage of technology in their summative assessment, efforts were taken in this research to understand the format of final examination that are being incorporated across the selected four disciplines. Figure 29 below (for a higher resolution image, please refer to Appendix I) illustrated those educators in *University A* from the *Computer Science/Information Technology* and *Engineering* discipline, typically prepares the final examination using the conventional *closed-book* examination format. It was also observed that a handful of courses/units offered in these disciplines also adopt the *open-book* examination format. This is something quite interesting as it is not customary for final examination to be set in such a format.

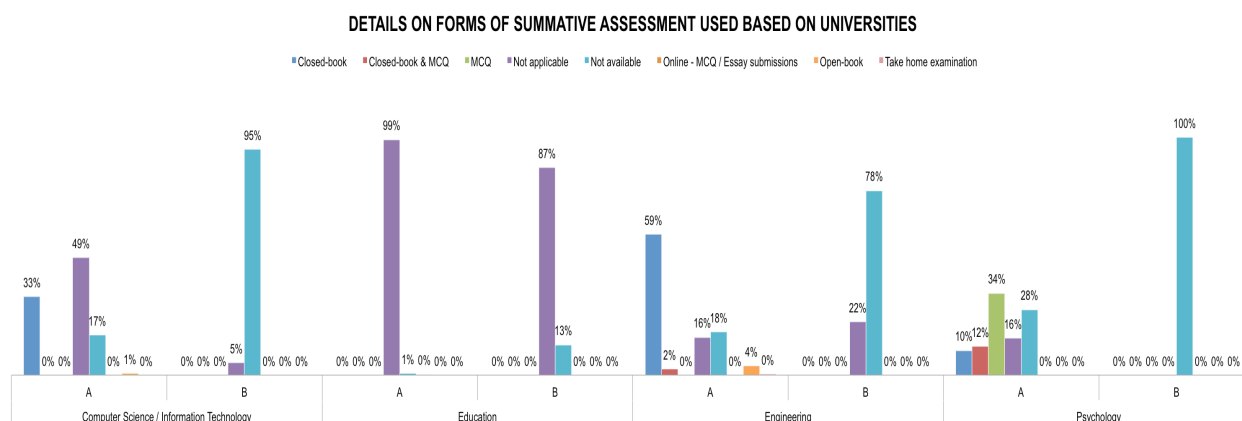


Fig. 29: Details on forms of summative assessment used

As for those in the *Psychology* discipline, based on the available course outlines/unit guides, educators on average were found to be more inclined to construct the final examinations in the form of *multiple-choice questions*. Contrary to all the three disciplines, educators from the *Education* discipline in both universities were found to place more emphasis on assessing their students through continuous formative assessment rather than using summative assessment.

## Forms of feedback provided

Figure 30 below (for a higher resolution image, please refer to Appendix J) provides an overview of the forms of feedback generally provided by educators across disciplines in both universities to inform students about their performance so that appropriate remedial efforts could be made in a timely manner (if needed) and continuous effort in keeping students informed about their growth and improvement areas are in place.

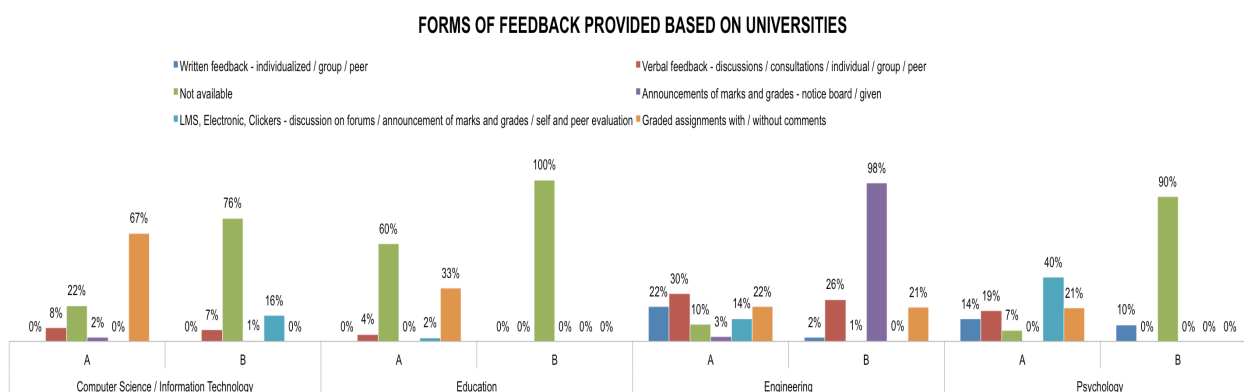


Figure 30: Forms of feedback provided

Educators from the *Engineering* and *Psychology* disciplines in *University A* were found to commonly provide students with a variety forms of feedback, such as: (1) *announcement of marks and grades*; (2) *graded assignments with/without comments*; (3) *LMS, Electronic, Clickers*; (4) *verbal feedback*; and (5) *written feedback*. However, it is also observed that educators in the *Computer Science/Information Technology* discipline only uses two forms of feedback, which are (1) *graded assignments with/without comments*; and (2) *verbal feedback*. On the other hand, educators from the *Education* discipline mainly provided feedback to their students in the form of (1) *graded assignments with/without comments*; (2) *LMS, Electronic, Clickers*; and (3) *verbal feedback*.

As for *University B*, educators in the *Engineering* discipline emphasized quite a bit on providing feedback through (1) *announcement of marks and grades*; and (2) *verbal feedback*. Meanwhile, it was interesting to also note that as much as educators from the *Computer Science/Information Technology* in *University B*, did not incorporate much learning technological tools in formative assessments, they were certainly putting in a lot of effort in providing feedback to their students through the use of technology – (1) *online*

through LMS, Clickers, email; and (2) verbal feedback. Educators in the *Psychology* discipline mainly focused on providing *written feedback* to their students.

Thus, the findings from this aspect of the qualitative data in short provided information on the current AF practices used by educators across disciplines and universities. These findings also included important information such as HEIs in Malaysia have yet to explore on the possibility of incorporating educational technological tools in summative assessments. In other words, conventional (pen-and-paper) form of final examination still takes precedence in assessing students' level of understanding. Similar precedent were also observed in providing feedback to students, in which written and verbal feedback were educators' preferred forms of feedback regardless of disciplines and universities.

### ***Integration with the interview findings***

Figure 31 below presented the overall representation of the merging of results from both secondary data analyses and interview data. As such, it was important to note that the findings from the transcribed interview data were found to be consistent with the findings from the secondary data analyses.

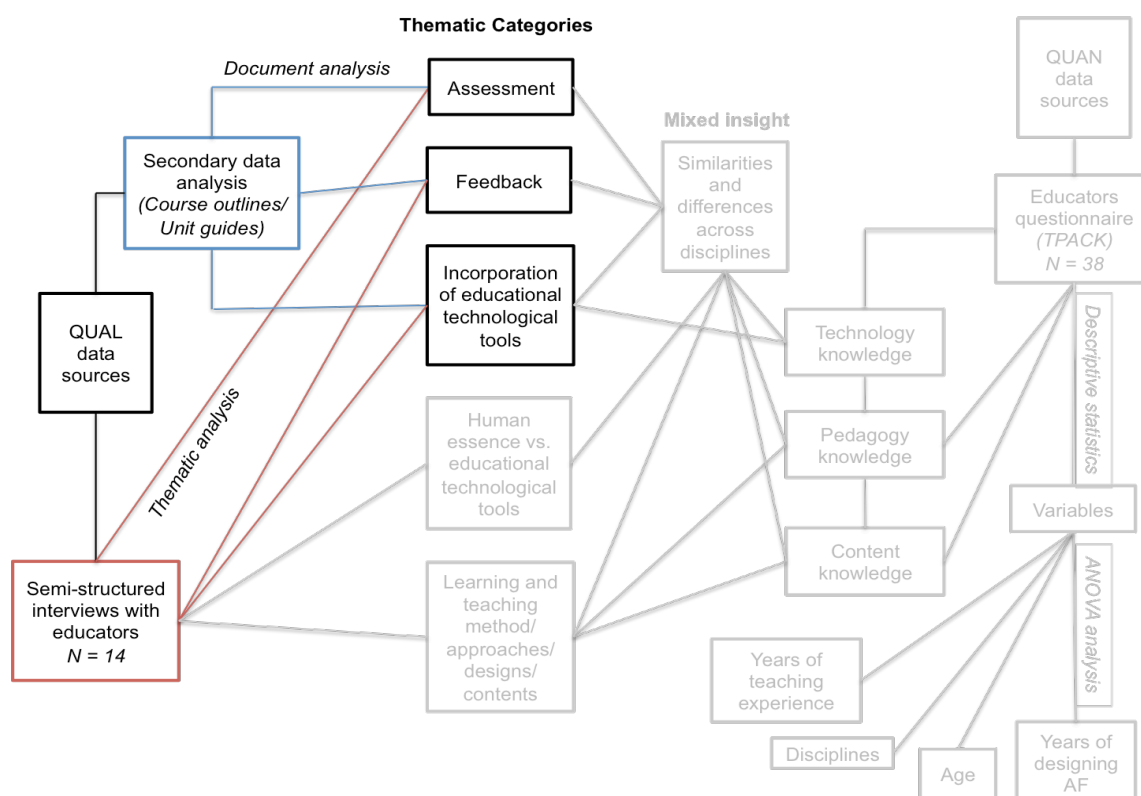


Figure 31: Representation of the findings from secondary data analysis and interview data (Phase 2)



Apart from that, findings from the interview sessions also presented this research with two additional themes whereby the obtained findings from the secondary data analyses were not able to capture. These two themes as shown in Figure 32 below were identified as: (1) *Human essence vs. educational technological tools* and (2) *Learning and teaching methods/approaches/designs/contents*.

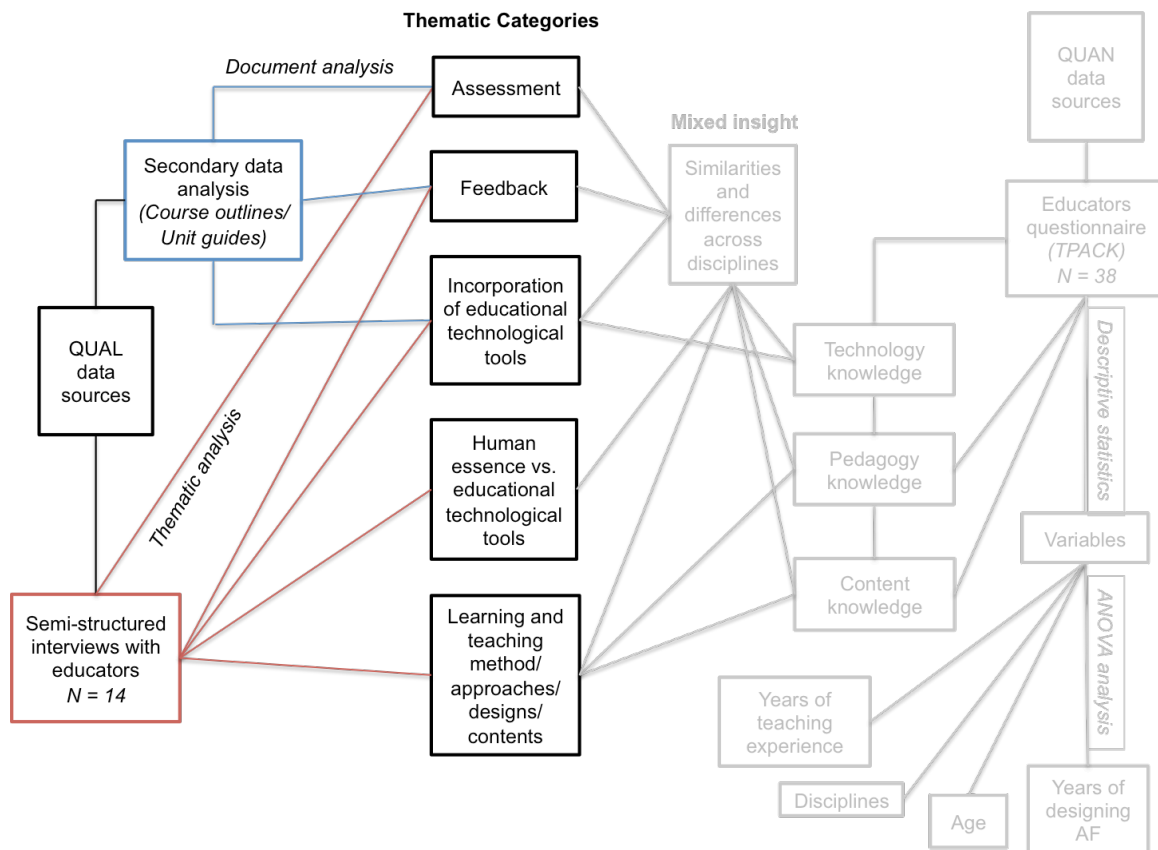


Figure 32: Two additional themes that derives from semi-structured interview data

Thus, this provided some novel insights in why some educators' are more receptive in incorporating educational technological tools and vice versa. It was also interesting to understand that as much as some educators were more inclined to incorporate educational technological tools in their AF practices; ultimately, these educators deemed that the very essence of human interaction in the student-teacher relationship to be a far greater element than the educational technological tools itself.

Below are some excerpts from the interview sessions that reflected the fresh insights provided by the two additional themes:

*“I would much rather prefer more face-to-face contact with students to work through things with them because that’s where and how you build a relationship between teacher and student”*

*“I think at the end of the day, technology is still not the decider but the mediator between the educators and the students”*

*“You see education is a very complex thing as it deals with human, there are many factors involved, one of it could be your software framework and you also have to look at the human factor, it could be their learning style, it could be their personality, all are involved”*

All in all, the results from both secondary data analysis and interview data indicated there were some forms of educational technological tools being integrated into the assessment practices across disciplines and universities, but ironically not in the feedback practices. This may reflect that educators in HEIs within the Malaysian context may still perceived assessment and feedback as two separate entities. Also important to note that, although this integration were carried out and conducted by educators in a small percentage, their efforts mainly more noticeable in the discipline of *Education* and *Psychology* from *University A*.

The next subsection presented the results in addressing the second research question of this research through the integrated findings from the collected secondary data analysis and transcribed interview data.

#### **4.2.2 Research question 2 – What are the similarities and differences among educators across disciplines in the design of assessment and feedback practices in HEIs in Malaysia?**

Upon capturing the results that leads to addressing the first research question, it is crucial to shift the attention to the second research question asked in this research. The data used to investigate the similarities and differences in the design of AF process among educators across disciplines, were mainly derived from the semi-structured interviews. As such, Table 18a and Table 18b (refers to Appendix K and L) further illustrated the identified themes from each of the participants through the use of thematic analysis.

## **Similarities**

This research was able to acquire the understanding in which educators from *University A* generally incorporated some form of learning technological tools in the design of AF practices, based on the information stated in their unit guides/course outlines. However, additional information derived from the interview sessions indicated that majority of them seemed to come in unison that as much as they think that technology is important in today's learning and teaching context, they cannot help but to also think that all these educational technological tools are just a mere tool to assist and enhanced the overall learning experience. The fundamental aspect and heart of learning and teaching process still lies at the very core and essence of human interaction.

Hence, educators in *University A* mainly find themselves to be in an impasse on whether how can they incorporate these educational technological tools to enhance the AF practices and still able to maintain the student-teacher interaction. Educators in *University A* were also more receptive and able to see the bigger picture on the importance of integrating these tools into their LT practices.

