

**Professional experience, practice-led
teaching, and employability
for
IT degree programmes**

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by

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Abstract

The purpose of this doctoral study is to explore how IT practice-led teachers inform their professional experience on the educational experience of IT degree students, and the relationship which emerged from this investigation on graduates' employability. Mixed methods approach is adopted in this study, including semi-structured interviews with practice-led teachers, student surveys (course-level and programme-level) and class observations for disciplinary inquiry, whereas integrated research is used for exploring the topic of project management. Key emerging themes include practice-led teaching profiling and capital distinctions; co-curricular course design, experiential learning and networking; the organising principle between first principle's teaching approach and vocational training approach, positioning of educational authenticity and authentic work practices in acquiring applied and practical practices, classroom community of disciplinary inquiry on intellectual project works, and the integrated view on project management among different research instruments.

This study is specific to the context of IT degree programmes, and the research implications may be relevant to other contexts whose programme orientations are applied and practical in nature when the concept of knowledge structures for expertise development is considered. The educational value can be drawn to the possible concepts of educational authenticity and resemblances on the acquisition of professional practices in university environment.

Keywords

Absorptive capacity, Co-curricular design, Educational authenticity, Employability, Experiential learning, Graduate capital, Knowledge structure, Network capital, Practice-led teaching, Professional experience, The USEM model, Transferability

List of Abbreviations

AIW	: Authentic Intellectual Work
BCS	: British Computer Society
CEQ	: Course experience questionnaire
ELT	: Experiential learning theory
GDP	: Gross domestic product
GDPR	: The General Data Protection Regulation
HP	: The Hewlett-Packard Company
IBM	: International Business Machines Corporation
ICT	: Information and communications technologies
ILO	: International Labour Organisation
IEEE	: Institute of Electrical and Electronics Engineers
ISACA	: Information Systems Audit and Control Association
IS	: Information Systems
IT	: Information technology
OECD	: The Organisation for Economic Cooperation and Development
PMI	: Project Management Institute
PMP®	: Project Management Professional®
SEO	: Search engine optimisation
UNCTAD	: The United Nations Conference on Trade and Development
UNESCO	: The United Nations Educational, Scientific and Cultural Organisation
WIL	: Work-integrated Learning
WTO	: World Trade Organisation

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CHAPTER 1 INTRODUCTION

1.0 Introduction

In the ancient times, universities were often viewed as ivory towers with privileged status, where elite students were housed. The primary objective of academic research institutions historically was focused to generate new knowledge through the laboratories of academic and scientific research and to nurture the elite scientists. Therefore, there has been a clear divide between arts subjects and science subjects in the universities and they can have full autonomy in deciding how to educate their students and so do the academic programmes. When the economies of developed countries have started to boom in the late 70s, the role of higher education becomes a pivotal topic for policymakers who are looking for the active role of universities contributing to the economic growth through the production of more graduates as productive workers. This phenomenon happens in many of the governments all over the world, and this trend has taken the lead to the present, the New Economy or knowledge economy, and is surely moving forward as socio-economic development. The European Union (EU) and the United States (US) are responsible for the setting out the top-level initiatives or frameworks related to the directions for educational policies, allowing the individual member states or nation's states to design on their state's educational policy. In the UK, the Dearing Report (1997) envisions the learning society, and the Browne Report (2010) makes the recommendations on higher education funding and student finance. In Asia, English language is the teaching medium in the universities of Singapore and Hong Kong, making these two metropolitans always competing. In Hong Kong, according to the Education Bureau, the post-secondary education in the government's policy is to provide multiple and flexible articulation pathways for the young people, and currently, there are about 50% of the relevant age cohort having access to degree education; and the overall direction is to further develop Hong Kong as a regional education hub (EDB, 2022) whereas this direction has been initiated since 2007 (Mok and Cheung, 2011). The University Grants Committee of Hong Kong plays the key role in planning and monitoring of all the universities as it is the main government funding body, being viewed as the executive arm of the government in higher education, whose agenda of quality assurance in the form of a territory-wide "management audit", making the fashionable notion of "market sensitive" among the university administrators (Mok, 2000, 161). The growing trends of knowledge-based economy, in the UK, the US and in Asia, indicate the increasing demand in labour markets and the rising competitions in international markets; and these market forces strongly push the higher education institutions to produce more productive young people in supporting for better economic performance in the societies. For the universities, one of the key missions is to nurture the graduates to become smart and knowledgeable, hopefully can be true experts in their respective discipline, one way or the other, and be successful in the field and in the society, making their career aspirations as part of the life-enhancing journey.

1.1 Background to the study

The idea of this doctoral research is originated from my intention to find some ways in helping the fresh IT graduates to have a good career start from a graduate job, while the main theme of the study is triggered by one encounter in my first graduate job and one in my further study. After completed the first degree in the UK, I got my first graduate job which was a product marketing role in a local IT company whereas I was impressed by the hiring manager who interviewed me and then immediately made me a better offer than what was expected in my job application. After years, I still could recall what he said, “I want to let you work happily in the company”. Looking back, it was probably because I was the right candidate in the job and the hiring manager wanted to keep me staying in the company. Yes, I liked my graduate job because I worked smoothly, no problems in getting things done. The manager always assigned me the tasks with clear expectations, sometimes with some sample documents like product promotion plan for my reference. As a fresh graduate, it was extremely supportive and made my work very handy when I was starting to join the industry practices, the marketing “community of practice” in IT field where my manager was the “old timer” who taught me as a “newcomer” on how to perform the job properly and effectively (Lave and Wenger, 1991). About six months later, I was told to attend a meeting with one global vendor to learn the way on how to get resources support from the supplier, but it happened I joined the discussion. After the meeting, my manager was impressed by my ability in grasping the insights as a product officer in competitive product positioning and sharing my thoughts in the meeting. It was probably due to the benefit of ‘short distance’ support from my supportive senior peers and my level of potential development was ‘in collaboration with more capable peers’ (Vygotsky, 1978). Shortly after that meeting, my manager announced to reform the product marketing team, from the job role as owner of product brands (e.g., Apple, HP, IBM, Microsoft) to owner of product categories (e.g., laptops, desktops, servers) across different brands. Revisiting that experience for now, my manager was smart for leveraging the best knowledge and skills of the staff, limiting the staff headcounts for cost savings because product category owners need to possess higher-level skills, like analytical skills and market sensitivity. The other experience was in the master’s degree course of project management that the instructor arranged a guest lecture conducted by the senior executive from a global bank. The industry speaker shared with us the launching the large-scale IT projects in the bank, such as the roll-out of online banking system as one of a few globally at that time. In his sharing, he did not introduce the top-notch technologies adopted in the bank but rather emphasised the different kinds of considerations that his team needed to be taken, like the consensus with business users who were the sponsors in the project budget and the actual users of the systems. To me, that was an insightful lecture to have changed my perceptions about the roles of IT staff in a company, and that have motivated me to take on a new and challenging job as solution consultant at a later stage, improving the malleability of my self-efficacies (Dweck, 1999).

The above two encounters were my invaluable experiences. When I started to think about my research thesis, I revisited my positive experiences to learn that the industry experience of the manager can help a newcomer to pick up the job so effectively, and that of the guest speaker can give insights to the students, even making job change within the field. Why the guest lecture could attract me and promote my higher level of thinking and self-reflections because the context of sharing was contextually relevant and meaningful to me. Therefore, I show great interest to explore how the professional experience of some practice-led teachers to better support the students' learning. Besides, the market conditions are always changing, and the IT industry is kept advancing; remaining competitiveness, the university graduates do want to be employable always in changing jobs. Hence, it is reasonably to have the research topic of professional experience linking to the notion of employability, that is the current debate topic as supported by my academic supervisor. My previous working experience in the IT industry, and the familiarity in identifying some relevant research participants in the universities, I would like to explore how the teachers with professional experience can influence the learning of their taught students, in what ways and to what extent the IT degree students can be benefited from their practice-led teaching in terms of graduate job and career development, that is, the graduate employability.

Thesis chapters are organised into five chapters. Chapter 1 introduces the background, and the research aims of the research study, along with a review of the relevant literature in Chapter 2. Chapter 3 provides the rationale for the methodology and research methods adopted in the study while Chapter 4 details the data collected and the analysis of the findings. Chapter 5 discusses the findings in correspondence to the literatures review and Chapter 6 is the final chapter to conclude the study with some implications for future research work.