Below are some examples of the extracted statements from the interview sessions with educators in *University A*:

*"I would much rather prefer more face-to-face contact with students to work through things with them because that's where and how you build a relationship between teacher and student"*

*"I think at the end of the day, technology is still not the decider but the mediator between the educators and the students"*

*"You see education is a very complex thing as it deals with human, there are many factors involved, one of it could be your software framework and you also have to look at the human factor, it could be their learning style, it could be their personality, all are involved"*

Educators in *University B* were also utilizing some forms of educational technological tools, in which they were mainly more motivated to use the university's LMS; as it is compulsory for all academics staff. However, this preference or the incorporation of any forms of educational technological tools was not clearly indicated in the unit guides/course outlines. Hence the initial findings derived from just the collected unit guides/course outlines alone

in *University B*, portrayed an absence in educators' efforts in incorporating the use of educational technological tools.

This research were then able to have a clearer understanding on the actual landscape of the LT practices in *University B* gathered from the semi-structured interview sessions. The interview findings lead to a more holistic understanding in which, it is not that the educators are not using any forms of educational technological tools; it was merely not stated specifically in how they incorporate technology in the AF practices. As much as that is being said, the educators in *University B* in general were also not very inclined to integrate educational technological tools in designing and enhancing their assessment activities and feedback process. The reason being is that some of them felt that it was too much of a hassle to incorporate learning technological tools when they do not see the point of using it.

According to Embi (2011), educators in the HEIs were generally found to be quite complacent with the existing teaching practices (i.e: traditional teaching methods) and also felt that they were not so savvy when it comes to technology (technophobia). This is further supported by the examples of excerpt statements below:

*"As long as they fulfilled the requirements, so it doesn't really matter how they actually do it"*

*"I personally think that there is some importance in the conventional method of teaching and assessing the students. That is where we can challenge the students in the way they think"*

*"I am not so used to the available learning (educational) technological tools out there and because my class is small, so I don't see the need to automated the assessment and feedback process as it is still manageable to assess and provide feedback to them manually"*

Another theme to highlight is that educators from both universities mutually agree that feedback is essential and it reduces the gap in the learning and teaching process because ultimately assessments are designed and conducted so that students will be able to receive feedback on their learning progress. Similar findings was summarized in the study conducted by Chan and Nazamud-din (2017), in which they highlighted the importance of AF practices in enhancing learning. They also suggested that lecturers (educators) ought to be more thoughtful in ensuring the quality, quantity and timing of feedback being provided to students.

Some of the examples of the extracted transcripts from the interview sessions are as followed:

*“Definitely, because they will need to learn from their past mistakes especially in the units that I teach is a design course. They will have to look back and improved on their previous design, which is why feedback is very crucial for a design course”*

*“A feedback without an interaction is not a feedback. See, whenever you do your feedback, you try to feedback to them to see how far are they in achieving the outcome so that they know where they are”*

Even though in consensus, educators across disciplines and universities agree that providing feedback is essential in guiding and assisting students to learn better; there were however numerous of educators that only provide feedback when the students asked for it. The reason for this occurrence is generally being linked to the fact that these educators have a large cohort size in which providing personalized and individualized feedback to all students may seem to be quite a herculean task for these educators.

Samples of the interview statements are stated as below:

*“I give feedback in groups or in general because we can’t afford to give individual feedback because it requires time, so I only provide when the students asked me”*

*“We don’t give feedback as a general now, but we will give feedback when the students ask”*

It is also apparent that educators generally gave feedback manually across disciplines. With that being said, efforts to incorporate technology in providing feedback to students are still in its infancy stage. The reason being is that majority of the focus are being place on understanding and working out on how to further adopt and incorporate educational technological tools into assessing students throughout the semester (some at the end of the semester), and least on how to better equip students with information on their progress and how they can improve their performance. This is further supported by the findings from Deeley (2018) as it was demonstrated in her research that AF could be enhanced through the use of technology.

Hence, Table 19 below recaptures the similarities among educators across disciplines in the two selected HEIs in the design of AF practices.

Table 19: Similarities among educators across disciplines and universities based on the interview data

Similarities	Details
<b>Assessment</b>	Incorporated some forms of educational technological tools, mainly revolves around the functionality offered within the university's LMS
<b>Forms of formative assessment typically used</b>	(1) Essay/Written/Annotated Reviews/Bibliographies; (2) Project Work/Practical; and (3) Examination (e.g.: Quizzes, Midterms)
<b>Forms of summative assessment typically used</b>	Conventional final examination at the end of the semester
<b>Types of technology based formative assessment used</b>	(1) Online submissions; (2) Online quizzes; and (3) Online discussions/Forums
<b>Feedback</b>	Important and assist in reducing learning gap  Typically provides manual and conventional feedback without incorporation of educational technological tools  Provides personalised and individual feedback only when students take the initiative to ask
<b>Forms of feedback typically used</b>	(1) Graded assignment (written feedback); and (2) Verbal feedback

## Differences

On the other hand, it is also important to note that the differences that this research was able to gather from the collected unit guides/course outlines and transcribed interview data. One of the main differences noticeable in this research was educators' their perceptions of integrating educational technological tools to enhance the AF practices, regardless of disciplines and universities. Cheok and Wong (2015) also reiterated on how when teachers (educators) are able to understand and are fully pleased with the functionality of the tools, they will be more inclined to use and will also more likely to intensified the usage of these tools or systems.

As such, this research was able to denote that educators in *University A* were generally more inclined and accepting towards the notion of integrating educational technological tools to enhance the AF practices in comparison to educators in *University B*. The data gathered demonstrated educators in University B to be more predisposed in maintaining the status quo of how they assessed and provide feedback to students. The reason being was that although they recognized the benefit and potential of these tools bring to the AF practices, they regarded the transition needed was too much hassle and time-consuming to integrate them into the AF practices.

Apart from that, this research also found that there were slight differences when it comes to the preparation of the course outlines/unit guides in which *University A* provided a more precise information explaining exactly how the AF practices will be conducted and delivered to students in comparison to *University B*. The course outlines/unit guides gathered in *University B* indicated a more generic statement which is “*continuous assessment*” across disciplines as a form of assessment with not much details on how the feedback are being delivered to students. This situation could be a significant indication on putting forward the much needed standardization in improving the quality of course outlines/unit guides among HEIs in Malaysia.

The Table 20 below recaptures the differences among educators across disciplines in the two selected HEIs in the design of AF practices.

Table 20: Differences among educators across disciplines and universities based on the interview data

Differences	Details	
	University A	University B
<b>Perceptions of educational technological tools</b>	Potentially beneficial but it is still just a tool and human essence/interaction is still the core	Too much hassle and time-consuming to integrate these tools into the AF practices
<b>Course outlines/Unit guides</b>	Precise information on what was being stated and delivered in the LT process	Generic information that may not reflect the actual representation of what was being delivered in the LT process

## Integrated findings

Overall representation of the integrated findings between the secondary data analysis and interview data are illustrated in Figure 33 below:

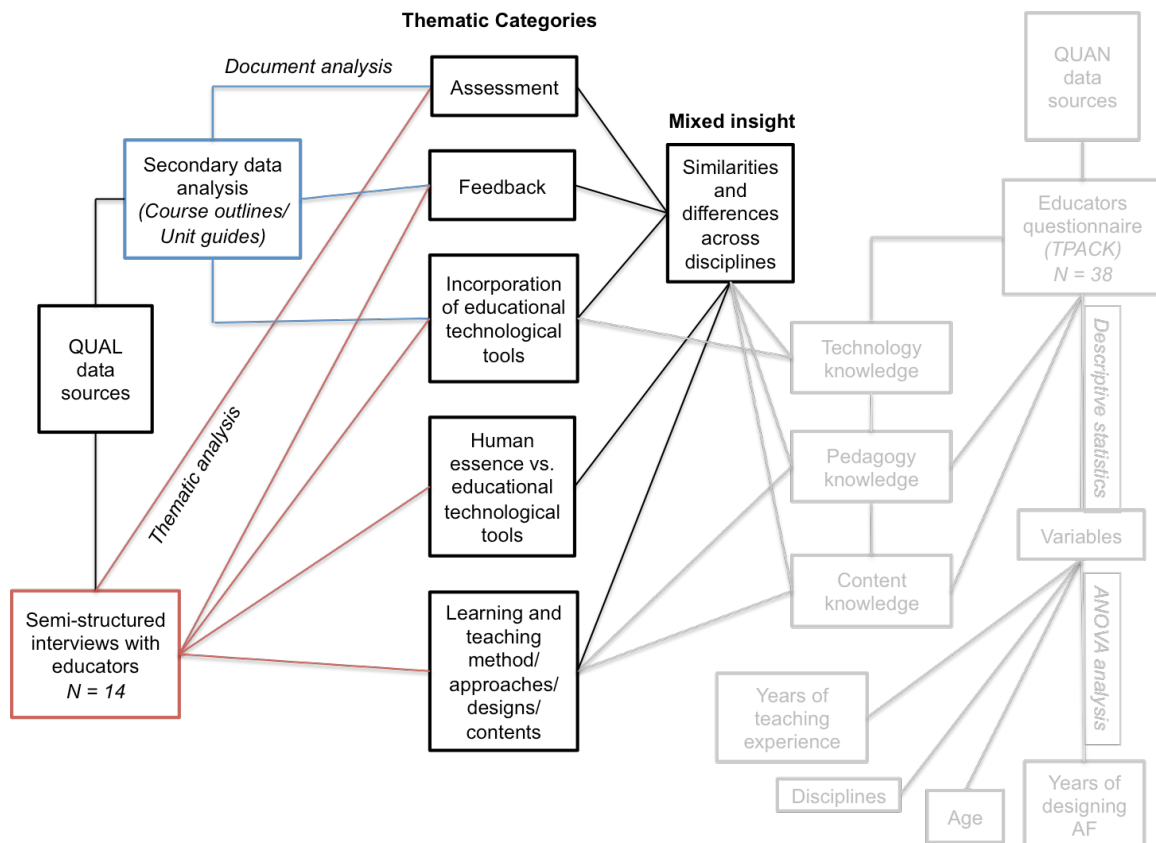


Figure 33: Representation of the integrated findings from secondary data analysis and semi-structured interview data that leads to the mixed insight (Phase 3)

### 4.2.3 Research objective 3 – model a technology enhanced assessment and feedback framework to facilitate the usage of educational technological tools in HEIs in Malaysia

Upon discussing the findings of research question 1 and 2, this research also seeks to answer its third research question, which is to model a technology enhanced AF framework in order to facilitate the usage of educational technological tools.

Based on research question 1, this research was able to take a closer look at the current practices of educators across disciplines in HEIs in terms of their AF practices. The secondary data analysis of course outlines/unit guides, along with the interview sessions were able to provide an overview of AF practices used by educators across disciplines.



The summary of that integrated findings indicated that there were notable differences across disciplines, possibly due to the nature of each disciplines; *Computer Science/Information Technology* and *Engineering* disciplines are mainly more technical in practice – hence, more usage of *project-based/practical assessments*. In comparison, *Education* and *Psychology* are more theoretical in nature – hence, uses more *written form* of assessments such as *Essay/Written/Annotated Reviews/Bibliographies*. The findings from research question 1 also illustrated that educators across disciplines were more inclined to incorporate technology in assessing their students but not in incorporating technology to provide more personalized and individualized feedback to students. Hence, the feedback component in the LT process is still very much rooted in the conventional phase.

Meanwhile in research question 2, this research was able to provide a further insight into the similarities and differences among educators across disciplines in the design of assessment and feedback practices. Educators in *University A* are generally more susceptible towards the notion of incorporating technology in assessing and providing feedback to their students in comparison to educators from *University B*. Educators from *University A* generally have a more positive impression and mindset on the effectiveness of learning technological tools as well as their own capability in using the learning technological tools.

On the other hand, educators from *University B* are less receptive towards the usage of technology due to the much dimmer impression and mindset. They perceived that by incorporating technology into their AF process would in turn led to a nuisance in maintaining the design as there will be more time and effort needed to convert the entire lesson plan to fit into a technology-based content.

Another reason being is that educators from *University B* in general do not perceive that there is a need to incorporate technology, as either they are still able to manage their small number of students or that the class size is too large; hence leads to a hassle in using learning technological tools. They also believe that the conventional method of learning and teaching, assessing and providing feedback to their students is still the way to go as it is much more effective. Some on the other hand, were not too sure of what are the available educational technological tools out there that they can use. Hence, they remained with the conventional method.

However, Chan and Nazamud-din (2017) also stated in their study that it is essential for teachers (educators) to change the way they assess their students as this would help in preparing and aligning their students for the skills that are needed in the 21<sup>st</sup> century. Thus, to meet the needs of the 21<sup>st</sup> century skills, educators need to incorporate a variety of instructional and learning methods to facilitate and ensuring their students are meeting these needs (Chan & Nazamud-din, 2017). To reinforce on the importance of this, Habibi, Yusop, and Abdul Razak (2019) highlighted that educators' ability to integrate technologies into teaching has been identified and recognized as one of the requirements needed, especially in enlisting new teachers (educators).

As such, this research attempt to further investigates educators' perceptions of their capability to incorporate technological pedagogical content knowledge in their day-to-day LT process through the online survey. The findings gathered in the descriptive statistic illustrated that in general, educators across disciplines in the selected HEIs scored higher in Pedagogical Knowledge for Meaningful Learning (PKML) while scoring lower for (1) Technology Content Knowledge (TCK); and (2) Pedagogy Content Knowledge (PCK).

The details of the scoring are provided in the Table 21 below.

Table 21: Average scoring of educators across disciplines in TPACK

<b>Descriptive Statistics</b>					
	N	Minimum	Maximum	Mean	Std. Deviation
TOLTK	38	15	25	20.26	3.046
TOLPK	38	16	30	23.84	3.184
TOLCK	38	10	15	12.29	1.487
TOLTCK	38	5	10	7.84	1.405
TOLPCK	38	5	10	7.97	1.102
TOLTPK	38	7	15	11	2.092
TOLTPACK	38	12	25	18.18	3.368
TOLPKML	38	37	60	47.74	6.106
Valid N (listwise)	38				

This indicates that typically the average educators in HEIs who participated in the survey were more confident in the execution of pedagogical knowledge for meaningful learning within the courses/units taught (TOLPKML). This includes knowledge on planning instructions, delivering lessons, managing students and addressing individual differences,

along with dimensions of active learning, constructive learning, authentic learning, intentional learning, and collaborative learning (Chai et al., 2011). In comparison, educators indicated that they were unsure on how technological tools could be used to deliver the content of courses/units taught or how specific tool would be best suited for certain disciplines (TOLTCK). On the same note, educators in average were also found to be unclear of how to make the courses/units taught; to be more comprehensible to students while understanding its relationship to specific learning outcomes (TOLPCK).

In other words, findings from the survey indicated that educators in HEIs in Malaysia are more confident, comfortable and contented in their knowledge of the TPACK framework as a standalone entity as shown in Table 21. Each of the knowledge such as Technological Knowledge (TOLTK), Pedagogical Knowledge (TOLPK), Content Knowledge (TOLCK) and the adapted Pedagogical Knowledge for Meaningful Learning (TOLPKML) – all have a higher mean value compared to the blend of two or more knowledge together. Similar findings conducted in the Indonesia context, found that teachers' (educators') perceptions in regards to the needs of integrating technology into teaching and also on TPACK will assist in teaching practices (Habibi et al., 2019). This could imply that the TPACK framework may not be as adaptable in the Malaysia context or even the Asian context.

Apart from conducting descriptive statistics, one-way between-groups analysis of variance (ANOVA) was also conducted to explore the impact of the following variables: (1) disciplines; (2) age; (3) years of teaching experience; and (4) years of designing AF on educators' perceptions of technology pedagogy content knowledge (TPACK). Participants were divided into four groups according to their (1) disciplines: Computer Science/Information Technology, Education, Engineering and Psychology; four groups according to their (2) age: 21-30; 31-40; 41-50; and 51-60; five groups according to their (3) years of teaching; and (4) years of designing AF: no experience, less than 2 year, between 2 to 5 years, between 6 to 10 years and more than 10 years.

The ANOVA analysis presented in Table 22 and Table 23 indicated that only two variables: (1) disciplines and (4) years of designing AF, indicated there was a significant difference among the mean scores on the educators' perception of TPACK. Meanwhile, the other two variables: (2) age and (3) years of teaching experience, implied there were no significant differences among the mean scores on the educators' perception of TPACK.

Table 22: One-Way Analysis of Variance (ANOVA) of Disciplines as measured by TPACK questionnaire

	df	SS	MS	F	Sig.
Between groups	3	110.788	36.929	4.064	.014
Within groups	34	308.922	9.086		
Total	37	419.711			

\*df: Degree of freedom representing the number of independent pieces of information that went into calculating the estimate

\*F: Analysis of variance ratio representing the variance between the groups, divided by the variance within the groups

From the Table 22 above, there was a statistically significant difference at the  $p < .05$  level in the TPACK scores for the four selected disciplines (*Computer Science/Information Technology, Education, Engineering and Psychology*):  $F(3, 34) = 4.064$ ,  $p = .014$ . The actual difference in mean scores between the groups was quite small. The effect size, calculated using eta squared, was 0.264. Post-hoc comparisons using the Tukey HSD test indicated that the mean score for *Education* discipline ( $M = 23.33$ ,  $SD = 2.08$ ) was significantly different from *Engineering* discipline ( $M = 17.20$ ,  $SD = 3.33$ ) and *Psychology* discipline ( $M = 17.78$ ,  $SD = 1.97$ ). On the other hand, *Computer Science/Information Technology* discipline ( $M = 19.50$ ,  $SD = 3.39$ ) did not differ significantly from either of the other disciplines.

In other words, the ANOVA results ( $F = 4.064$ ,  $p < .05$ ) further confirmed that educators from the *Education* discipline, the *Engineering* discipline and the *Psychology* discipline differ significantly in terms of their TPACK scores.

Table 23: One-Way Analysis of Variance of Years of Designing Assessment and Feedback as measured by TPACK questionnaire

	df	SS	MS	F	Sig.
Between groups	4	146.611	36.653	4.429	.006
Within groups	33	273.100	8.276		
Total	37	419.711			

\*df: Degree of freedom representing the number of independent pieces of information that went into calculating the estimate

\*F: Analysis of variance ratio representing the variance between the groups, divided by the variance within the groups

Similarly, Table 23 above, indicated that there was a statistically significant difference at the  $p < .05$  level in the TPACK scores for the years of designing AF (*no experience, less than 2 years, between 2 to 5 years, between 6 to 10 years and more than 10 years*):  $F(4, 33) = 4.429$ ,  $p = .006$ . The actual difference in mean scores between the groups was quite

small. The effect size, calculated using eta squared, was 0.349. Post-hoc comparisons using the Tukey HSD test indicated that the mean score for *No experience* group ( $M = 15$ ,  $SD = 2.31$ ) was significantly different from *Between 2-5 years* group ( $M = 20$ ,  $SD = 2.63$ ) and *More than 10 years* group ( $M = 19.8$ ,  $SD = 3.62$ ). *Less than 2 years* group ( $M = 18$ ,  $SD = 2.65$ ) and *Between 6-10 years* group ( $M = 16.75$ ,  $SD = 2.61$ ) did not differ significantly from either of the other groups in Years of Designing Assessment and Feedback.

In other words, the ANOVA results ( $F = 4.429$ ,  $p < .05$ ) further confirmed that educators that has *no experience*, with *Between 2-5 years* and *More than 10 years* of designing assessment and feedback differ significantly in terms of their TPACK scores.

### **4.3 Proposed framework**

Through the effort of triangulating the results gathered using secondary data analysis, semi-structured interview sessions and survey (shown in Figure 17), this research was able to have a better insight and understanding as to why similarities and differences occurred among educators across disciplines. These insights paved way in understanding that there is a need to develop a more holistic AF model with the incorporation of technology. Thus, this research proposed the need to develop a framework in which technology enhanced assessment and feedback (TEAF) could be use to assist educators in understanding more about what it takes to design more versatile assessment practices and also to provide students with a clearer and more constructive feedback, shown in Figure 34 below.

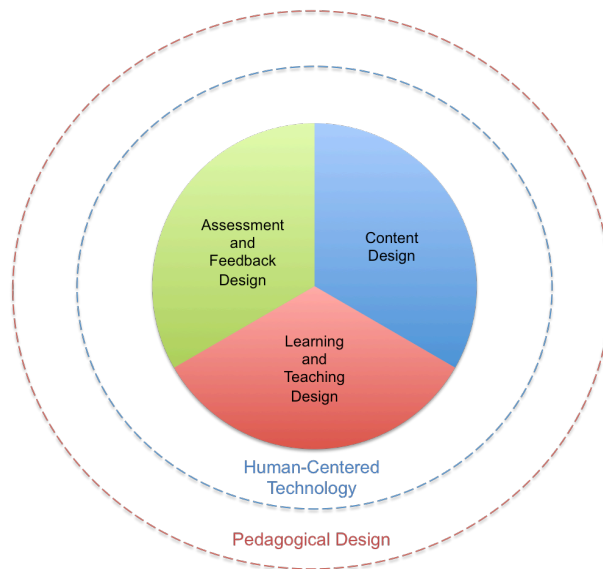


Figure 34: Technology Enhanced Assessment and Feedback (TEAF) Framework

This research argues that the educational process should comprise of three main pillar, namely: (a) *Assessment and Feedback Design*; (b) *Content Design*; and (c) *Learning and Teaching Design*. Unlike the existing TPACK framework (see Figure 35 below), this research proposed that the *Technology* aspect of education should not be a variable or construct on its own; instead it should be taken into consideration for educators to start perceiving the *Technology* aspect as a context. Hence, in contrary to the TPACK framework, this research perceives and interprets the *Technology* aspect as a contemporary and dynamic context in the higher educational setting. Thus, this *Technology* aspect works as a binding substance while interacting with the three main pillars of education and also the *Pedagogical Design* of the given course/unit.

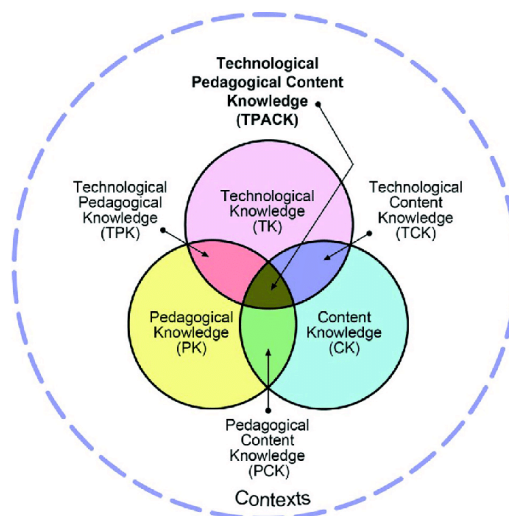


Figure 35: Technological Pedagogical Content Knowledge (TPACK)

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As such what should be given more emphasis in the educational setting is not on which educational technological tools to use; but on how the *Assessment and Feedback design*, *Content Design* and *Learning and Teaching Design* would be taken into consideration beforehand, in the commencement of a course/unit, regardless of disciplines. Once these three pillars have been decided upon and addressed, the selection of suitable *Human-Centered Technologies* (either from the ready available pool of educational technological tools selection or to design a new one), would then serve as a supplementary component in making the delivery of the course/unit, an even more engaging one. Subsequently, the *Pedagogical Design* also interacts and leads to the available *Human-Centered Technologies* to further support the integration of these technologies with the core pillars of this TEAF framework.

A more thorough explanation on this TEAF framework will be described in the following Chapter 5 along with further clarifications on how this framework would differ from the existing TPACK framework and also how TEAF would be a more appropriate framework to be apply in the higher education context in Malaysia, given the circumstances of the current educational technological tools level of usage. The next section also explains about the differences within disciplines as captured by the TEAF framework.

## CHAPTER FIVE

### TECHNOLOGY ENHANCED ASSESSMENT AND FEEDBACK (TEAF) FRAMEWORK

In this chapter, a thorough discussion and considerations on how the overall findings of this framework will be able to address the notable gaps indicated in the literature; along with addressing the research questions established earlier. This chapter also reviewed what relevant stakeholders can learn and benefit from this framework that was not address in the existing literatures and frameworks available in this area. This framework will also be constructive as a blueprint for relevant stakeholders and also for disciplinary differences when it comes to integrating educational technological tools in HEIs.

*Section 5.1* of this chapter explains about this research's effort in addressing the missing gap. *Section 5.2* on the other hand provided detail information on how the proposed TEAF framework would be able to be adopted to guide educators in their effort of incorporating educational technological tools to enhance the current AF practices. *Section 5.3* discusses the deconstruction of the TEAF framework and the definitions of each of the pillars and context of the framework, followed by *Section 5.4* on the versatility of this framework in being adapted into the various disciplines within the HEIs setting.

#### **5.1 Addressing the missing gap**

Considering the complexity of the assessment and feedback practices in the learning and teaching process, the challenge that this research has undertook was revealed through making an effort to understand the circumstances that educators are currently in with regards to adopting the TPACK. Figure 36 illustrated how TPACK framework will be acknowledged when educators are able to successfully and effectively fuse *Technological Knowledge (TK)*, *Pedagogical Knowledge (PK)*, and *Content Knowledge (CK)* seamlessly – otherwise termed as the '*sweet spot*' in this research; within the learning and teaching contexts. This research argues that the '*sweet spot*' is only achievable under an ideal context, whereby educators are familiar with all the three aspects of knowledge and are able to easily switch from one aspect of knowledge to another, interchangeably.



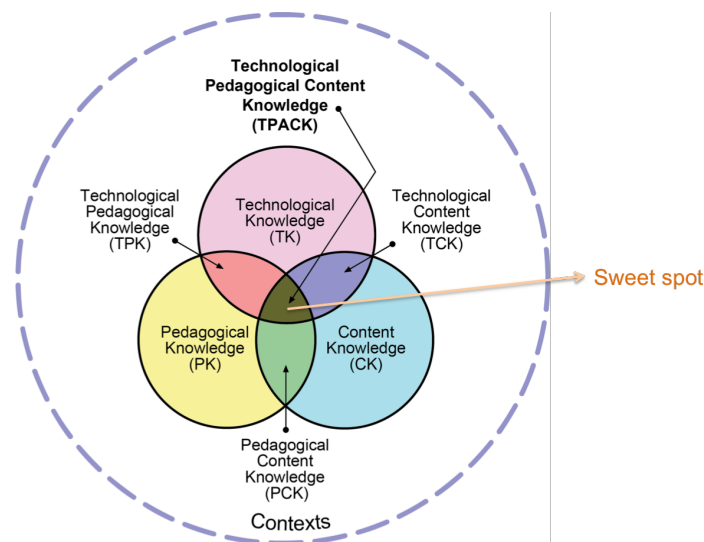


Figure 36: Identified 'The Sweet Spot' of TPACK

However, in reality, the current situation of educators' level of knowledge in regards to these identified aspects of the TPACK framework have shown that educators in HEIs in Malaysia, regardless of disciplines are still far from achieving the desired 'sweet spot' as identified from the initial TPACK framework. Figure 37 below indicates the aspects in which HEIs educators in Malaysia are currently at. This was identified through the results gathered from the TPACK survey. As much as the TPACK framework would be the most ideal framework exist currently to support educators in successfully and efficiently fuse all the three key components seamlessly.

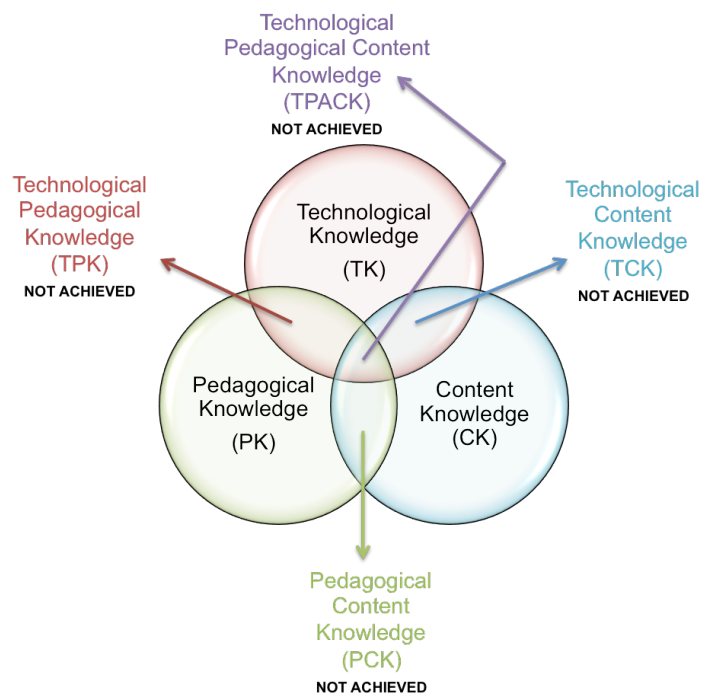


Figure 37: Current TPACK situation among educators in HEIs in Malaysia

The results gathered indicated that educators in HEIs in Malaysia are still in the midst of trying to successfully integrate Technological Knowledge (TK) with Pedagogical Knowledge (PK) and Content Knowledge (CK). As such, in order to achieve the desired ‘sweet spot’ may still be kind of far-fetched. Hence, this would imply that a more versatile framework is needed in the Malaysian context, as HEIs in Malaysia may not be as forward moving when it comes to the area of educational technology.

As such, based on the results gathered and analysed in this research, a more versatile framework was developed. Figure 38 below illustrated on the aspects and areas that will be included in this newly developed Technology Enhanced Assessment and Feedback (TEAF) framework.

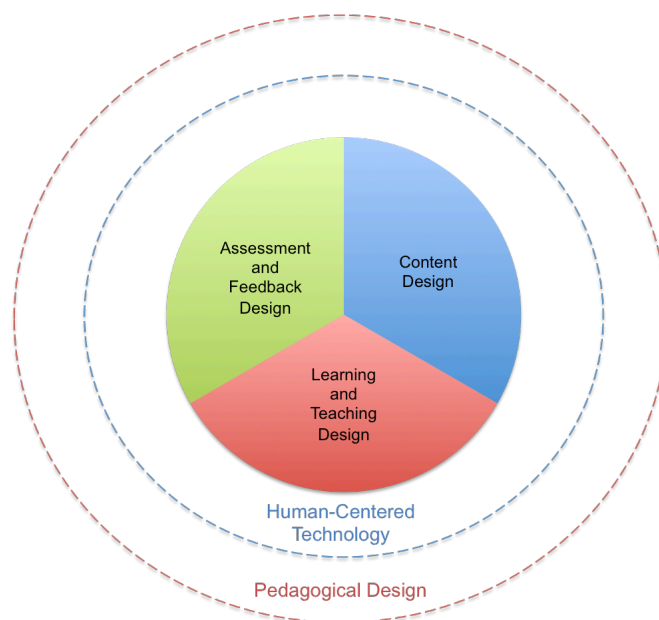


Figure 38: Technology Enhanced Assessment and Feedback (TEAF) framework

This TEAF framework aims to explain how a successful and efficient integration of educational technological tools into the assessment and feedback practices lies not in overlapping of the technological, pedagogical, and content knowledge; but on three very fundamental pillars of the educational process itself. These three pillars are being identified as the core of this framework as the emphasis should be given to these pillars, namely: (a) *Assessment and Feedback Design*; (b) *Content Design*; and (c) *Learning and Teaching Design*. This framework would also take into considerations on the *Human-Centered Technologies* that are readily available or if should HEIs decide to design their own version of LMS. Lastly, the *Pedagogical Design* of a particular course/unit would also

be taken into considerations, as different disciplines may or may not, opt for one or a combination of different learning and teaching methodologies and strategies (i.e.: problem-based learning, blended learning or flipped learning) that is deemed to be the most fitting and appropriate in alignment with the nature of the disciplines.