1.2 Degree programmes related to information technology

The outlook of information technology (IT) industry is continuously to be robust. Driven by the advanced technological innovations in this digital era, the global economy is enjoying the unprecedented economic growth as well as facing the unforeseeable challenges. The digital economy, conceptually, "comprises goods and services that either were produced using digital technologies or include these technologies" (Henry-Nickie et al., 2019, 3). Digital technologies are largely becoming the dominant role in affecting the factors of economic growth, national security, and international competitiveness while the information and communications technology (ICT) industry underpins the economic performance and contributes job creation in the digital economy. ICT assets are generally consisted of computer hardware, software, and internet communications, and broadband

infrastructure. Based on the economic study on OECD countries (Spiezia, 2012), it is found that “increased GDP growth and country-specific global competitiveness can be primarily attributed to growth rates in ICT investment (Henry-Nickie et al., 2019, 3). Responding to the structural change within the ICT sectors, there is a transformational shift from the manufacturing-focus to the service-focus, illustrating the corresponding move from hardware-centric to software-centric level of growth. The emergence of increasing focus on ICT service sector and ICT software-centric, it leads to the changes in the workforce demand and supply in IT industry. Overall, “the proliferation of digital technologies will continue to bring unprecedented structural changes to the U.S. economy, cementing the IT industry’s position as a leading source of growth and employment” (Henry-Nickie et al., 2019, 9). In a broader sense, most of the world nations have been speeding up the adoption of the emergent technologies such as cloud computing, artificial intelligence, machine learning and 5G technologies to promote ongoing growth in the region. The report recognises that the aggregation approach in analysing the current IT industry trends is not effective enough to provide a complete picture of all sub-sectors within the IT industry, which is comprised of the productions from a pool of sub-industries, primary and secondary IT sector (Trauth et. al., 2007), which are not operated in isolation.

IT discipline is considered as one of the core industries, enabling the business growth in the other industry sectors whose firms have their IT department, particularly in large firms, to support their business operations. It is commonly viewed that IT professionals can have wider job choices in the market because the secondary IT sectors (e.g., finance, retails, telecommunications, pharmaceutical and government sector) are huge market hiring for IT staff. For IT graduates working as in-house IT staff in the technology-enabled sectors, they need to apply what they learned in the universities in their jobs. The emergence of new technologies creates new business models, and new job creations in the IT field, for example, related to those recent and exciting technologies of artificial intelligence, blockchain, Internet of Things, cloud computing, robotic automation and 5G technologies. The latest new job role is ‘data scientists’, who are expected to possess a new set of skills to perform the work. In this study, the context is IT discipline and thus the study scope is focused on the degree programmes related to information technology. The names of the undergraduate degree programmes can be ranged from information technology, computer science, information systems, information engineering, IT security and so on. All these degree programmes are technical-oriented named as IT degree programmes in this study, whereas each degree programme can be designed by focusing on the specific stance of IT, such as, computer science is technology-driven study, information systems is relatively less technical and more consultancy-based study, and information engineering is oriented in communications on network infrastructure and architecture. However, these differences do not have impact in my study as the research focus is not to compare between programmes but rather, the contextual nature of IT knowledge and skills in different degree programmes can be aligned as IT work is teamwork, team members working together to develop the IT systems and solve the problems if arisen. Putting them under one umbrella of IT discipline

can be advantageous to create a holistic view of IT degree programmes because IT department or IT projects are made up of different types of IT jobs as a performing team.

1.3 Research aims and questions

The research aims of this study are to explore the value of IT professional experience in university teaching. The teaching staff, who possess long years of industry experience in the IT field, joining the teaching profession in universities, is the good research source for investigation and understanding. Professional experience is lived, intrinsic in nature and therefore, this research study is rather challenging as what Perkins (2006) described it as 'conceptual submarine' for the students. Through the study of some practice-led teachers in IT degree programmes, it is hoped that their professional experience can be reflected in their teaching methods and approaches. The study is conducted in the universities in Hong Kong which are regarded as international-oriented in higher education arena that 4 out of total eight universities are ranked top 50 in QS World University Rankings 2021. According to the United Nations' global statistical report for 153 countries, Hong Kong is ranked the 15th in the Readiness for Frontier Technologies Index and is on the 3rd, just after Singapore on the 5th and South Korea on the 7th in Asia (UNCTAD, 2021, 137). For the study on the practice-led teachers informing the professional experience on the IT degree students, both the curriculum design and their teaching pedagogy will be examined in relation to the graduates' employability.

The main research question is to explore the teaching pedagogy of the practice-led teachers in IT degree programmes and the sub-questions are:

- What is the profiling of the practice-led teaching in IT?
- How does the IT curriculum design support for the graduates' employability?
- In what ways, the practice-led teaching pedagogy can facilitate the acquisition of disciplinary knowledge and skills by IT degree students?

1.4 Current academic concepts, models, and theories

Below are the main academic concepts, models, and theories underpinning this study:

- Nature of knowledge and skills: knowledge structures, absorptive capacity
- Capital theories: human capital, social capital, network capital, employability capital, graduate capital
- Curriculum design: the USEM model of employability through curriculum, work-integrated learning (WIL)
- Authenticity: educational authenticity, authentic intellectual work (AIW)

- Experiential learning: experiential learning theory (ELT), networking
- Knowledge transferability: case-based, scenario-based, encapsulation

1.5 Research positioning

This research project is to study the practice-led teachers, who are all IT practitioners, and their students in IT degree programmes in Hong Kong. For me, I possess many years of working experience in the information technology field in a range of local and regional job roles related to different marketing positions and client management, mostly for IT vendors; and sometimes, providing support for the project teams, acting like deputy project manager to meet with the clients. Though I am not regarded as technical staff, my capability in understanding technologies is good enough and even exceeding the expectations as required in the job. Therefore, I am an insider, possessing strong market sensitivity of the IT industry. During the research interviews with the practice-led teachers, those interviews were mostly conducted as the open discussions as I would ask for more explanation based on some of their responses in the subject matters and their experience sharing. Basically, they knew that I could understand what they said, and thus they were very willing to share their thoughts and give me more examples as the illustrations. All the interviews turned up to take longer than the original schedule. Correspondingly, most of the questions in the semi-structured interviews were extended to cover some sub-topics when the practice-led teachers brought up the discussions relevant to the research sub-questions. Those topics supplementary to the initial questions allowed me to go deeper into the theme of the study, and to better understand their teaching pedagogy. To certain extent, some of the sub-topics were co-created by the interviewee and I, the researcher, during each of the research interviews. I would also like to indicate at the beginning that when conducting the data analysis, my understanding and interpretation are backed by my own experience in the industry. The declaration of researcher's position in the study is necessary to acknowledge the readers while allowing them to make judgement on the researcher's objectivity.

1.6 Significance of the Study

This study starts from the IT practitioner's approach to examine the practice-led teachers' pedagogical approaches in informing their professional experience on the educational experience of the IT degree students for the acquisition of disciplinary knowledge and skills. That can be concluded by applying some of the academic theories, and some of the analysis may offer the explanation to the work of Peeters et. al. (2019) in employability capital. IT discipline is applied and practical profession that demands for close integration between theories and applications through the professional practices. Hence, the centrality of IT students' learning is for technicality and practicality whereas 'IT academics is very dynamic'

because the field the students are studying is dynamic (George and Marett, 2019). The contextual barriers, however, create the teaching and learning gaps between university education and workplace practices, and that are acknowledged by the educators, the IT practitioners, and the employers. Knowledge transfer is the buzzword commonly used by all parties but IT knowledge and skills are seen as easily obsolete. In the study, the practice-led teachers are the subject to be studied; the capital distinctions denote their personal strengths and resources while the notions of educational authenticity articulate the values of the practice-led pedagogical approach in the learning process of the IT degree students in the university education. The capital dimension is highly relevant in this study as the role of capital conceptions is recognised as the factors for increasing the productivity gains whilst the authentic learning experience in the classroom or the lab is precisely meaningful for the students' educational learning experience in professional practices. More importantly, can facilitate the students to become reflective thinkers in the learning process in the trusted university environment where the students' malleability in self-efficacies is strengthened by allowing to make mistakes and corrections; these are the self-efficacy (E) and the metacognition (M) in the USEM model of employability (Knight and Yorke, 2002), which in turn, can interact with and influence the other two variables of understanding (U) and skills (S) in the model, supporting the IT graduates' employability. It is achieved by converting their industry experience and professional practices into case-based and scenario-based course teaching materials as applied practices or into the lab practices as practical practices; and also, through the dialogical communications as authentic experience for the students to do self-reflections.