The research advocates that these three main pillars should be the epitome of the educational setting, in which the AF practices will now also be given the much needed emphasis or more, before the technology aspect. While existing framework focuses more on the technological aspect within the educational settings and viewing feedback as a secondary component to assessment, this contrasting emphasis that AF as an equal entity in this research; is to ensure that students will be benefited from this TEAF framework. Subsequently, the missing link in the Malaysia Education Blueprint – identified as efforts to improve the quality of education through producing graduates with the skills that are needed by employers; will also be address by placing the much needed emphasis on the *Assessment and Feedback Design* pillar.

This research also propose that educators and key educational policy makers may want to readjust their view and realigning their focus on getting the main pillars of educational setting on the right track. Perhaps by reviewing and revolutionizing on how *Assessment and Feedback Design*, *Content Design*, and *Learning and Teaching Design* could work together as one entity, alongside within the integration of *Human-Centered Technologies* blending into the selected *Pedagogical Design* would be useful in enhancing educational setting. This is further supported by the findings from Poth (2018), who pointed out that technology enhanced formative assessments (TEFA) strategies would enable educators to create continuous assessments systems where learning and assessment merge. This is aligned with the TEAF framework as developed by this research in which the assessment, along with feedback design, content design and learning and teaching design; are the protagonist of the educational setting.

Furthermore, this research also reckons that when one of the three main pillars starts to infuse with technology, the other two remaining pillars will inevitably needs to be redesign in way where technology will be adopted as it is after all the binding element of this TEAF framework. Thus, this research hypothesizes and challenge that *technology* will not only needed to be introduce in Assessment alone but in the *Assessment and Feedback Design*, *Content Design* and subsequently, the *Learning and Teaching Design* itself. Only when

this massive step forward happens, will only then the educational setting finally be realigned and mount to the needs of 21<sup>st</sup> century.

The reason being is that the effort to incorporate technology to further enhance AF in the selected top HEIs in Malaysia have been observed and shown to be still in its infancy stage and quite often are limited to the compulsory incorporation of the institution's own learning management system. For example, educators are using it at a very minimum level such as uploading lecture materials and using it, as another platform to store their materials instead of maximizing it's potential. With that, the existing institutional LMS used in the selected HEIs varies and the understanding of whether these LMS has it been developed using a proper framework remains unclear. Embi (2011) found that e-Learning administrators in HEIs in Malaysia believe that the future plans for incorporating educational technological tools should be focused on applications such as Podcasting, Educational Games and Simulation. This key finding calls for an urgency among HEIs in Malaysia to first stop and focus on what is more important at the moment – to streamline the way how students are being assessed and provided with feedback under the online environment. This research reckons that before HEIs in Malaysia are able to successfully incorporate and tap on the potential of educational technological tools, the core foundation of education itself has to be revisited.

A more in-depth reflection on how educators can incorporate educational technological tools – either from their own institutional LMS or other readily available resources or platforms; are crucial in helping educators to further evaluate their assessment and feedback design. The process of choosing and incorporating educational technological tools into daily learning activities, to better assess their students across different cognitive levels and skills; and ultimately to provide feedback to their students; may be needed to further encourage and eventually move the evolution of educational setting to a higher level. As much as incorporating educational technological tools into the AF provides the opportunity for more effective, efficient and collaborative learning experience; educators first need to consciously choose to make the transformation and elevate the shift from being summative assessments or examination-oriented to a continuous assessment-oriented that allows a more personalized and individualized AF culture in the higher education setting. This mindset and leap of perspective needs to take place in order for educators to be able to create of a more versatile learning experience with the assistance of educational technological tools.

## 5.2 Deconstructing the TEAF framework

First and foremost, the key purpose of this TEAF framework is to be a constant stimulus in igniting educators' and relevant stakeholders' effort to consciously place emphasis on the much-needed aspects of integrating technology to enhanced AF practices in HEIs. The current predicament in the Malaysian context is no longer on the question of whether educators should or should not be integrating educational technological tools, but is moving towards the question of how should they be integrating these tools into the educational setting.

As such, this subsection provides explanations on the main pillars and variables that interact with the pillars under any given educational settings within the higher education context. The core of this framework lies with the three main pillars, namely: (a) *Assessment and Feedback Design*; (b) *Content Design*; and (c) *Learning and Teaching Design*. These three pillars are distinct from one another, yet connected in the collaborative nature of the educational setting – reflecting the actuality of how educators plan and design the courses/units that they are responsible for. Explanations for each of the main pillars are as such:

(a) ***Assessment and Feedback Design (AFD)***: comprises of the different types of AF design typically used by educators across disciplines as the findings from this research indicated that there are certain types of AF design that thrive better in accordance to the nature of each of the disciplines. An example would be like how a Project Work/Practical type of assessment design would be more fitted in the Engineering discipline due to the more hands-on nature of this discipline in comparison to the other discipline. As such, under this framework, educators would be able to have the flexibility to adopt any forms of AF design that are deemed suitable for the nature of their respective courses/units within and across different disciplines.

(b) ***Content Design (CD)***: consists of the different contents that each course/unit from various disciplines provides. Focuses on the understanding of how the nature of the content would directly influence the manner of how the course/unit is to be delivered. For example, a heavily concentrated numerical-based content (e.g.: Statistics) would need to be delivered in a manner that provide more hands-on practice opportunities in class as compared to a more theoretical-based content (e.g.: Philosophy). For this such nature of

content would then require educators to allocate more opportunities for students to interact with one another through discussions and debates in class.

(c) ***Learning and Teaching Design (LTD)***: contains the types of learning and teaching design theories or models that educators would like to adopt for a particular course/unit in their respective disciplines. This is also otherwise known as the Instructional Design models and educators should ponder upon before the commencement of any course/unit. For example, educators from the *Engineering and Information Technology* discipline would generally adopt a constructivism learning theory/model in which educators facilitate learning through empowering students to make connections between new concepts and past experiences; while educators from the *Psychology and Education* discipline would typically go for the behaviourism and cognitivism of learning theories/models such as situated cognition where educators assist students to apply what is being learnt in the educational setting to the real world through communities of practice (CoP) theory.

As a whole, the three main pillars in this TEAF framework will influence and interact with one another whereby each of the chosen design within the pillar would have an effect on the other remaining pillars as these three pillars work together in an effort to provide a more holistic learning experience for students within the educational setting. Under this framework, these pillars also influence and interact with other variables that exist within the educational setting, such as: (a) *Human-centered technology*; and (b) *Pedagogical Design*. Further explanations on how these come together under the TEAF framework are as such:

(a) ***Human-centered technology (HCT)***: encompasses some of the readily available educational technological tools in the market. This includes tools like Learning Management Systems (LMS) such as Moodle; Personal Response Systems (PRS) such as Clickers; screen capture videos software programs such as Camtasia; Computer-Based Assessments (CBA) such as GradeMark, Kaizena and plagiarism checker – Turnitin and many more other available educational technological tools.

(b) ***Pedagogical Design (PD)***: contains the types of learning and teaching methodologies and strategies that educators would like to use in their respective course/unit. This includes deciding on a problem-based learning, an active learning based, a flipped-classroom based or a blended learning based. Again the selection of pedagogical design would depend on how comfortable and knowledgeable the educators are in delivering the

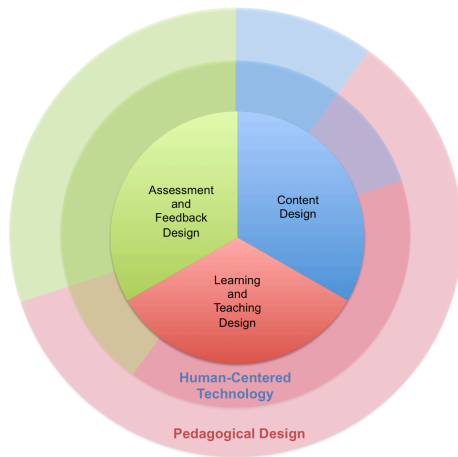
content of the course/unit using the chosen pedagogical design within their own respective disciplines.

Thus, in other words, this framework would offer a more diverse usage and application for educators. This in turn provides educators with the freedom to customize the integration of educational technological tools into the educational setting. Through this customization, educators are able to tailor-made their course/unit to cater to the different needs of the group of students, regardless of the cohort size (larger or smaller classroom size) and educational settings (face-to-face or distance learning). As such, the plasticity of this feature offers a versatile framework that will be able to be integrated across any disciplines. This framework would be the starting point of a more successful and efficient integration of educational technological tools that will lead to the enhancement of the AF practices in higher education.

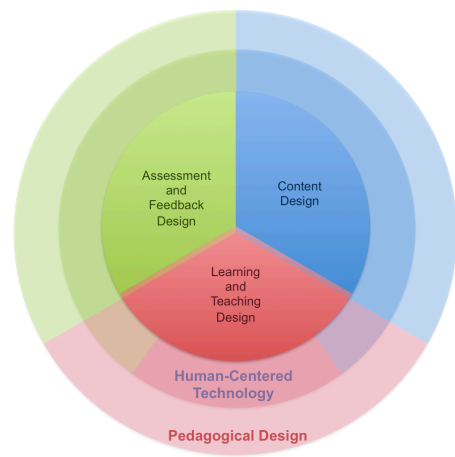
### **5.3 Versatility of the TEAF framework**

Upon describing and explaining on three main pillars alongside with the two changeable aspect of LT process, this section provide some illustrations on how the TEAF could be adapted to the nature and needs of various disciplines.

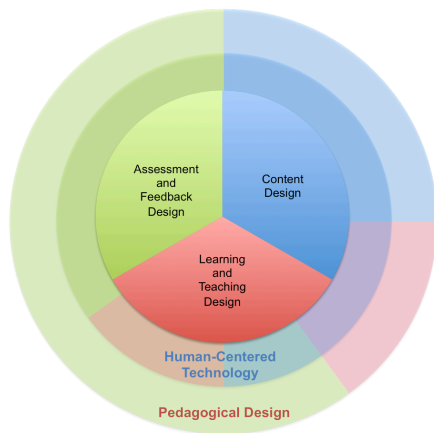
In retrospection, Figure 39 below depicted how the TEAF framework addresses the similarity and differences among disciplines based on the findings gathered in this research through the publically available secondary data analysis of course outlines/unit guides, semi-structured interview with educators from the selected disciplines (*Computer Science/Information Technology, Education, Engineering and Psychology*), and lastly distribution of online survey.



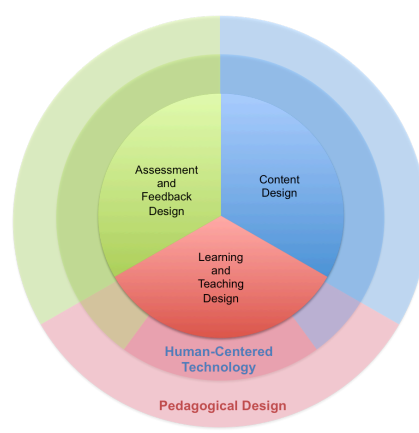
Computer Science/Information Technology



Education



Engineering



Psychology

Figure 39: Versatility of TEAF framework in catering to the need and nature of selected disciplines

It is essential for this research to clarify that, as much as this framework provides the flexibility for educators to decide the magnitude of each of the three main pillars (*Assessment and Feedback Design*, *Content Design*, and *Learning and Teaching Design*); the core principle of this framework remains as pillars that are equivalent to one another. With that being said, in the context of *Human-Centered Technology* and *Pedagogical Design*, the influences of the pillars might differ depending on the nature and needs within the discipline itself. Further explanations on how TEAF can be applied in each of the disciplines are explained in the following subsections.



### 5.3.1 Computer Science/Information Technology discipline

This TEAF framework provides the flexibility to be adapted in accordance to the nature of the *Computer Science/Information Technology* discipline as shown in Figure 39. This framework was able to capture the requirements of this discipline through thorough findings gathered from this research through a mixed method approach. As such, it is recommended that the focus of the *Human-Centered Technology* (HCT) context within this discipline should prioritize on the *Learning and Teaching Design* (LTD) and *Assessment and Feedback Design* (AFD) pillars. The reason as to why the Content Design (CD) requires a lesser emphasis in this HCT context is because presently there is already some sort of programme standards being outlined in the Malaysian Qualifications Agency (MQA) using the learning framework of the Association for Computing Machinery (ACM) (Malaysian Qualifications Agency, 2015). Therefore, the incorporation of educational technological tools should be on the focus of on how to incorporate these educational technological tools to enhance the LTD and also the AFD practices within the discipline. Figure 40 below provided a depiction on how the three main pillars interact with one another within the HCT context.

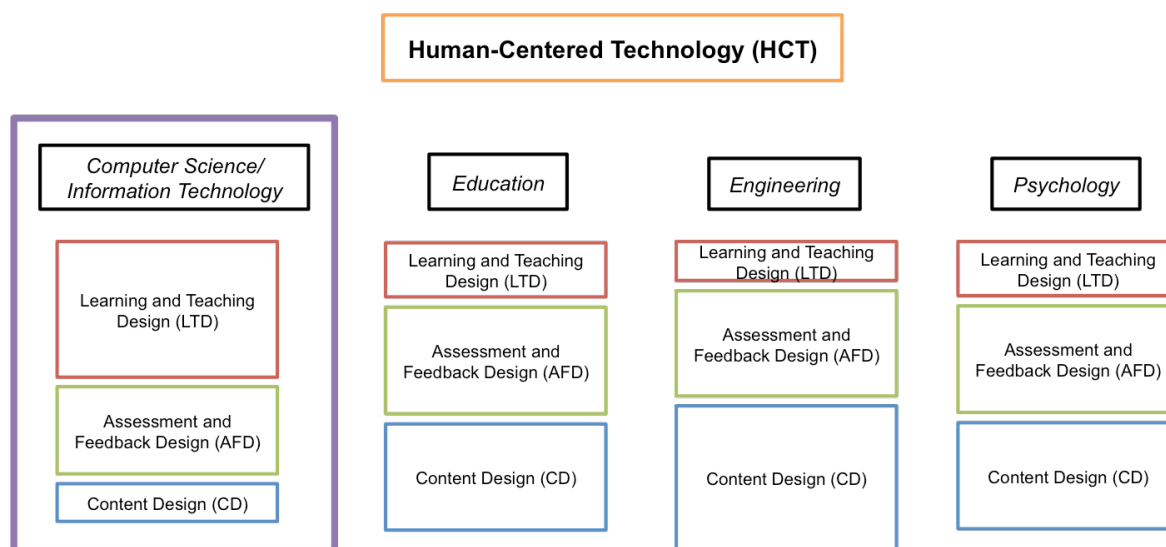


Figure 40: Interaction between three main pillars within the Human-Centered Technology context (Computer Science/Information Technology discipline)

Similarly, in the *Pedagogical Design* (PD) context, the emphasis would also be on LTD, followed by AFD and finally CD. It is understood that in the *Computer Science/Information Technology* discipline, the content of what needs to be delivered in the LT settings changes in a rapid manner as a means to catch up with the demands of the market. Hence, the LTD needs to be interactive and engaging in a way to assist students in grasping the crucial underlying concept of the content. As such, it will be more beneficial for educators to look into their choice of pedagogical strategies to appropriately guide the understanding of how PD would have an impact on the LTD, AFD and CD pillars. This is to ensure that all three pillars are interacting with one another on the same wavelength and operating from the same page. Hence, better representation of this interaction within the PD context is shown in Figure 41 below.