In terms of academic relevance in the study, it is found that the conception of network capital (Huggins, 2010) and its relational dimension can be applied between universities and the industry through the experiential learning activities as 'bonding ties' (Tomlinson, 2017) in networking between industry speakers or company representatives and the university students; in which the calculative ties (Huggins et al., 2012) can be perceived to be 'soft ties' in forms of potential employment opportunities. In addition, that may contribute to the interpretations about the identification of social capital, not as separate dimensions but loaded on all dimensions of employability in the conceptual model of employability capital defined by Peeters et. al. (2019). Moreover, this study is consistent with the theory of educational authenticity proposed by Splitter (2009, 142), emphasising that the disciplinary inquiry in the classroom can allow the students to acquire authentic learning experience and to become reflective thinkers without the need to going via with the real world as well as "inquiry-based teaching is not context-free". However, this study comes up 'the alternative view' on the pre-condition of related prior knowledge, which is rejected by Splitter in the authentic intellectual work developed by Newsmann et al., (1995), by claiming the possible risks of pouring insert knowledge and subverting the constructive process of the student learning. In this study, the classroom disciplinary inquiry into the students' intellectual project work after class presentation is truly authentic learning experiences engaged by the students who can become the reflective thinkers. As it is learners-driven teaching, the project work contextually in IT disciplinary serves as the students' related prior knowledge,

the knowledge base, allowing dialogical conversations as disciplinary inquiry between teachers, student presenters, and fellow classmates that the constructive student learning is not subverted as the role of teachers is a listener and facilitator. In the field of IT disciplinary knowledge and skills, the orientation of the solutions proposed is for problem-solving, demanding the IT professionals to possess some related prior knowledge and that prior knowledge can be some IT theories or some practical experience, the concept of absorptive capacity (Cohen and Levinthal, 1990). The concept of knowledge structures between chains of practices and networks of understanding for expertise development can be served for explaining why educational authenticity for IT disciplinary learning requires the learners, the IT students, to possess some related prior knowledge. The same rationale can be applied for supporting the organising principle between academic teaching or first principle's approach and vocational training approach on course-level and programme-level. Learning for IT concepts and theories, Johnson's (1987) objectivist view for meaning is treated as disembodied and received by a human mind rather than shaped by it; whilst Sfard's (1994) constructivist view can be adopted in the learning for solving the IT problems as meaning is conferred through the understanding of the learner. Based on the above understanding derived from this study, the role of related prior knowledge can be retained as absorptive capacity, enabling the knowing capability of the learners possibly to produce some forms of intellectual capital (Nahapiet and Ghoshal, 1998), and the notion of educational authenticity can contribute to the learning of IT disciplinary knowledge and skills, minimising the above-mentioned issues described by the academic scholars of authenticity. Therefore, the intended contribution to knowledge is that the professional knowledge of IT practice-led teaching can become the authentic learning experience of the IT students; and this interpretation can be applied to other disciplines which are applied and practical in nature, having the similarities in the concept of knowledge structures for expertise development.

CHAPTER 2 LITERATURE REVIEW

2.0 Introduction

Globalisation is comprised of a set of economic, cultural, social, and political levels in shaping a globalised world. Due to the close interconnectedness between economic level and political level (Slaughter and Leslie, 1997), it imposes some changes in business sectors and the labour market. In the era of knowledge dominance, developed countries are transforming into “knowledge-based economy where innovative ideas and technical expertise hold the key to the new global competitive challenge” (Brown et al., 2008, 4). Human capital is viewed as “a factor of production” and “growth of human capital is both a condition and a consequence of economic growth” (Mincer, 1984, 195); and it is pivotal that “labour is, of value in itself, can be developed to retain and enhance its value” (Tymon and Stumpf, 2003, 13). As said by Altbach et. al. (2009, 154), in the knowledge-based economies of most countries, higher education is posited as a major engine of economic development; within the changing global contexts, “national and regional governments increasingly rely on universities to become an anchor in their national and regional innovation systems, which is critical for their survival as knowledge economies”. So, the role of higher education in the 21st century will be explored in this chapter.

Responding to the economic globalisation, the business sectors are looking for innovative ways to improve the business operations and e-commerce is seen as the most viable option supported by the Internet technologies. According to the United Nations’ global statistical report, it was estimated that “the global value of e-commerce sales (B2B and B2C) reached almost \$26.7 trillion in 2019”, representing about 30% of GDP, and B2B e-commerce sales were accounted to 82% of all e-commerce sales (UNCTAD, 2020, 4). With the emergence of new technologies, like frontier technologies, there are both opportunities and challenges arising in the labour market, including the creation of new job groups but some job losses in the low-skilled job categories. In higher education sector, how can the universities deal with the challenges in terms of ‘academic practice’ (Neary et. al., 2012) and meanwhile, better support the graduates’ employability upon graduation? It is the main theme in this research study. As for IT industry, the kinds of technologies have to be applied and deployed before making contributions to the businesses and societies and so do the economic growth. According to Patrick et al. (2008), work-integrated learning (WIL) is the curriculum design intended for integrating theory with workplace practices, facilitating the student learning of disciplinary knowledge and skills in a real-world context (Smith, 2012). Besides, situated cognition or situated learning can help to promote a model of instruction with implications for classroom practice (Brown et al., 1989), articulating the authentic learning for the students (Herrington and Oliver, 2000). So, the above will be explored to understand how teaching pedagogy can support for the learning of IT degree students and the conceptions of educational authenticity (Splitter, 2009), authentic intellectual work (AIW) (Newmann et

al., 1996, 2001) and competence-based authentic assessments (Gulikers et al., 2008) will also be discussed in detail. Regarding the graduate employability, the USEM model of employability through curriculum (Knight and Yorke, 2002) and the conceptual experiential learning (Kolb and Kolb, 2013) will be used for assessing the curriculum design while the notion of graduate capital (Tomlinson, 2017) will be leveraged for understanding the practical implications for teaching and learning. The last part will investigate the literatures on how knowledge can be retained and transferred; from which to understand whether the graduates can apply what they learned in university education into the workplace; if it is feasible, what are the implications in teaching and learning in the IT degree programmes.

2.1 The role of higher education in the 21st century

2.1.1 Globalisation, the new economy, and the global marketplace

Globalisation is regarded as a set of changes on economic, cultural, social, and political levels in shaping a globalised world (Waters, 1995; Stevenson and Tooms, 2010). Olssen et. al. (2004) characterise the uniqueness between different versions of globalisation: economic level refers to the formation of a 'world economy', cultural level as global cultural icons, like McDonald's, and political level to the establishment of powerful global political institutions, like World Trade Organisation (WTO). Each version of globalisation is known for the importance but structurally independent (Waters, 1995). According to Deem (2001, 7), globalisation is drawn largely on economic version because it is "the global spread of business and services as well as key economic, social and cultural practices to a world market, often through multi-national companies and the internet". Slaughter and Leslie (1997) point out that the interconnectedness between economic level and political level can impose changes on the business and labour markets, leading to the corresponding adjustments in higher education policies, enforced by politicians and policymakers. Stevenson and Tooms (2010, 9) further posit it as "an organising principle", allowing different versions of globalisation to cooperate and emphasising that "the integration of economic impulses and political ideas has become hugely powerful in a globalised world".

The concept of 'knowledge economy' (Cohen et al., 2000) or 'New Economy' is emerged in the studies of the new growth theories in the late 1990s (Pohjola, 2002; Godin, 2004) as there are new patterns of structural changes in the economies of different nations, such as free movements of capital flows and deregulated international trade and investment. Productivity gains are key indices for growth performances (Pohjola, 2002); according to Godin (2004, 687), the long historical studies have exposed "the difficulty of measuring productivity correctly" and there was "limitations of using research and development as an indicator of science and technology"; hence, it is the practice of classical economists to adopt the strategy to integrate productivity into the statistics to support for their policy-

oriented framework, making their study reports always convincing. Baily and Lawrence (2001) indicate that the driving force for IT innovation was originated from the demand for improved technologies within the service industries, but IT investments were unable to be identified as the primary factor in the productivity. Rather was the innovations in products, business practices and technology leading to the productivity gains (Farrell, 2003). When the new economy implies the 'superior economic structure', ICT industry can be viewed as the internal engine to facilitate the structural economic change in the economies (Pohjola, 2002). Once ICTs are adopted in all economic fields, accompanied by its rapid diffusion, it becomes the state of 'digitalised economy' (Bukht and Heeks, 2017).

The supremacy of economic globalisation denotes the formation of a superior economic structure in a world economy (Pohjola, 2002; Olssen et. al., 2004); for those capturing these global trends successfully, can eventually outperform its rivals (Pohjola, 2002). The convergence of technological advancements and telecommunications into a single system (Dickens, 1998) has created "a volatile, dynamic, global competitive knowledge-focused society" (Hagen, 2002) where the operation of the global marketplace is driven by the Internet, through the power of network computing. Hackbarth and Kettinger (2000) refer e-commerce as doing business transactions over the computer-mediated networks; and according to the global statistical report published by The United Nations, it was estimated that "the global value of e-commerce sales (B2B and B2C) reached almost \$26.7 trillion in 2019. This corresponded to about 30% of GDP and represented an increase of 4% from 2018 (\$25.6 trillion)". And the global B2B e-commerce sales (over online market platform and electronic data interchange) were 82% of all e-commerce (UNCTAD, 2020, 4). E-business is interpreted as the new business model (Higgin, 1999), fundamentally transforming a company into a digitally networked enterprise, heralding the new economy (Hackbarth and Kettinger, 2000, 78) where the success of e-business is relying on the readiness of the redesigned business processes, and the seamless connectivity to "the expanded enterprise through a universal digital medium to partners, suppliers, and customers", implying business process integration and cross-enterprise involvement with the external parties in the real world. Based on the United Nations' global report (UNCTAD, 2020, 6), there were about "1.48 billion people, or a little over one quarter of the world's population aged 15 and older, made purchases online in 2019. This is 7% higher than in 2018". There were "some 360 million online shoppers made cross-border purchases in 2019 - around one in four of all online shoppers". These global figures disclose the popularity of making purchases overseas by the online shoppers, increasing the need for e-business enterprises integrating with the extended enterprise in their e-infrastructure and business model.

The G20 leaders was first acknowledged the opportunity in digitalisation at the 2008 Washington Summit and then five years later, they brought up the discussion of 'digital economy' at the St Petersburg Summit 2013 at the first time as they discovered the gaps existed in the international taxation framework in handling the growth of online transactions (G20, 2020). Though Rouse (2016) offers the simplest description on digital

economy, an economy based on digital technologies, that can be articulated further to belonging the worldwide network of economic activities enabled by information and communication technologies (ICT). Per G20 leaders' insight, "the digital economy refers to a broad range of economic activities that include using digitized information and knowledge as the key factor of production, modern information networks as an important activity space, and the effective use of information and communication technology (ICT)" (G20, 2016, 1), driving for productivity growth and economic structural optimization. Niebel (2018, 205) launched the study to investigate the impact of ICT on economic growth in 59 countries and the findings proved that "ICT still contributes substantially to economic growth not only in developed but also in developing and emerging countries". However, the G20 members are struggling to keep up with the rapid pace of digital innovation, since many countries experience the growth of digitalisation at different paces (G20, 2020).

2.1.2 Human infrastructure, human capital, social capital, and network capital

Farrell (2003, 106) points out that "a key dynamic of the real new economy is the virtuous cycle of competition, innovation, and productivity growth". In the knowledge-intensive societal environments, the interconnectedness can energise the competitive conditions that the market players must look for new ways to innovate the business processes to improve the productivity across different sectors. Whilst in a globalised world, competitions can help to encourage the economic sector to place significant considerations in the readiness and sustainability of the talent pool, "the human infrastructure", the term originated from the work of Star and Ruhleder (1996) who conduct the study on technological infrastructure, identifying three out of eight characteristics, "embeddedness", "learned as a part of membership", and "linked with conventions for practice", embedded with social practices and institutions (Sambasivan and Smyth, 2010, 2). This indirect discovery of human side in infrastructure later becomes the new research area, particularly for some IT academic researchers on cyberinfrastructure, and the focus of human infrastructure is about the living of people, through a range of economic and social activities such as for work, education, and health care, in a civil society. Trauth et. al. (2007) claims that if the retention effort of the young and educated workforce is overlooked, it is possible that the human infrastructure may not be able to support the economic initiatives, though the physical IT infrastructure is ready in the region. Familoni (2006) offers a global view to confirm the pressing role of economic and social infrastructure as the superstructure of development and growth in the nations of both developed and still developing countries. Kumari and Sharma (2017, 30) apply this 'socio-economic view' on infrastructure in their case study on the economic development in India; and then claim that "economic infrastructure assists in production functions by lowering production cost and raising the productivity of labour and capital while social infrastructure helps to improve the efficiency and skills of manpower".

The concept of human capital refers to the labour, having value in itself, “can be developed to retain and enhance its value” (Tymon and Stumpf, 2003, 13) and the creation of human capital is achieved by making “changes in persons that brings about skills and capabilities that make them able to act in new ways” (Coleman, 1988, S100). In a knowledge economy, human capital, being ‘the educational attainment of the labour force’ (Benhabib and Spiegel, 1994), or ‘an accumulated stock of skills and talents in the educated and skilled workforce’ (Mathur, 1999) or ‘the competencies and capabilities of the workforce’ (Tymon and Stumpf, 2003), is positioned as the pre-requisite for economic growth in the region. Based on Benhabib and Spiegel’s (1994, 166) research findings derived by running the growth accounting regressions in aggregate cross-country data, human capital as a factor and its accumulation “fails to enter significantly in the determination of economic growth”, and even the opposite result is shown. Rather, when the growth of total factor productivity as a function of human capital is being suggested as an alternative model, the more positive results are found. “Human capital, although itself produced by human capital and labour, is a significant input in the production of knowledge ideas”; and also, “human beings with knowledge produce more knowledge” (Mathur, 1999, 205). Due to the non-rival and non-excludable nature of knowledge, the resulting spillover effects can “create a wedge between private rewards and social benefits” as there is less market incentive for firms to produce more inventions and innovations, leading to the output level of knowledge “below the social optimum” (Mathur, 1999, 214).

Social capital is a “social and individually held capital” (Huggins et. al., 2012, 207, 209), that can be articulated by the individual’s ability to “mobilise their network to enhance personal returns with place-bound environments” or “geographic space”. For Coleman (1988, S95), social capital is viewed as “a resource for action”, denoting social structure as rational action paradigm and having an influence on the development of human capital; like human capital, social capital can facilitate productive activity and “economic performance” (Nahapiet and Ghoshal, 1998, 243), which can be accomplished through the extensive trustworthiness and trust within a group. Sociologists see actors to act in “social context” where their actions are “shaped, constrained and redirected by the social context”; whereas economists see actors to act in their own self-interest for “maximising utility”. There are three forms of social capital, “obligations and expectations” within the social environment, “information channels” inside the social structure, and “social norms” accompanied by sanctions (Coleman, 1988, S119, S105); and when a person gives up the self-interest for the sake of the interests of the collectivity, “work[ing] for the public good”, this property of social norm can differentiate it from the other two forms. Regarding the mutual recognition within networks, Bourdieu (1986) identifies the “durable obligations” coming from one’s feelings of gratitude, respect, and friendship or from the institutionally guaranteed rights derived from membership in a family, a class, or a school. Additionally, social status or reputation is the significant form of social capital, derived from joining “membership in specific networks”, especially for those networks with “relatively restricted” membership (Bourdieu, 1986; Nahapiet and Ghoshal, 1998, 243). Other scholars following Coleman, however, argue that social capital is “an investment in social relations” made by individuals or actors to enhance

their expected returns through personal access to the embedded resources in the social environment (Lin, 2001, 17). Hence, social capital carries the perceived value inherited in the 'social structure' (Coleman, 1988) or 'interpersonal social networks' (Dasgupta, 2005), generated through socialisation and sociability as a form of community participations (Borgatti and Foster, 2003). Alternatively, social capital can be defined as "a resource for persons" (Coleman, 1988, S98) in the creation of localised trust, or "the stock of accumulated resources that one can access based on the relationship that can aid or be leveraged in accomplishing an end or furthering a pursuit" (Tymon and Stumpf, 2003, 12). Huggins (2010) acknowledges the resources embedded in relationships where the potential for information is inherited in social relations (Coleman, 1988); and agrees with Tymon and Stumpf's view on the important factor in one's ability to access by highlighting the value of resources accessibility in addition to its acquisition.