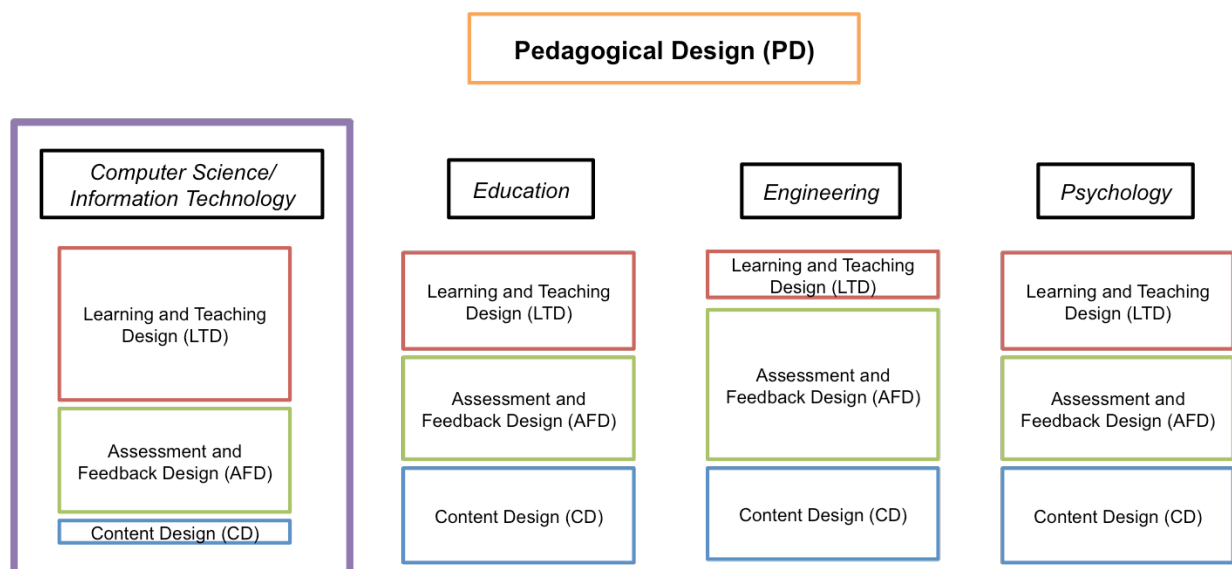


Figure 41: Interaction between three main pillars within the Pedagogical Design context (Computer Science/Information Technology discipline)

### 5.3.2 Education discipline

As for the *Education* discipline, this TEAF framework allocates freedom for educators to also work on the three pillars within the HCT context. Having that said, the emphasis within the HCT context in this discipline however, will be on AFD and CD in comparison to the LTD (refer to Figure 39 and Figure 42). Thus, the current scenario being captured in this discipline is slightly different from the *Computer Science/Information Technology* discipline described in the previous subsection.

The Malaysian Qualifications Agency (MQA) also formulated a programme standard for the *Education* discipline that outlined specific guidelines that will transform the quality culture of teacher education in Malaysia (Malaysian Qualifications Agency, 2016b). However, in the formulated programme standard, emphasis was placed on how the LT practices for teachers' education should be. Hence, this research would recommend that the decision to incorporate educational technological tools and the selection of these tools to be on enhancing the AFD and CD pillars. As indicated in the programme standard, educators in the *Education* discipline have prior knowledge in preparing a suitable LTD; thus it is only natural to place the emphasis on the other pillars within the HCT context. As such, Figure 42 below provided an illustration depicting this interaction in a concise manner.

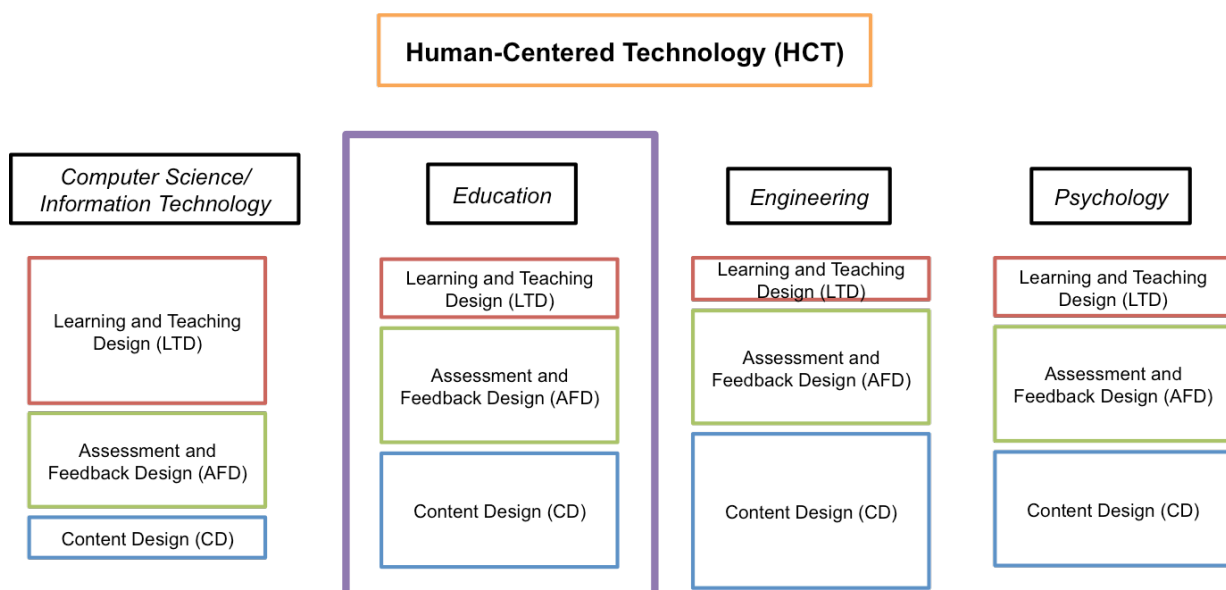


Figure 42: Interaction between three main pillars within the Human-Centered Technology context (Education discipline)

As for the PD context, this research was also able to identify a more balance approach of the emphasis given for each of the pillars from the findings. It was understood that the *Education* discipline appears to be both theoretical and practical in nature, which requires educators in this discipline to adopt a more balance approach on blending all the three main pillars in a holistic manner. This provided the opportunity for educators in the *Education* discipline to either opt for pedagogical strategies that are all-inclusive or to work with multiple strategies that will enable them to connect the LTD, AFD and CD pillars in a coherent manner. This equilibrium manner of interaction within the PD context is being represented in Figure 43 below.

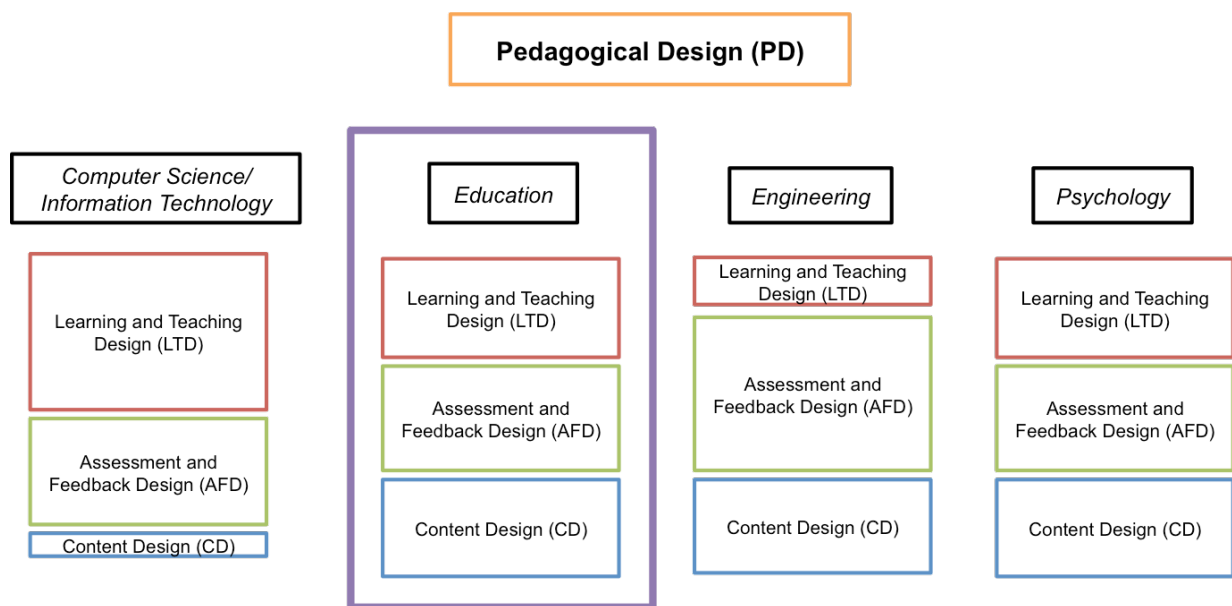


Figure 43: Interaction between three main pillars within the Pedagogical Design context (Education discipline)

### 5.3.3 Engineering discipline

This TEAF framework also offers parallel adaptability that fits into the requirements of the *Engineering* discipline. It was depicted in Figure 39 that emphasis was placed on the CD and AFD pillars within the HCT context. The reason being is that as much as this discipline is also governed by a handful of professional bodies such as Engineering Accreditation Council (EAC) and Board of Engineers Malaysia (BEM) (Malaysian Qualifications Agency, 2011), it was done in a way that educators are still encouraged to have the flexibility to design the content.

As such, the incorporation of educational technological tools can be incorporated to enhance the designing of the content (CD) to make it more interesting for students as it mainly involves a lot of technical information. Similarly, the AF practices in the *Engineering* discipline will also be benefited through the incorporation of these tools as it ensures the technicality of information has been retained in a higher order-thinking manner as emphasised by the professional bodies in this discipline. A better understanding on this interaction can be seen in Figure 44 below.

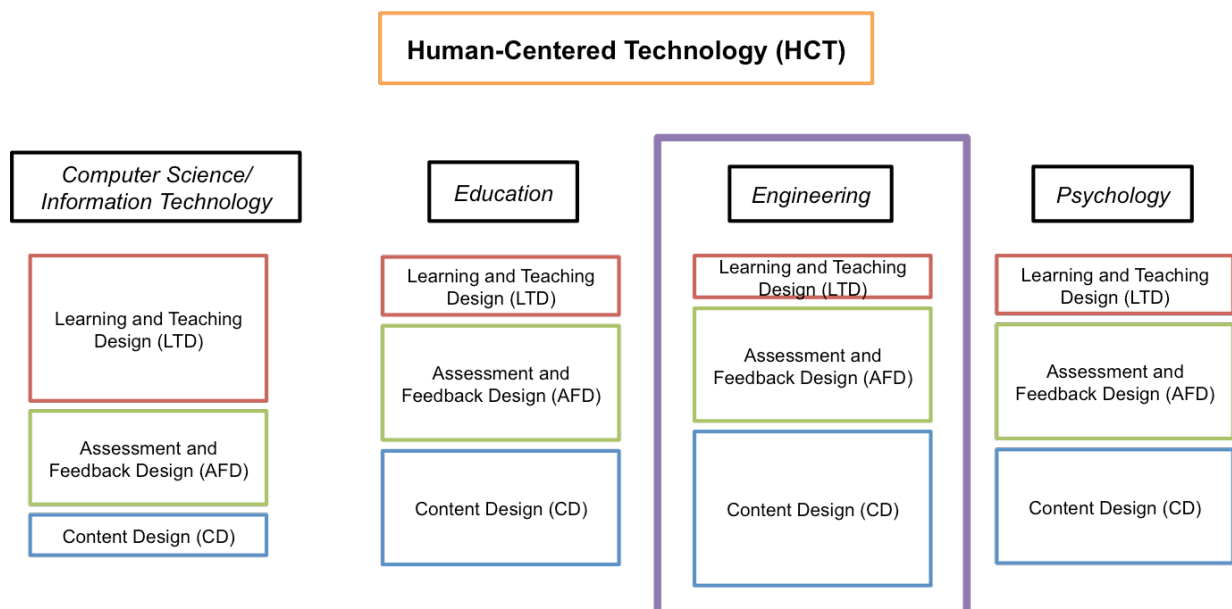


Figure 44: Interaction between three main pillars within the Human-Centered Technology context (Engineering discipline)

However, within the PD context, emphasis would be given to AFD, as the nature of this discipline requires students to have the ability to apply both knowledge and skills in an innovative, pragmatic and hands-on manner. Similar nature was also observed in the *Computer Science/Information Technology* discipline. Thus, this reiterates on the versatility of this TEAF framework and its ability to support the difference of nature across the selected disciplines, depicted in Figure 45.

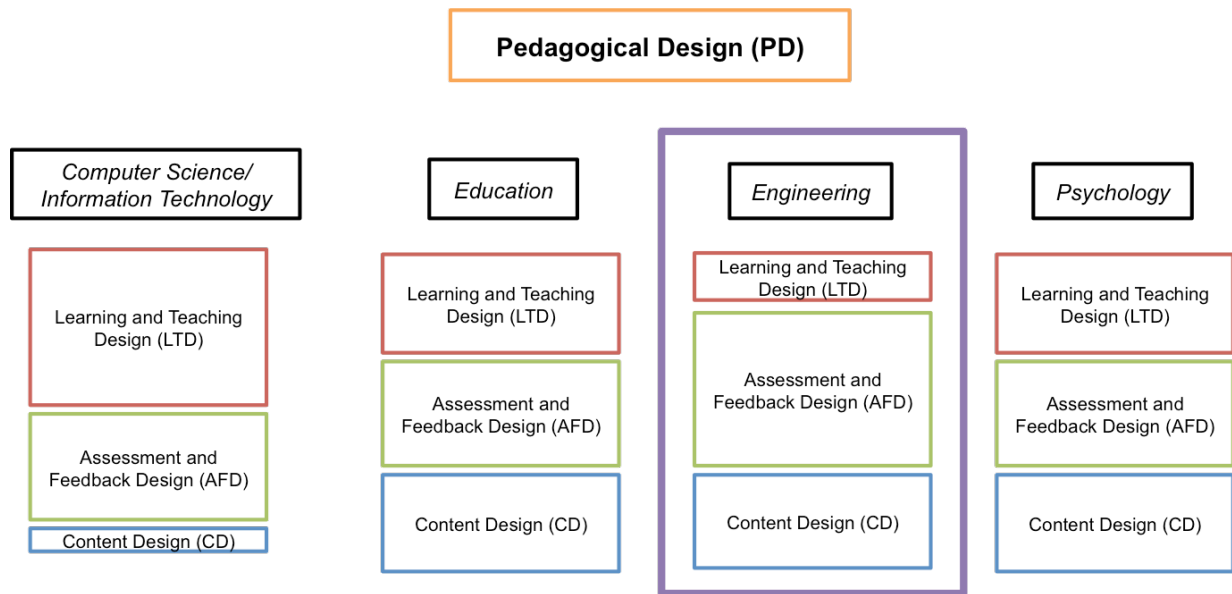


Figure 45: Interaction between three main pillars within the Pedagogical Design context  
(Engineering discipline)

### 5.3.4 Psychology discipline

The findings gathered in this research indicated that the *Psychology* discipline being represented in the TEAF framework shows similar emphasis on the three main pillars to the *Education* discipline within the HCT context. As the nature of this discipline is more on understanding, comprehending, and application of the learnt theoretical knowledge, it is proposed in this research that the incorporation of educational technological tools will further assist educators to deliver the content, assess and provide feedback to students in a more effective manner. Thus, the emphasis given will be on incorporating the educational technological tools to enhance the AFD and CD pillars. Figure 46 below provided a clearer depiction of this interaction within the HCT context.

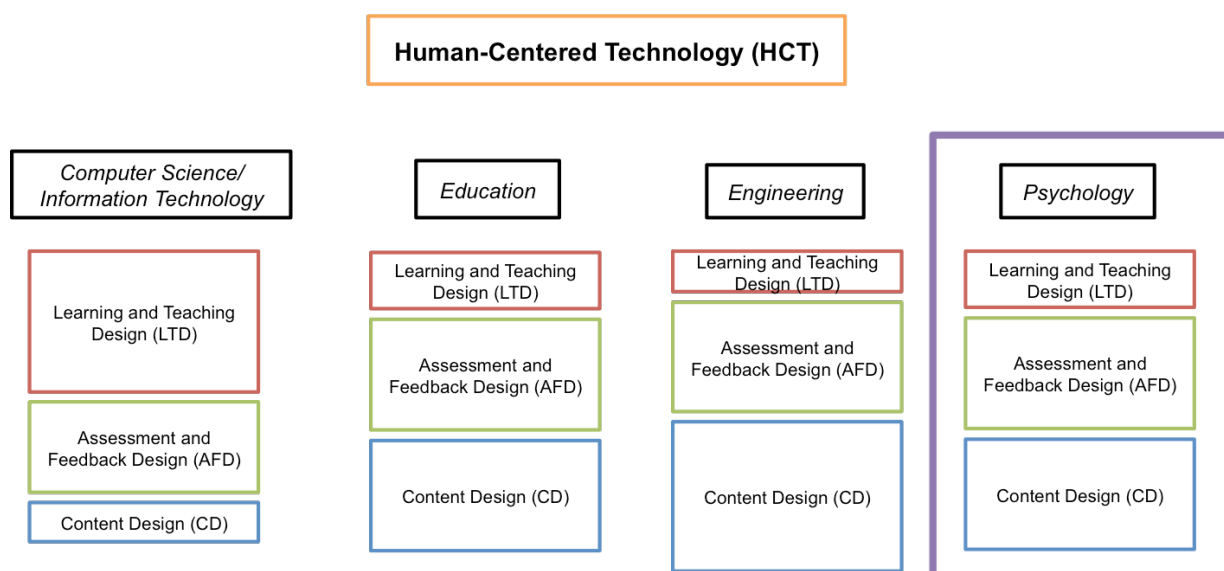


Figure 46: Interaction between three main pillars within the Human-Centered Technology context (Psychology discipline)

MQA also developed a programme standard with reference to some of the major psychology associations such as American Psychological Association (APA), Australian Psychological Society (APS) and British Psychological Society (BPS) (Malaysian Qualifications Agency, 2013). With the given nature of the *Psychology* discipline, that is both theoretical and practical – a matching depiction to the *Education* discipline was represented as well.

As shown in Figure 39 and Figure 47, a more balanced emphasis across the three main pillars within the PD context was illustrated, that once again mirrored the situation captured in the *Education* discipline.

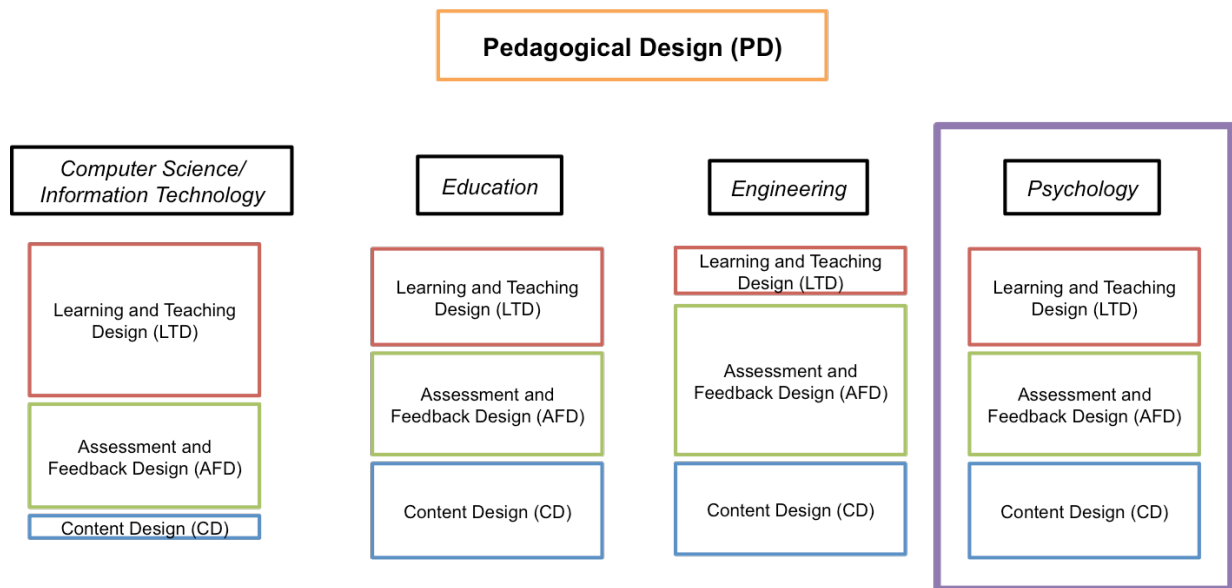


Figure 47: Interaction between three main pillars within the Pedagogical Design context (Psychology discipline)



## **CHAPTER SIX**

### **SUMMARY, IMPLICATIONS AND RECOMMENDATIONS**

This chapter provides the summary, implications and recommendations of this research. *Section 6.1* to *Section 6.2* reviewed the main findings of the research in accordance to the research questions. *Section 6.3* on the other hand, presented the significance of the findings, while *Section 6.4* stated the limitations of the research. Continuing with *Section 6.5* is on the implications for the relevant stakeholders such as policy makers, educational technological tools or systems designers and the receiving end user, the students.

#### **6.1 Summary of main findings**

The objective of this research is to ultimately develop a versatile framework that encompasses integral knowledge on integrating the educational technological tools to enhance the current AF practices among educators across disciplines in HEIs in Malaysia, through the following research questions:

**Research Question 1: How are the forms of educational technological tools being integrated into current assessment and feedback practices across disciplines in HEIs in Malaysia?**

**Research Question 2: What are the similarities and differences among educators across disciplines in the design of assessment and feedback practices in HEIs in Malaysia?**

**Research Question 3: How a proposed technology enhanced assessment and feedback framework (TEAF) would facilitates the usage of educational technological tools in enhancing the assessment and feedback practices in HEIs in Malaysia?**

The analysis and discussion phase of the research on the AF practices led to the following observations:

1. Assessment:

- Similar forms of formative assessment were being used across disciplines (e.g.: *Essay/Written/Annotated Reviews/Bibliographies* and *Project Work/Practical*).
- Final examination was typically used as the main form of summative assessment and often includes a large percentage from the overall marks needed to pass the course/unit.
- Incorporation of educational technologies was typically used to assist on submission of assignments and on assessing students' level of understanding on the course/unit.

2. Feedback:

- Similar inclination was observed across disciplines when it comes to providing feedback to students; in which *Written* and *Verbal* feedback were often used.
- Incorporation of educational technologies in the aspect of providing effective feedback to students is still in the infancy stage of planning.

3. The decision to incorporate educational technology to enhance AF is still undecided as educators are still in a stalemate when it comes to using educational technology due to various reasons – a framework would be beneficial in assisting the much needed transition.

4. Current AF practices in HEIs are still purely conventional and manual (Human essence), with very basic usage – mainly on uploading/downloading of learning materials; from the handful of educational technological tools adopted.

5. An essential part of learning and teaching methods / approaches / designs / contents from the educators' perspective focuses on the aspect of a more flexible educational technological tools which would enable educators to integrate appropriate tools that not only support their selected educational pedagogies and strategies, but as well as to enhanced their current AF practices.

## **6.2 Significance of the findings**

The significance of the findings presented in this research can be divided into two parts in which these parts are being categorized into (1) knowledge contribution and (2) practical contribution.

Under the knowledge contribution, the findings of this research provided a more in depth knowledge and information on how educators in the HEIs typically prefers to assess their students and how this evaluation will in turn guide students to have a better understanding on their progress and actions needed for better progression. As such, the findings provided some enlightenment in which as much as there are differences in the four selected disciplines, educators in these disciplines were also similar in many ways. These similarities could be an indication that addressing the gaps in AF practices may not be as daunting as it appears to be. Of course, given that the sample size in this research may not be enough to provide a generalizable outcome but this could be a starting point in looking deeper to the disciplinary differences as a key to understanding and addressing the gaps. Apart from that, the knowledge contribution of this research could also be seen in the way of how the provided research questions were addressed accordingly through a detailed and systematic manner, which could be replicated in a larger scale.

As for the practical contribution, through understanding the similarities and differences in the way educators in HEIs assess and provide feedback to their students; educational technological tools designer would be able to design a more sophisticated tool that would enable educators from across disciplines to incorporate it into their daily LT and AF process. With a thorough and holistic understanding of how educators assess and provide feedback to students would enable a more well-thought design science behind coming up with a more intricate user-interface that is more unified and integrated with the aspects and components that truly matters.

Echoing that, the formulated framework that derived from this research could also be beneficial in assisting educators to not only leverage from the existing educational technological tools available but also to yield the best outcome through a guided understanding offered by this framework in designing and producing new educational technological tools. Thus, this will in turn enable educators to maximize the potential of

these educational technological tools in accelerating their efficiency in class and collaborating with students on what truly matters – their learning process.

Apart from that, the findings from this research will also provide a practical contribution through enabling educators with a more suitable customization of the integration process in relation to enhancing the AF process through the incorporation of educational technological tools. This customization is crucial as the degree and context of integration may differ among HEIs in Malaysia depending on the area of focus emphasised by the respective HEIs educators. The versatility offers through the development of the TEAF framework will also provide educators from various disciplines to incorporate educational technological tools not just in the LT process but also to enhance the current AF practices. To take the practical contribution a step further, the application of this TEAF framework can be implemented at the institutional level that provides an overall guidance to the HEIs educators reflecting the institutions area of focus such as being a research, based university or a teaching based university.

### **6.3 Limitations and recommendations for future research**

As with every research, this research also consist it's own set of limitations as imposed by the nature of the chosen research design and data collection strategies used. Although there were various means taken in the effort of data collection, the sample size gathered in the semi-structured interview session and survey may still be considered small. As such, the findings that derived from this research may not be completely representative of all educators in HEIs. Hence, the findings may not be generalizable to educators from a different discipline range in the higher educational setting. Thus, this research while limited in size, was able to capture some crucial information on the current AF practices and provided some ground insights on the current level of educational technological tools usage in the two top HEIs in Malaysia across the chosen disciplines.

Apart from that, the limitation of this research also derived from how the data was collected from top two universities in Malaysia. Although efforts were taken to go deeper by collecting data from four different disciplines within the two selected universities, the findings gathered may not be sufficient to represent the current scenario in the HEIs in Malaysia. As such, replication of this research could be conducted in future and include more HEIs as part of the sample. Similarly, a wider range of different disciplines could be

included as well as an effort to reiterate the findings and allowing a greater representation of the population. In turn this would allow the TEAF framework to have a better generalizability level as to how effective this framework is in facilitating the usage of educational technological tools in enhancing the AF practices in HEIs in Malaysia.

This research also recommend future research to look into how educators' area of discipline and years of designing AF could have an effect on the level of knowledge in incorporating technology into LT. The reason being is that though the findings in this research indicated there could be differences in terms of area of discipline and years in designing AF, replicating this research in a larger scale and subsequently enabling the generalizability of the findings and further validate the findings as well. Recommendations made in this study can also be applied to other areas such as the other educational sectors: pre-school, primary and secondary education. The reason being is that learning is the ultimate lifelong process and hence it will only make sense to also look into the different stages and how relevant stakeholders could make the overall LT and AF process in a more seamless manner.

#### **6.4 Implications for relevant stakeholders**

The implications gathered from this research can be viewed from a few perspectives and can be applied to several relevant stakeholders such as the current market demand; the policies makers in both the higher education sector and general education sector; educational technological tools designers and finally educators.

Firstly, the findings from the research although may be localized to a certain extend, nonetheless, offered a new perspective in understanding the current AF practices in HEIs and the impact of this may be sufficient to serve as a wake-up-call for the relevant stakeholders (e.g.: educational policies makers; top managements of both public and private HEIs; educators). On top of that, the distress call being put out by employers indicates that current readily available educational technological tools may not be tailored-made to what is needed by the market in their demands of producing up-to-par levelled type of graduates.

Hence, relevant stakeholders including those who are responsible in designing the various educational technology tools available in today's app store, play store and on the web –

are now urge to plan and make the necessary changes in addressing the gaps specified in this research. This also comprises the need to place more emphasis on what goes on when it comes to the LT philosophies being aligned in the AF practices, as well as the decision on which educational technology tools to be incorporated. Hence, this research strongly suggests that the rationale behind the design science of the development of new educational technological tools need place emphasis on understanding the actual execution and implementation of these tools for HEIs educators across disciplines through humanizing the educational technological tools. This is achievable when both the designers and educators collaborate in producing versatile tools comprises of the TEAF framework as the basis in developing these tools. In the long run, TEAF framework works as an adhesive bond that piece together the main constructs (refer to Figure 38) of the educational process and various pedagogical designs with the elements of technology.

Upon validating the TEAF framework, the implications of this research may provide a direct impact to students' learning process. The impact of this derives from the buy-in of the relevant ministries and policy makers, as they will be more aware of the rationale behind each recommendations and strategies proposed. In order to materialize the much-desired change, HEIs will then proceed with a top-down change management approach which will subsequently encourage educators to take the leap of faith to finally execute the recommendations and thus, benefiting both educators and students through this seed of change plated beforehand.

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## Appendix A: Ethics clearance



### Monash University Human Research Ethics Committee

#### Approval Certificate

This is to certify that the project below was considered by the Monash University Human Research Ethics Committee. The Committee was satisfied that the proposal meets the requirements of the *National Statement on Ethical Conduct in Human Research* and has granted approval.

**Project Number:** 1198

**Project Title:** Beyond the Foginess: Technology Enhanced Assessment and Feedback

**Chief Investigator:** Dr Rajendran Parthiban

**Expiry Date:** 28/11/2021

**Terms of approval - failure to comply with the terms below is in breach of your approval and the *Australian Code for the Responsible Conduct of Research*.**

1. The Chief Investigator is responsible for ensuring that permission letters are obtained, if relevant, before any data collection can occur at the specified organisation.
2. Approval is only valid whilst you hold a position at Monash University.
3. It is responsibility of the Chief Investigator to ensure that all investigators are aware of the terms of approval and to ensure the project is conducted as approved by MUHREC.
4. You should notify MUHREC immediately of any serious or unexpected adverse effects on participants or unforeseen events affecting the ethical acceptability of the project.
5. The Explanatory Statement must be on Monash letterhead and the Monash University complaints clause must include your project number.
6. Amendments to approved projects including changes to personnel must not commence without written approval from MUHREC.
7. Annual Report - continued approval of this project is dependent on the submission of an Annual Report.
8. Final Report - should be provided at the conclusion of the project. MUHREC should be notified if the project is discontinued before the expected completion date.
9. Monitoring - project may be subject to an audit or any other form of monitoring by MUHREC at any time.
10. Retention and storage of data - The Chief Investigator is responsible for the storage and retention of the original data pertaining to the project for a minimum period of five years.

Thank you for your assistance.

Professor Nip Thomson

Chair, MUHREC

CC: Alena Tan, Dr Esyin Chew, Professor David Mellor

## Appendix B: Approval of conduct – survey



Ref. No: CRM- 2123

6 December 2016

Alena Tan Yoke Teng  
School of Information Technology  
Monash University Malaysia

Dear Ms Alena

**Application to Conduct Research at Monash University Malaysia**

**Project Title: Beyond the Foginess: Technology Enhanced Assessment and Feedback**

I refer to your application for conducting a survey at Monash University Malaysia dated 29 November 2016 and I am pleased to inform you that your application has been approved.

I wish you all the best in your project.

Yours sincerely,

A handwritten signature in black ink, appearing to read "Shah", with a horizontal line underneath.