Huggins (2010, 348) proposes the notion of network capital where the perspectives of social capital and network resources are refined to be referred to "inter-firm networks"; and its conception conveys two characteristics, the structure and content of relationships (Adler and Kwon, 2002), following the 'structural-relational embeddedness' (Granovetter, 1992) introduced by Nahapiet and Ghoshal (1998) who state that the structural dimension is the pattern of connections like the size and spread of the network, and the relational dimension is the nature or strength of connections. The distinction between social capital and network capital is that the former is built by social networks focusing on the resource value created through "interactions between network actors based on a logic of sociability and social expectations" while the latter is formed through 'calculative' (Williamson, 1993) networks as means of capturing the resources contained "within inter-firm networks based on a logic of business and professional expectations" (Huggins, 2010, 348). Therefore, the formation of 'network ties' (Scott, 1991) in inter-organisational networks, or 'knowledge networks' (Nahapiet and Ghoshal, 1998; Maggioni and Uberti, 2009) can be served for enabling the access and exchange of knowledge underpinning firm-level innovation. The motivation behind the firms' investment in these network ties is the expected economic benefits (Hite and Hesterly, 2001) or economic returns (Huggins, 2010). Inter-organisational knowledge networks, through a complex set of interactions between internal and external actors, are crucial in the firm's innovation process where an individual or organisation can take more effective action (Drucker, 1989), as well as a key element underlying the "economic success and competitiveness of regions" (Huggins et. al., 2012). Huggins et. al. (2012, 223) carried out the research to analyse the knowledge-based sectors, with OECD's definition adopted, across three different regional settings on their investment in knowledge alliances, and the finding "confirms the role of strategically developed inter-organisational network forms as innovation catalysts". In addition, for those firms having more knowledge-rich environment, non-localised networks are viewed as more supportive during the innovation process (Garnsey and Heffernan, 2005), implying that more advanced local and regional economies are rather aggressive to establish their global knowledge networks to strengthen the knowledge base (Lorentzen, 2008).

2.1.3 The roles of universities as knowledge-based institutions in the 21st century

In the new economy, knowledge and innovative ideas are the critical components of economic advantage, with 'intellectual capital' (Stewart, 1997) being a pivotal resource and human capital being highly appreciated as drivers for economic development (Florida and Cohen, 1999), that are supported by social capital (Huggins, 2000) linking up the interactions and relations among individuals and firms developing the network capital (Huggins et. al., 2012) in global knowledge networks (Gertler and Levitte, 2005). With respect to the educational perspective, globalization is defined by Altbach and Knight (2007, 290) as "the economic, political, and societal forces pushing the 21st century higher education toward greater international involvement". Higher education, reacting or not, is affected by a changing world because globalization implies the provision of instant and extensive information that can weaken the place of higher education as "provider of knowledge" (Neary et. al., 2012, xi). Hence, "the traditional values of "collegiality, trust, and professional discretion" (Deem, 1998, 52) in higher education that characterise "academic practice" (Neary et. al., 2012, 53) are also challenged since the role of higher education is expected to bring contributions in the nations' economic development. The economies, particularly in the advanced countries, are now demanding for "knowledge workers" (Tymon and Stumpf, 2003, 12), being labelled as the people who can access and use the significant portions of information from the extensive pool of resources. Knowledge workers are rather successful because they can learn fast and share with others in need and can "access the most relevant information" and differentiate it from that of the non-relevance; and their success is largely built on the possession of highly adaptive problem-solving skills in dealing with technology and people, not only having a set of skills and tools. Mincer (1984, 195) highlights the importance of university education that can "involve not merely the transmission and embodiment in people of available knowledge, but also the production of new knowledge; and its diffusion generates worldwide economic growth". With the growing number of students graduated from universities year-on-year generally, through the support of government policies to increase the literacy of the citizens and the overall growing world population, these knowledge-based institutions can serve for the ongoing supply of new pools of talent workforce in the economy when the university graduates start to enter the labour market. That is the reason why Hagen (2002) said that universities are targeted by the policymakers to aid economic regeneration because they are the largest 'knowledge-based institutions' in the regions.

Education is generally perceived to be critical to economic success in a global economy and education policy is central in addressing the educational purpose in a nation, and that is inevitably linked to wider political philosophies and ideologies (Adams, 2014) as the purpose of education is "fundamentally bound up with wider questions about the nature of society"

(Bell and Stevenson, 2015, 146). When universities are obligated to adopt increasingly “marketized practices”, Neary et. al. (2012, 49) caution that the nature of the teacher-student relationship is seen to have been changed, and even the “professional identity” of teachers (McIntyre, et al., 2019, 164) can be reframed by labelling ‘good teacher’ as the “compliant employee”. Studying on some published articles, below are some highlights about the direction of higher education in the EU, the UK, the US, Asia, and Hong Kong. Being announced in the European Union (EU) 2020 strategy, both education and training initiatives are becoming one of the main focuses for policymakers to improve the existing stock of skills in the nation states. According to Humburg et. al. (2013, 2), the EU plans for reducing the school drop-out rates by having 40% of young people successfully attained a degree certificate by 2020 in the member states. Through the improved coordination of national and European policy, the EU is aiming at “smart, sustainable, inclusive growth” in the people’s skillsets, leading to “an improved knowledge base in the population”, and “bridging the gap between the worlds of education and work”. This strategic plan releases the vision of the EU leadership team in the field of education but not specifying what exactly the educational institutions need to do. In the UK, higher education is directly driven by the government’s educational policies in every aspect. For example, Dearing Report (NCIHE 1997) presents the UK vision of higher education development in the coming 20 years, recognizing the pivotal role of higher education in contributing to commercial success in a globalized economy but also “acknowledging traditional role of the university and the importance of widening participation still further” (Neary et. al., 2012, 46). Thirteen years later, when it comes to the Browne Report’s (2010) recommendations, once translated into policy, it creates the tensions in the government funding allocation in university teaching. However, the prime role of teaching in universities is not questionable because “universities are first and foremost geared to generating advanced knowledge through research at the same time as they disseminate that knowledge through teaching” (Dearlove, 2000, 263). Neary et. al. (2012, 104), therefore, expose the foreseeable issues of negative impact on teaching quality and the peer review systems which “will not, therefore, be able to withstand the power and pervasiveness of the post-Browne quality agenda, reinforced by the discipline of market forces”, pushing the academics to “internalize the new discourse and adapt their practice accordingly”. Nationally, there is a UK-wide programme, the Knowledge Transfer Partnerships (KTPs) launching over 40 years, aiming for “helping businesses to improve their competitiveness and productivity through the better use of knowledge, technology and skills that reside within the UK Knowledge Base” through the cooperation between universities, businesses, the UK government, and other sectors (Moscardini et. al., 2022, 815).

In the US, after World War II, one of the nation’s key education policy objectives is to achieve the mission of diversification, allowing different types of institutions to better serve a diverse set of students and social needs. “All government functions that are not specifically described as federal are reserved for the states by the US Constitution, which is silent on education” (Eckel, 2008, 178), that can be echoed in the study conducted by Moscardini et. al. (2022, 817) that the set of patterns in higher education, like low state

subsidies, “in the early decades of the twentieth century are persisting today” and “the weight of history to matter considerably in state-level indicators regarding higher education (Goldin and Katz, 1999)”. Due to the increasing economic pressure, the relationship between states and their institutions is becoming rather complicated; according to the US Higher Education Policy, it mentions that “many states are now setting explicit objectives for their colleges and universities to contribute to, if not to be the centrepiece of, state or regional economic development efforts” (Eckel, 2008, 181). The National Governors’ Association (2007) in the US shows that most governors are expecting the increasing role of public universities to fuel the engines of the new economy by offering the innovations necessary for the generation of new ideas and skilled workers. Hence, Aronowitz (2000) argues that learning is no longer the focus in the American higher education system whereas the primary goal of an education is to facilitate the student’s identification with social and cultural authorities so that they can be trained for specific occupations or skills.

In Asia, Altbach and Umakoshi (2004, 19, 20) point out that “nowhere is Asia have the early stages of contemporary economic development been dependent on higher education”. Universities were mainly serving the elites and thus, “governments invested little in higher education”. In the 1980s, the expansion in universities in Asia was largely driven by the emerging middle classes, “those seeking upward mobility in society”; and those developed countries such as Japan, South Korea, Taiwan, and Singapore, they were no longer competitive enough with lower-wage economies and therefore, “were forced to move toward becoming ‘knowledge-based economies’” where the governments have started to see higher education as a key factor in national economic survival. Since then, higher education access and endorsement have grown more dramatically in Asia than in any other area of the world (Moscardini et. al., 2022). According to Ng and Tang (2008), universities in Hong Kong, Singapore, Malaysia, Australia, and Japan have kicked off the effort of internationalisation, following the global trend in marketisation, corporatisation, and commercialization. governance and management. Regarding the direction in higher education policies, the universities in the Asia Pacific region are “greatly shaped by the institutes and practices of Western countries, especially the USA and UK, but also Pacific countries, notably Australia”. To take the example of University Grant Committee of Hong Kong (UGC), which is the main government funding body and is seen as the executive arm of the government in higher education (Mok, 2000), the reviews on research, teaching, and governance conducted in the universities, including both the instruments and the assessment criteria adopted by the Committee, are mainly borrowed from the West, including the UK, the US and Australia (Mok and Cheung, 2011). Ng (2012, 450) finds out that universities in Hong Kong, Singapore, Malaysia, India, and South Korea are running in line with “the Anglo-American paradigm”. Since the early 1990s, the Hong Kong government has started the higher education reform and “a landmark decision was made in 1989” to increase the number of students entering the undergraduate programmes from 6 percent to 18 percent in the 1990s and the “rapid expansion was completed by 1995” (Mok, 2000, 156), turning from an elitist system to a massive expansion in higher education in a short period. The quality assurance movement in the higher education sector was started

from 1994 and is seen as the Hong Kong government's correspondence in both the wider global policy context and the context of local policy; whereas the UGC's initiative for the development of centres of excellence within UGC-funded universities attracted more than 41 applications in November 1998 but only five of the applications were selected, showing that "more market-oriented principles and strategies" (Mok, 2000, 161) or Clark's (1983) typology of "market model" of governance identified in the US, the UK, Australia, and Hong Kong (Shin and Harman, 2009, 8), are considered in the higher education sector of Hong Kong.

Based on the above government policy-related scenarios, the role of higher education has already intertwined with the economic agenda of the governments to support for the economic growth; and it is applicable in both developed and developing economies. The economic role of universities, in both types of economies whether government fundings are allocated or not, is explicitly expected; and this role is commonly measured by the number of university students graduated per year. Those high-level strategy plan, educational reports, and white papers, being described as "government policy drivers" (Neary et. al., 2012, 53), are used for predicting the kinds of knowledge and skills and the supply of the educated workforce required for fulfilling the future needs of the society; and in this sense, it is the expected socio-economic role played by the universities. In the academic world, it has always been "characterised by centres and peripheries" (Altbach et. al., 2009, 10); and where the strongest universities are "seen as centres" because of "their research prowess and reputation for excellence". Accelerated by the impact of globalisation, the academic world becomes more complex when rankings, particularly international rankings, are more than a number. It challenges the universities in finding "their footing on the global higher education stage" (Altbach et. al., 2009, v) because these world league tables are posited as the benchmarking tool for higher education institutions (Hazelkorn, 2007), influencing the decision-making processes of many higher education institutions. Hence, universities and their degree programmes are, indeed, automatically entered into the political world of university ranking league tables, such as QS World University Rankings®, Times Higher Education World University Rankings (THE), and The Academic Ranking of World Universities (ARWU). Having a higher position in these league tables is almost equivalent to winning a world-wide reputation, with better quality of staff and students, and probably attracting more public and private resources; when articulating to the country level, it would mean for the third-party endorsement of academic excellence and the more the number of the universities are at the top rank, the more competitiveness the country is globally (Altbach and Balan, 2007). Under this academic-political setting, if the name of a university was not shown up in any one of these league tables, could that university claim itself as part of the global university circle? It looks like a very difficult question to be answered. It becomes clear that universities are playing the triple 'economic-social-political' role as the higher education institutions for the society in the 21st century, becoming increasingly crucial as an economic and social institution to nurture more young people and equip them as knowledge workforce, and acting as the ongoing direct support during the process of economic transformation in the nations.

Aronowitz (2000) votes for the notion of “knowledge factory” and Jacoby (2001) coins it as “academic factory”, implying to create the true higher learning in universities and advocates for dismantling the notion of ‘corporate university’. Such dismantling is commented as “a biting critique of the corporatisation of higher education could have remained merely a pedantic diatribe against the non-critical manufacture of credentials as econometric worth and wealth for the elite” (Aronowitz and Burney, 2001, 157). Jacoby (2001) warns that if higher education system surrenders the independence, meaning to allow the learning in favour of more training, the needs of a democratic state will be overlooked. Universities in Europe are viewed as the key drivers of a knowledge-based society, with the European Commission (EC) placing them at the heart of Europe’s knowledge triangle of research, education, and innovation. In terms of higher education policy, it is in the centre of EU policy with the goal to create a ‘Europe of knowledge’ (Lisbon European Council, 2000; Humburg et al, 2013, 2); whereas the profound changes in higher education in respond to the macro-environmental factors (e.g., shifting demographics, internationalisation) need to “maintain its relevance” (Speight et al., 2020, 97). Higher education is seen to take on a slow journey towards re-conceptualising to be ‘sustainable university’ because both sustainability literacy and digital literacy have started to move up the higher education agenda, though facing “the challenge in securing space within the “crowded” curriculum” (Speight, 2017, 2). Increasingly, the Internet becomes the dominant infrastructure for knowledge and information, acting as a repository and as a global platform for knowledge exchange between people. Moscardini et. al. (2022, 821) appreciate in seeing the transformation in the universities as “it is imperative for their survival”, whereas “the multiple and diverse responsibilities of higher education are ultimately key to the well-being of modern society” (Altbach et. al., 2009, xxi).

2.2 Tensions of employability on graduate labour market, academic credentials, and employers’ expectations

2.2.1 Tensions between massification of higher education, student mobility and employability

The changing demands in the knowledge economy, the digital economy, and the rising of AI-enabled ‘gig-economy’ (UNCTAD, 2021, xix; ILO, 2016), intensifying by the globalised competitive environments because of the rapid diffusions of new technology adoptions in businesses and individuals, all of these are pushing the knowledge economies in tremendous pressures to react for economic development and growth and so do the higher educational institutions to react for “survival” (Altbach et. al., 2009, 154). The rapid expansion of student enrolments in higher education in different parts of the world has been viewed as a worldwide phenomenon as policymakers leverage the educational policy

to enlarge the pool of knowledge-based workforce and to minimise the size of low literacy labour force in the nations to support for the economic goals. Taking the UK as an example, “in 1950 only 20,000 degrees were awarded against a total of 500,000 today” (Moscardini et. al., 2022, 815). If such large volumes of student enrolments cannot be delivered within the existing operational and resource parameters by the universities, this kind of expansion can create the tension between mass higher education and the quality of the teaching services delivered (Giannakis and Bullivant, 2016). Such tension raises the concerns in the quality of higher education which emerged as ‘world-wide phenomenon’ (Akalu, 2016, 260) as what Vught and Westerheijden (1994, 357) challenged, “the extrinsic values of higher education have driven many governments to policies of quality control in higher education. The increasing costs of higher education systems had to be legitimised by clearly definable societal benefits”. In addition, the knowledge economy enhances “global mobility” of international students and in response, “academe plans a central role in mobility” to attract students coming from other parts of the world (Altbach et. al., 2009, 2).

The trend for the massification of higher education, however, seems to be irreversible and the impacts are far-reaching, leading to “overcrowded graduate labour market” (Anderson and Tomlinson, 2021, 675) and “credential inflation” (Tomlinson, 2008, 55). According to the OECD statistics quoted by Pavlin and Svetlik (2014, 419), in between 1997 and 2010, the age group of 25-64 years old with tertiary education was increased from 21 to 30 per cent in the OECD countries. In the EU-21 countries, the increase was increased from 18 to 28 per cent (OECD, 2012). In several developed countries such as Canada and the USA, the share of tertiary educated exceeded 40 per cent. In a similar fashion, the European Union (EU) 2020 strategy, one of the key targets is to attain 40 per cent of young people who can successfully complete a study in higher education by 2020 (Humburg et al., 2013). In Asia, the patterns behind the rapid expansion in higher education sector and the fast growing of student enrolments in higher education are very different from the West; according to Asian Development Bank (2011), one of the major drivers is closely related to the marketisation and privatisation of higher education. “Without sufficient state funding, the growing ‘privateness’ in higher education is becoming a far more popular trend in Asia” (Mok and Neubauer, 2016, 6). For the own good of economic value and competitive advantage, it is the government policy that driving for the transformation of educational systems from elite-centric to mass higher education to fulfil the demands from industries and employers. The question is whether there are enough job vacancies available in the labour market for the graduates. According to the UNESCO data published in 2009 (Altbach et. al., 2009, viii-ix), there are more than 2.8 million students studying outside their country of origin in 2007, and the estimated figures will be reached 7.2 million of internationally mobile students by 2025. The patterns of international student mobility show that the students in Asia are more preferred to study in North America, Western Europe and Australia, and the students within the European Union are encouraged for mobility within the member states. “Globally, international student mobility largely reflects a South-North phenomenon”. If the cohorts of degree programmes are oversized, the employment prospects can become scarce to the graduates; and thus, exposes the issues to “societies facing workforce

surpluses in some areas and shortages in others” (Altbach et. al., 2009, 104). When this issue expanded to the international level, it creates the potential imbalance in the supply and demand of global workforce, possibly “leading to high numbers of unemployed and underemployed college and university graduates” (Altbach et. al., 2009, 68).