**PROFESSOR MAHENDHIRAN NAIR**  
Deputy President (Strategy)  
Monash University Malaysia

Jalan Lagoon Selatan, 47500 Bandar Skyway  
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Operating Company: Monash University Malaysia Sdn Bhd (Co. No. 458601-U)



## Appendix C: Explanatory statement



### EXPLANATORY STATEMENT

(Interview and Focus Group Interview Participants)

**Project Title:** Beyond the Foginess: Technology Enhanced Assessment and Feedback

**Project Number:** 1198

**Dr Rajendran Parthiban**  
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School of Engineering &  
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alena.tan@monash.edu

You are invited to take part in this study. Please read this Explanatory Statement in full before deciding whether or not to participate in this research. If you would like further information regarding any aspect of this project, you are encouraged to contact the researchers via the phone numbers or email addresses listed above.

#### What does the research involve?

The research objectives are as follows:

1. To investigate the current assessment and feedback practices across disciplines in institutions of higher learning in Malaysia;
  - a. To understand and analyse the current assessment and feedback practice in terms of its adoption of learning technologies.
  - b. To understand and analyse the learning technologies adopted and the way it is being integrated into the existing assessment and feedback by educators across disciplines.
2. To understand and analyse the similarity and differences among educators across disciplines in the design of assessment and feedback process with(out) incorporating technology in institutions of higher learning in Malaysia;
  - a. To investigate Malaysia educators' perception on the effect of current adoption of educational technology tools in enhancing the assessment and feedback process in institutions of higher learning in Malaysia.
3. To propose and model a framework that facilitates the usage of educational technologies for assessment and feedback in institutions of higher learning in Malaysia.

An investigator who has no conflict of interest will interview educator participants and the interview session will last about 20 minutes. On the other hand, student participants will be interviewed in a group by an investigator who is not their lecturer and the interview session will last about 15-20 minutes as well.

#### Why were you chosen for this research?

You were chosen for this research because you have indicated that you are willing to be interviewed either (1) in an online survey conducted prior to this invitation or through the announcements made in your classes; or (2)

## Appendix C: Explanatory statement (continuation)

being carefully selected and invited from the pool of experts in educational design. Your contact details were provided in the online survey or the email invitation.

### **Consenting to participate in the project and withdrawing from the research**

The consent process involves signing the consent form and returning the consent form. You are under no obligation to take part in this research – it is a voluntary and anonymous for the online questionnaire. Completion of the survey will be taken as consent that you are willing to take part in this research. As the survey is anonymous, it will not be possible to withdraw data once you have submitted the survey.

You also have the right to withdraw from participation at any stage of the interview, along with any implications of withdrawal and the possibility to withdraw recorded data once you have been interviewed for the audio recording interview is available. Participants can withdraw from the research at any point of time before the end of the interview session. Not participating in this research will not disadvantage you in any way.

### **Possible benefits and risks to participants**

Your responses will help in enhancing the educational reform and Malaysia higher education. You might feel slightly uncomfortable during the interview or when recording takes place especially if you are not used to being audio-recorded.

### **Payment**

You will be given a RM20 gift card as an appreciation for your time and input to the project.

### **Confidentiality**

The level of confidentiality or anonymity will depend on participant's preference as indicated in the consent form.

### **Storage of data**

The voice recordings will be stored on one external hard drive stored away carefully and on a password-protected desktop at the PhD researcher's workstation. Only the listed researchers above will have access to the information. The data will be digitally deleted when it is no longer required.

### **Use of data for other purposes**

The research data may be published in an educational journal/conference paper/project reports/presentations/posters or for an education award application dossier. Only aggregate de-identified data may be used for other projects where ethics approval has been granted.

### **Results**

A copy of any published journal/conference paper will be made available to participants via email or link to a publication, once the research is published upon request from the participants.

### **Complaints**

Should you have any concerns or complaints about the conduct of the project, you are welcome to contact the Executive Officer, Monash University Human Research Ethics (MUHREC):

## Appendix C: Explanatory statement (continuation)

Executive Officer  
Monash University Human Research Ethics Committee (MUHREC)  
Campus Research Management  
Monash University Malaysia  
Jalan Lagoon Selatan  
47500 Bandar Sunway  
Selangor Darul Ehsan  
Malaysia

Tel: +6(03) 5514 6000    Email: [researchoffice@monash.edu](mailto:researchoffice@monash.edu)    Fax: +6(03) 5514 6001

Thank you,

Dr Rajendran Parthiban & Alena Tan

### Section A: Interview questions

1. What types of assessment do you use to assess your students' performance?
  - Do you incorporate technology-enhanced assessment?
  - What led you to develop these assessment activities?
2. How has the way you design assessments changed or developed over the years?
  - If you have integrated educational technologies into your educational pedagogy, has your teaching changed? How?
3. Do you provide feedback to your students? If yes, how often? If no, why?
  - Do you think feedback is a crucial aspect of assessing students' understanding and to assist students in their learning?
  - Do students express satisfaction with feedback provided in your subject when they provide feedback related to their learning experience?
4. How do you ensure that the intended learning outcomes have been achieved?

Appendix E: Survey questions

2. Section A: Demographics information

Please respond to **ALL** of the statements below.

\* Gender:

☐ Female

☐ Male

\* University:

☐

☐

☐ Other (please specify)

\* Age group:

☐ 21-30

☐ 31-40

☐ 41-50

☐ 51-60

\* Discipline / Faculty / School / Department:

☐ Information Technology

☐ Education

☐ Engineering

☐ Psychology

☐ Other (please specify)

## Appendix E: Survey questions (continuation)

\* Role(s) in education:

- ☐ Academic / Educator
- ☐ Admin staff in Learning and Teaching related centre
- ☐ Other (please specify)

\* Year(s) of teaching:

- ☐ No experience
- ☐ Less than 2
- ☐ Between 2 and 5
- ☐ Between 6 and 10
- ☐ More than 10

\* Year(s) of involvement in designing of the assessment and feedback process:

- ☐ No experience
- ☐ Less than 2
- ☐ Between 2 and 5
- ☐ Between 6 and 10
- ☐ More than 10

\* Would you be interested to participate in an interview session to provide descriptions on the level of usage and adoption of learning technologies in your teaching units, especially in the aspect of assessment and feedback?

- ☐ No
- ☐ Yes (please provide your contact details below, either an email address or phone number):






## Appendix E: Survey questions (continuation)

### 3. Section B: Technological, Pedagogical, and Content Knowledge (TPACK) Survey






Please answer **ALL** of the statements.

Kindly choose one response that best describe your opinion, using the following rating scale: 1 = strongly disagree; 2 = disagree; 3 = neutral; 4 = agree; and 5 = strongly agree.






\* I have the skills to use technology.

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
				





\* I can learn technology easily.

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
				





\* I am able to use conferencing software (Yahoo, IM, MSN Messenger, ICQ, Skype etc.) for collaboration purposes.

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
				






\* I am able to teach my students to use web 2.0 tools (e.g. Blogs, Wiki, Facebook, Podcasting).

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
				





















\* I am able to use a learning management system (Blackboard, IVLE, WebCT, Moodle etc) to support teaching.

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
				

\* I know how to assess student performance in a classroom.

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
				

## Appendix E: Survey questions (continuation)

* I can assess student learning in multiple ways.				
Strongly disagree	Disagree	Neutral	Agree	Strongly agree
				
* I can use a wide range of teaching approaches in a classroom setting (collaborative learning, direct instruction, inquiry learning, problem/project based learning etc.).				
Strongly disagree	Disagree	Neutral	Agree	Strongly agree
				
* I am able to adjust my teaching methodology based on student performance/feedback.				
Strongly disagree	Disagree	Neutral	Agree	Strongly agree
				
* I have various ways and strategies of developing my understanding of my teaching subject.				
Strongly disagree	Disagree	Neutral	Agree	Strongly agree
				
-- C'mon! Let's carry on! --				



## Appendix E: Survey questions (continuation)

4. Section B: Technological, Pedagogical, and Content Knowledge (TPACK) Survey				
<p>Please answer <b>ALL</b> of the statements.</p> <p>Kindly choose one response that best describe your opinion, using the following rating scale: 1 = strongly disagree; 2 = disagree; 3 = neutral; 4 = agree; and 5 = strongly agree.</p>				
* I can think about the subject matter like an expert who specializes in my teaching subject.				
Strongly disagree	Disagree	Neutral	Agree	Strongly agree
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
* I have sufficient knowledge about my teaching subject.				
Strongly disagree	Disagree	Neutral	Agree	Strongly agree
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
* I can use appropriate technologies (e.g. multimedia resources, simulation) to represent the content of my teaching subject.				
Strongly disagree	Disagree	Neutral	Agree	Strongly agree
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
* I use technologies to help achieve learning outcomes easily in my teaching subject.				
Strongly disagree	Disagree	Neutral	Agree	Strongly agree
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
* I know how to select effective teaching approaches to guide student thinking and learning in my teaching subject.				
Strongly disagree	Disagree	Neutral	Agree	Strongly agree
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
* My teacher education or similar program has helped me to think more deeply about how technology could influence the teaching approaches I use in my classroom.				
Strongly disagree	Disagree	Neutral	Agree	Strongly agree
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Appendix E: Survey questions (continuation)

\* I am thinking critically about how to use technology in my classroom.

Strongly disagree

Disagree

Neutral

Agree

Strongly agree

\* I can adapt the use of technologies that I am learning about to different teaching activities.

Strongly disagree

Disagree

Neutral

Agree

Strongly agree

\* I can teach lessons that appropriately combine my teaching subject, technologies and teaching approaches.

Strongly disagree

Disagree

Neutral

Agree

Strongly agree

\* I can select technologies to use in my classroom that enhance what I teach, how I teach and what students learn.

Strongly disagree

Disagree

Neutral































Agree

Strongly agree

-- We've got this! Left! Right! Left! Right! Let's keep marching on! --

155

## Appendix E: Survey questions (continuation)

5. Section B: Technological, Pedagogical, and Content Knowledge (TPACK) Survey				
<p>Please answer <b>ALL</b> of the statements.</p> <p>Kindly choose one response that best describe your opinion, using the following rating scale: 1 = strongly disagree; 2 = disagree; 3 = neutral; 4 = agree; and 5 = strongly agree.</p>				
<p>* I can use strategies that combine content, technologies and teaching approaches that I learned about in a training course or program in my classroom.</p>				
Strongly disagree	Disagree	Neutral	Agree	Strongly agree
				
<p>* I can provide leadership in helping others to coordinate the use of content, technologies and teaching approaches at my university.</p>				
Strongly disagree	Disagree	Neutral	Agree	Strongly agree
				
<p>* I am able to use online student assessment to modify instruction.</p>				
Strongly disagree	Disagree	Neutral	Agree	Strongly agree
				
<p>* I know how to guide my students to learn independently.</p>				
Strongly disagree	Disagree	Neutral	Agree	Strongly agree
				
<p>* I stretch my students' thinking by creating challenging tasks for them.</p>				
Strongly disagree	Disagree	Neutral	Agree	Strongly agree
				
<p>* I am able to plan group activities for my students.</p>				
Strongly disagree	Disagree	Neutral	Agree	Strongly agree
				

Appendix E: Survey questions (continuation)

\* I am able to identify appropriate topics for group activities.


Strongly disagree


Disagree


Neutral


Agree


Strongly agree











\* I encourage my students to search for resources independently.


Strongly disagree


Disagree


Neutral


Agree


Strongly agree











\* I can develop evaluation tests and surveys in my teaching subject.


Strongly disagree


Disagree


Neutral


Agree


Strongly agree











\* I teach my students to monitor their own learning.


Strongly disagree


Disagree


Neutral


Agree


Strongly agree











-- Hang on, we're almost there! --

## Appendix E: Survey questions (continuation)

6. Section B: Technological, Pedagogical, and Content Knowledge (TPACK) Survey				
Please answer <u>ALL</u> of the statements.				
Kindly choose one response that best describe your opinion, using the following rating scale: 1 = strongly disagree; 2 = disagree; 3 = neutral; 4 = agree; and 5 = strongly agree.				
* I encourage my students to make use of available resources for their own learning.				
Strongly disagree	Disagree	Neutral	Agree	Strongly agree
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
* Different learning theories and approaches underpin my teaching and assessment (e.g., Constructivist Learning, Multiple Intelligence Theory, Project/Problem Based Teaching).				
Strongly disagree	Disagree	Neutral	Agree	Strongly agree
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
* I can develop appropriate assessment tools using technology.				
Strongly disagree	Disagree	Neutral	Agree	Strongly agree
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
* I can create materials that map to specific learning outcomes.				
Strongly disagree	Disagree	Neutral	Agree	Strongly agree
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
* I help my students to reflect on their learning strategies.				
Strongly disagree	Disagree	Neutral	Agree	Strongly agree
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
* I can conduct a needs analysis for technologies to be used in the learning and teaching process to increase the quality of teaching.				
Strongly disagree	Disagree	Neutral	Agree	Strongly agree
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Appendix E: Survey questions (continuation)

Strongly disagree

Disagree

Neutral

Agree

Strongly agree

☆

☆

☆

☆

☆

Strongly disagree

Disagree

Neutral

Agree

Strongly agree

☆

☆

☆

☆

☆

Strongly disagree

Disagree

Neutral

Agree

Strongly agree

☆

☆

☆

☆

☆

Strongly disagree

Disagree

Neutral

Agree

Strongly agree

☆

☆

☆

☆

☆

-- Can you see the light at the end of the tunnel? :) --

## Appendix E: Survey questions (continuation)

### 7. Section B: Technological, Pedagogical, and Content Knowledge (TPACK) Survey




Please answer **ALL** of the statements.

Kindly choose one response that best describe your opinion, using the following rating scale: 1 = strongly disagree; 2 = disagree; 3 = neutral; 4 = agree; and 5 = strongly agree.

- \* I know how to use different evaluation methods and techniques.

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
				

- \* I can assess whether students have the appropriate content knowledge by using technology.

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
				

-- Well done and bravo! --

THE END

Thank you for your participation!