2.2.2 Tensions within higher education credentials and linking to graduate-level jobs

Higher education credentials are the ‘currencies’ (Tomlinson, 2008) that have been presented as crucial for economic development in fulfilling the changing needs of the knowledge-driven economy. However, the direct and linear relationship between the expansion of educational credentials and economic development underpinning the human capital model (Becker, 1993) is far from realistic; and thus, Tomlinson (2008, 49) criticises that there are “markedly different understandings about the role of higher education credentials as a source of economic growth, and the role of credentials in individual employability and labour market outcomes”. The difference in the above understandings is contributed by considering education and training as an investment that can yield social and private returns (Ashton and Green, 1996), leading to the direct contrast to the positional conflict and credentialist interpretation of the relationship between educational credentials and employment (Brown, 2000). The exponents of credentialist model argue that the rise in academic credentials does not necessarily represent a genuine economic demand for more highly qualified labour, and the spread of educational credentials can add little or no value to individuals’ human capital but rather adding more pressures on them to acquire further credentials for job access. Based on the difference between what is needed ‘to get jobs’ and what is needed ‘to do jobs’ (Tomlinson, 2008), there are different stages in the career development of the individuals and the realisation in ease-of-movements between jobs is coined as ‘movement capital’ (Trevor, 2001).

With the largely growing number of university graduates, it creates the paradigm shift in higher education credentials in some ways. The “graduate-ness” associated with higher education credentials has traditionally served as a “status confirmation” for the middle classes who can gain the positional advantage in the labour market through their social networks (Brown, 2000) and often, can enjoy the “legitimised educational and occupational advantage” (Tomlinson, 2008, 51) or named as ‘cultural capital’ (Tomlinson, 2017). Collins (1979) portrays it as the “mechanisms of social closure, limiting access to good jobs” (Adams and Demaiter, 2008, 353). Because of the trend for mass higher education systems, the degree credentials become a popular academic achievement attained by more young people nowadays, creating the tension on those who previously having the positional advantage over jobs but now are taking a relatively declining credential status, making the formally institutionalised cultural capital become “less potent in shaping access to employment” (Tomlinson, 2017, 343). Another shift is the increasing demands for soft skills,

or “behavioural competences” (Tomlinson, 2008, 51) during the employment recruitment and selection process; based on the content analysis of 1,000 job advertisements in graduate recruitment databases, Bennett (2002, 457) finds that the majority of the respondents cite the adding of “interpersonal skills” in the profile specifications on job advertisements as “logical motives”. That can pose new challenges to the university graduates’ skills and competence in their early experiences in the labour market (Brown and Hesketh, 2004) since these logical motives can be rather subjective, subject to the interpretations of the interviewers in the recruitment process. Due to the increasing global market competitions and the demand for new innovations, the employers have shown less attached to the academic credentials though are traditionally in form of the certificate of degree as the indicator of knowledge level and intellectual ability in the graduates’ employment; they are now more interested in the candidates’ personal attributes and skills, that is, the soft skills, like teamwork and work experience (Harvey, 2000), of the graduate attributes as the key selection criteria during the hiring process. In other words, degree certificate is no longer a complete ticket to get a graduate job and it alone, is not enough to hit the “first-base” or a “tick in the box” in the recruitment process (Harvey, 2000; Tomlinson, 2008). Elias and Purcell (2013) echo it by questioning the reliance on supply of graduates to indicate the market demand as it has increasingly become unmatched scenario, especially when facing the pressures from the massification of higher education.

The definition of graduate job is the controversial topic around graduate job versus graduate-level job and there is no consensus about what constitutes a graduate job (Green and Henseke, 2016). In the UK, it is the first destination graduate survey, inclusive of any employment in six-month period (HEFCE, 2001), being criticised for creating the possibility to pervade the graduate labour markets if institutional discrimination existed (Knight and Yorke, 2002); whilst for Pool and Sewell (2007), they treat it as the simplistic approach adopted for measuring graduate employability though accepted it as very vague and imprecise indication of what the student has gained. Compared to Harvey (2001), he logs it as the “first-destination returns” in the job type categorisation in his research project, acknowledging the considerable pragmatic pressure in keeping it simple for measuring graduates’ employability. Furthermore, it is suggested that “data on employment status six months after graduation may in fact be useful indicators of future labour market prospects” (Mason et al., 2009, 10). When the notion of a graduate job is defined as any job that a graduate does in the UK by The Association of Graduate Recruiters, Harvey (2000) welcomes the definition as it reflects the diversity of graduate employment. However, it is strongly criticised as the pointless tautology by Green and Henseke (2016) who devise a set of time-horizon of skills that graduate job should be incorporated, starting from a substantial portion of the skills already acquired in the university education, through the years after graduation the additional skills acquired in the workplace. For graduate-level job, Harvey (2001) refers it as fulfilling work or career-oriented job, requiring the graduates to possess the graduate skills and abilities at work. Similarly, Knight and Yorke (2002) necessitate the requirements for graduates in possession of understandings, skills, and personal attributes in order to perform adequately in a graduate-level job.

2.2.3 Tensions on graduate employability between employers' perception and universities

“Employability levels fluctuate with capital demand” (Williams et al., 2016, 897) whereas the mismatch between the competencies developed in higher education and those that are favoured by employers is also acknowledged, creating the tensions in supply and demand for university graduates. When there are challenging concerns over employability, the priority is always addressing the demands of employers “towards promoting the ready insertion of graduates in the labour market”. The central reality in the 21st century shows that “academia is more than a promoter of employability”; when market demands can be shifting so rapidly, the definition of degree programmes cannot be determined by the market (Abelha et al., 2020, 7). The desk research (Humburg et al. (2013, 86) investigation on the employability of university graduates from the perspective of EU employers, there are two contrasting perspectives obtained. One perspective is the primary focus of higher education to “produce generalists because the world changes so fast that specific knowledge is soon rendered obsolete”. The other perspective is having higher education to focus for developing “true experts” whose domain knowledge as the basis for professional expertise but acknowledging that “cannot be developed without content”. Because of the problems about specific knowledge obsoleted easily caused by the fast-changing world, it is found that there is “a tendency for policy to focus more on key competences” and general academic skills (for example, learning to learn) is considered as an alternative by the employers (Humburg et. al., 2013, 10). Searching for true experts, the employers further request for the university students acquiring the field-specific knowledge content in the development of their general academic skills because it is “practically impossible to acquire general academic skills without applying it to a specific context, and vice versa” (Humburg et. al., 2013, 86). It is acknowledged that the acquisition of specific knowledge is fundamentally interwoven with the general academic skills as well as the professional expertise.

The above two perspectives from the employers though are contradictory, the report finding shows that in nearly all the focus groups, the participants agreed that the main goal of higher education is to support the university students in developing key competencies, in addition to general academic skills and professional expertise. Other than the above two ideals but polarised candidate credentials, in the UK, the employers flexibly create the third type of ideology, ‘competent-person’ in the middle of the two poles so that it can help to fill in the job vacancies if no right candidate can be identified in the hiring process. The earlier study of graduate selection processes conducted by Brown and Hesketh (2004, 92) criticises the decisions made by these types of employers as “stylized, commodified and ultimately embodied within individuals in such a way as to render the process of selecting individuals in the labour market process open to new levels of subjectivity”. Ingram and Allen (2018)

refer those graduates as “social magic”, whose credentials are magically enhanced by employers if being hired for the jobs (Ashley et. al., 2016; Anderson and Tomlinson, 2021, 687).