## Appendix F: Thematic map

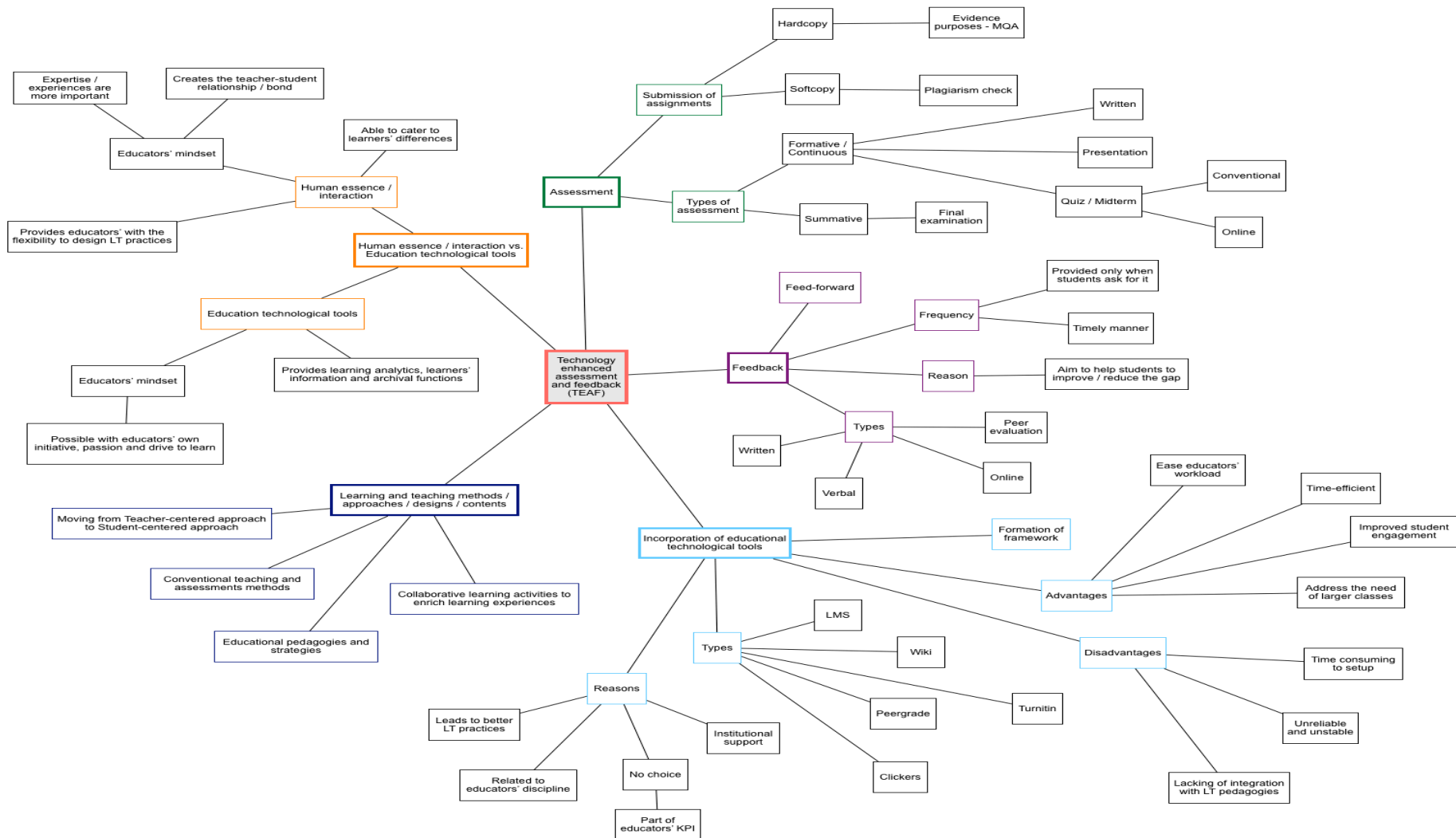


Figure 10: Thematic map



## Appendix G: Forms of formative assessment used

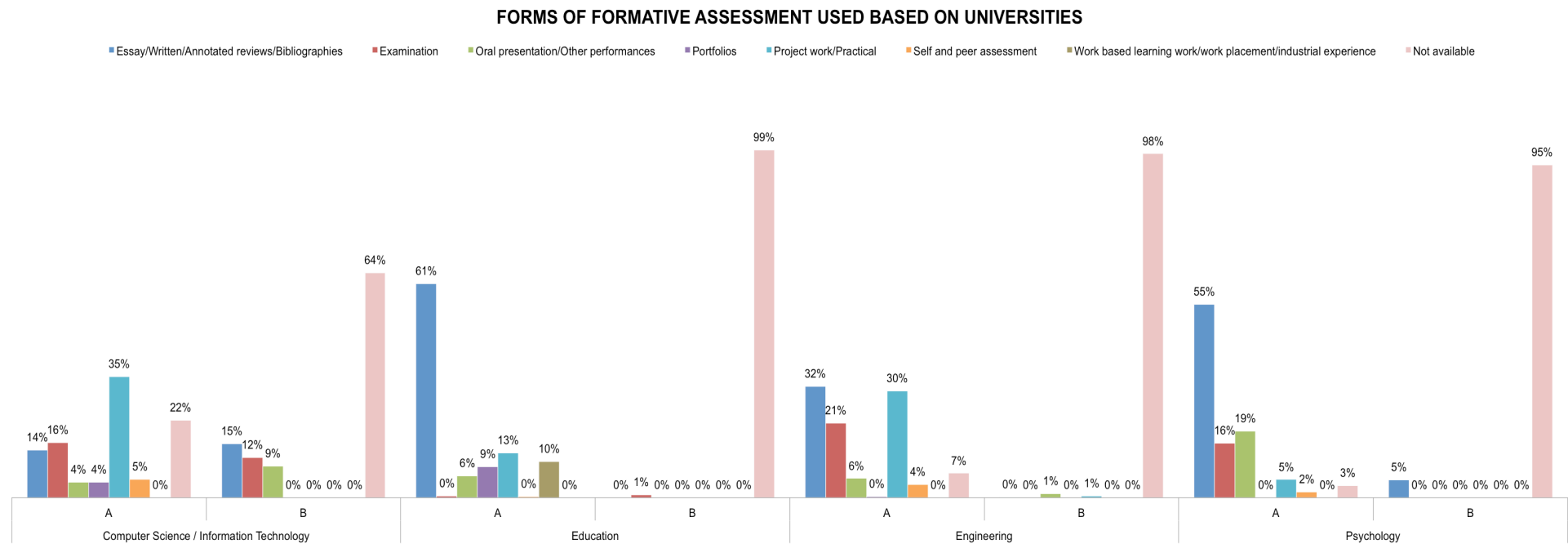


Figure 24: Forms of formative assessment used across disciplines and universities

## Appendix H: Types of educational technological tools used in formative assessment

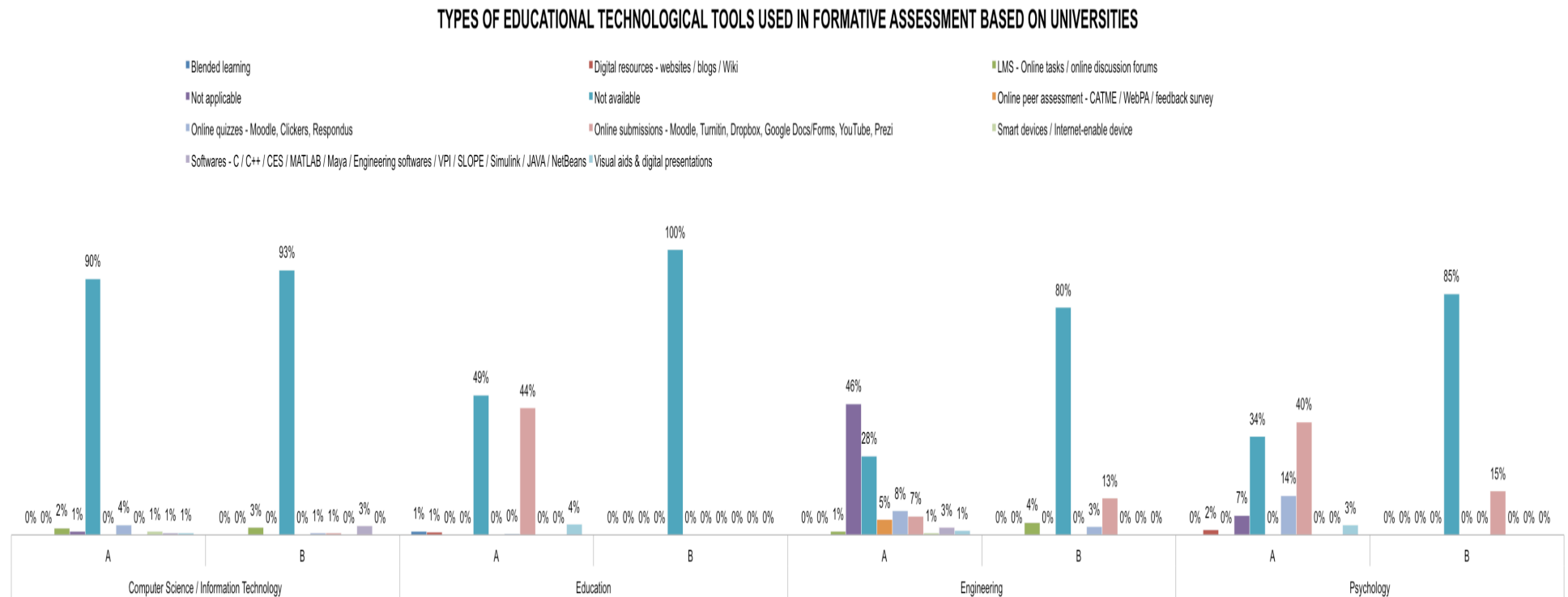


Figure 28: Types of educational technological tools used in formative assessment across disciplines and universities

## Appendix I: Details on forms of summative assessment used

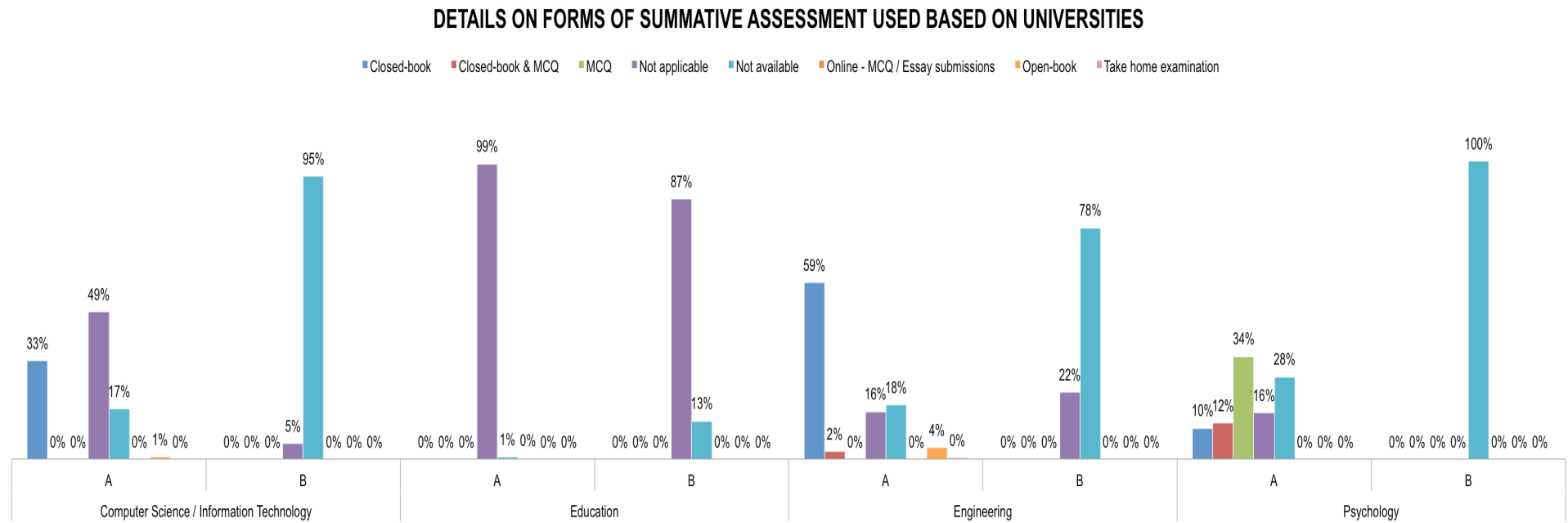


Figure 29: Details on forms of summative assessment used across disciplines and universities

## Appendix J: Forms of feedback provided

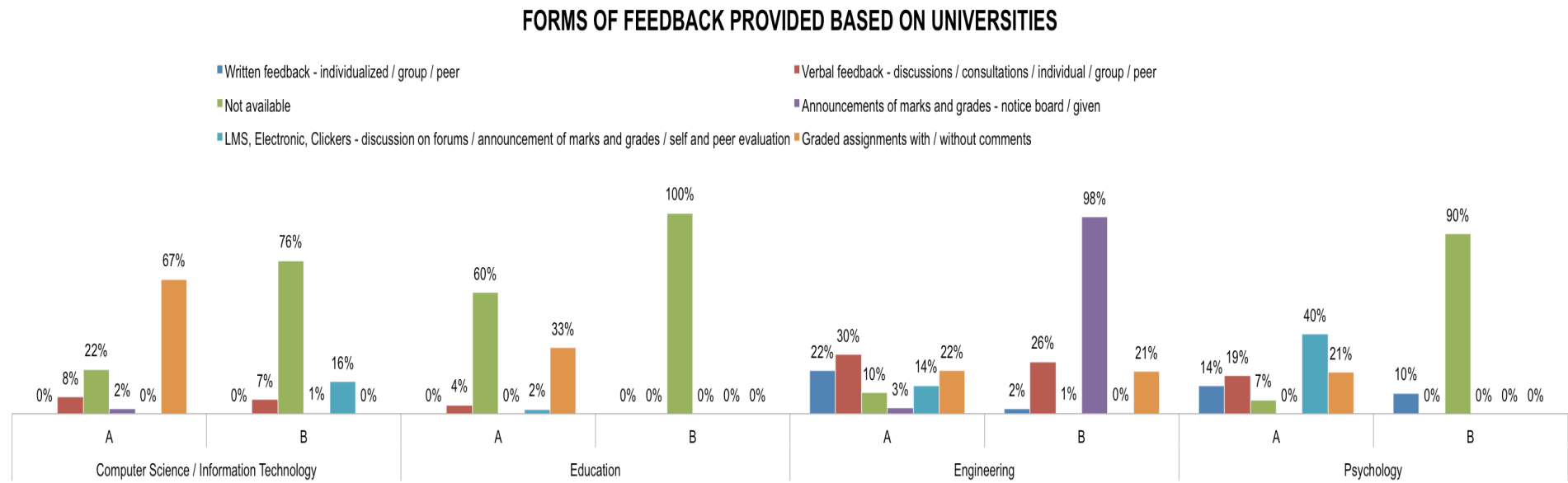


Figure 30: Forms of feedback provided across disciplines and universities

## Appendix K: Themes identified

Table 18a: Themes identified in the semi-structured interview sessions

Themes identified									
Interviewees	<i>Theme 1: Uses educational technology</i>	<i>Theme 2: Uses conventional teaching &amp; assessments method</i>	<i>Theme 3: Technology is important but the essence is human</i>	<i>Theme 4: Technology provide learning analytics, information &amp; archival</i>	<i>Theme 5: Existing technology are not integrated</i>	<i>Theme 6: Student- centered approach</i>	<i>Theme 7: Focused on collaborative &amp; learning activities to enrich experience</i>	<i>Theme 8: Educators' flexibility to design</i>	<i>Theme 9: Educators' passion &amp; drive to learn</i>
A1	✓		✓		✓	✓	✓	✓	
A2	✓		✓	✓			✓		✓
A3		✓	✓	✓	✓			✓	✓
A4	✓		✓	✓		✓	✓		✓
A5		✓	✓						
A6	✓			✓		✓	✓	✓	✓
B1		✓						✓	✓
B2	✓			✓		✓	✓	✓	✓
B3	✓	✓	✓	✓			✓		
B4	✓		✓	✓		✓	✓	✓	✓
B5		✓	✓			✓	✓	✓	
B6		✓			✓			✓	
B7		✓	✓		✓			✓	
B8	✓			✓	✓	✓	✓	✓	✓

## Appendix L: Themes identified (continuation)

Table 18b: Themes identified in the semi-structured interview sessions (continuation)

Themes identified							
Interviewees	<i>Theme 10: Educators' mindset (positive &amp; negative)</i>	<i>Theme 11: Learners' differences</i>	<i>Theme 12: Ease of educators' workload</i>	<i>Theme 13: More time &amp; effort needed to use technology, redundant functionalities, do not see the use/benefits of technology</i>	<i>Theme 14: Feedback to reduce the gap</i>	<i>Theme 15: Feedback should be timely &amp; feed-forward</i>	<i>Theme 16: Only provide feedback when students ask</i>
A1		✓	✓		✓	✓	
A2	✓	✓		✓			✓
A3				✓	✓	✓	✓
A4	✓		✓		✓	✓	
A5	✓				✓		✓
A6	✓	✓	✓		✓	✓	
B1	✓			✓	✓		✓
B2	✓	✓	✓		✓	✓	
B3			✓		✓		✓
B4	✓	✓	✓		✓	✓	
B5	✓			✓	✓	✓	✓
B6				✓	✓		✓
B7				✓	✓	✓	✓
B8	✓	✓	✓		✓	✓	✓