2.3 Employability and IT workforce development

2.3.1 Employability in terms of process model and resource model

Due to the tremendous economic pressures enacted from the spectrum of globalisation and the effects of internationalisation, the themes of employability have recently been renewed to interpret as the ‘process model’ (Forrier et. al., 2009, 2015) or the personal ‘resource model’ on employability (Peeters et. al., 2019); and these models are leveraged and advanced from the notion of movement capital (Trevor, 2001) in the labour market. Employability, through a process model, is to “secure employment against the background of changes in the pattern of individual careers and in the labour market”; therefore, Forrier et al. (2015, 56) describe it as “an individual’s chance of a job in the internal and/or external labour market” and the meaning of “chance” is a ‘job transition’. This chance is arguably triggered by three factors, the individuals’ “mobility to assess the realisation of this chance (i.e., job transitions)”, the set of “personal strengths in the form of knowledge, skills and attitudes that influence this chance (movement capital)”, or the use of “individuals’ appraisals of this chance (perceived employability)”. The dynamic research study of 643 Dutch-speaking employees confirms that “past job transitions increase movement capital” and the researchers’ suggestion is that “self-selection could be an alternative explanation” (Forrier et. al., 2015, 62) and the importance of personal strengths in employability agenda.

The conceptual “employability capital” (Peeters et. al., 2019, 79) can be seen as advancing the employability agenda to the next level, through the construct of employability matrix with employability distinction and capital distinction. “Employability distinction” refers to the purpose of personal resources, differentiating between job-related, career-related, and development-related. “Capital distinction” refers to the capital categorisations in forms of human and social. This model is perceived as “more accurate to capture the combination of obtaining and retaining employment” (Peeters et. al., 2019, 80). However, Trevor (2001, 621) emphasises that “the actual ease of movement of the individuals in the job market is simultaneously determined by factors at the market level (general job availability) and the individual level (movement capital)” whereas Forrier et. al. (2009, 61) criticise that the conceptual movement capital may be potentially “biased towards an agency perspective (over) emphasizing the importance personal strengths”. In terms of resource alignment in employability, the sets of personal resources or capital are “those that can help the individuals to attain their goals”, i.e., the purposes like to perform jobs or to make job transitions, and thus can influence the employability of individuals (Trevor, 2001), whereas

the type of capital specifies the “nature of capital”, referring to those resources that can promote an individual’s chance to obtain and retain employment. Peeters et. al. (2019, 81), therefore, identify the ‘competences tied to employability’, which is articulated into three separate classes within the employability dimension: “job-related (specific and generic) competences guarantee the present job; career-related competencies are important in view of potential other jobs in the near future, and development-related competencies in view of shaping a long-term career”. Based on the extensive literature review, the research study conducted by Peeters et. al. (2019, 87-88) adopted a Q-sorting study with 29 subject matter experts in mapping measurements onto the conceptual framework and the study results show support to the conceptual framework, with three issues identified. First, there were no items identified as the specific job-related skills category in the initial framework, causing the collusion with the other category of generic skills measurement, leading to the location of measurement gap for specific job-related skills. Second, it is found that capital-related categories are more difficult to differentiate compared to employability-related categories. Third, items on social capital loaded on all dimensions of employability, which cannot be identified as separate dimensions and the potential explanation may be due to the difficulty in allocating this kind of capital to an employability category.

2.3.2 Technology-enabled sector, new knowledge areas and new job groups

In an increasingly competitive global economy, “innovation and knowledge can be identified as key components of strategic advantage” and the power of digitalisation creates a new era of digital and information age (Brennen and Kreiss 2014). In the realm of technology sector, “the workforce reality is that IT professionals work both inside and outside the information technology industry” and there is subtle distinction between the primary and secondary IT sector (Trauth et. al., 2007). With the emerging cutting-edge frontier technologies, such as, artificial intelligence, robotics, and biotechnology, it boosts the creation of a “gig economy” (UNCTAD, 2021, 43) where frontier technologies are used to provide services via digital platforms, creating ‘location-based’ and ‘cloud-based’ gig work whose work tasks can be performed anywhere via the Internet, but the nature of gig work is typically placing the gig workers ‘on insecure terms’. However, new technology trends can lead to the creation of new job role and new job groups, in addition to the expansion in the existing IT work types. The growth in e-businesses, enabled by cyber infrastructures, is demanding the new job role in senior executive category, “Chief Technology Officer (CTO)”, to charter for all aspects of technologies for the organisations, particularly the cyber infrastructure; whilst the new job groups are related to “data security, data storage, Internet, and wireless technologies” (Reich and Nelson, 2003, 40). According to UNCTAD statistics, the forecasts in the increasing frontier-technology-related jobs are very substantial and significant, for instance, “by 2035, the global 5G value chain is expected to support 22 million jobs”, covering “network operations, core technology and components providers” (Rayome, 2019; UNCTAD, 2021, 19). Therefore, the planning for IT workforce development is rather complex and challenging.

With the emergence of electronic platform and e-commerce, it alters the business models and service models traditionally adopted in many industries, driving them to develop the technologically empowered organisational infrastructures and business operations. According to the work of Reich and Nelson (2003), the CIOs is described as the top business people who understand IT (Murphy, 2000) and their insights reflect that e-business has imposed three major changes in the future of in-house IT organisations, IT role becoming the strategic centre of the company, IT teams turning to value creation function, and IT staff facing higher expectations from the user groups who can be called as 'knowledgeable user community' (Hackbarth and Kettinger, 2000) or 'customers and partners' (Reich and Nelson, 2003). The infrastructure of E-business enterprises is the more standardised architecture throughout the IT organization to smooth the data flow (Purvis and McCray, 1999), but such efforts can pose new challenges to the existing infrastructures leading to the demands for new technical knowledge and skills, like data modelling, one interviewee said, "we're starting to get better with data modelling but that's a skill we need to get better about" (Reich and Nelson, 2003, 34). The cornerstone behind E-business is the reliance on the alignment of business and IT as the alignment can help to manage the 'value equation' (Kearns and Lederer, 2000) for the firms. But one interviewee rather dissatisfied and said, "we're spending so much money trying to knit all this stuff together, it's unbelievable!" (Reich and Nelson, 2003, 34). When the investment on web-enabled, mobile-friendly infrastructures involves a large sum, those investments need to be justified by "extend[ing] the IT value chain with business cases and benefits realisation being key parts of projects" (Reich and Nelson, 2003, 39). As what Hackbarth and Kettinger (2000, 92) stated, the more extensive and innovative the business process changes, the more critical is to conduct "business audit of their IT infrastructure" because these capabilities influence the speed and nature of the business process change as desired in the company (Broadbent et. al., 1999).

The above indicates that "information technology skills need to move even closer towards the strategic centre of the company, requiring increased business knowledge, improved ability to negotiate, and improved ability to create value" (Reich and Nelson, 2003; Trauth et. al., 2007, 114). With the increasing adoption of e-commerce in different industries, it is found that the competency requirements of information technology professionals are also altered (Cash et. al., 2004; Niederman, 2005) in terms of technical, business, relationship and conceptual skills which are all necessary to ensure information technologies work effectively (Trauth et. al., 2007). For business process integration, IT staff is required to understand the business practices of different departments and the external business partners whose systems may need to be connected to or partly integrated; and this process would demand the IT staff to possess good soft skills, in addition to the strong technical skills. It is the job of IT staff to conduct "a thorough review of current or potential customer and supplier process", to examine opportunities and threats for effective application of e-business technology (Hackbarth and Kettinger, 2000, 79). Apart from the standard practice of the cost-and-benefit analysis (Reich and Nelson, 2003, 34) as required in all business

models, e-business has brought up the new dimensions of security risks, legal, data fraud or theft and cyber-attacks, into the overall implementation considerations and analysis. Reich and Nelson (2003, 32) point out that “the launching of e-business initiatives that cross the corporate boundary has moved security to the forefront of issues. Security becomes not just a technical issue, but also a strategic and potentially legal one” (Birman, 2000). Just as one interviewee expressed concerns about the different government regulations imposed on their international offices where their team needs to handle the local compliance issues like telecommunications accordingly. The Internet can expose the firms to different types of cyber risks, showing that the massive incident of data fraud or theft are predominantly driven by economic motive and whose actors commit crimes using information networks (Bilan et al., 2019). According to the global risks report published by World Economic Forum (WEF, 2019, 8), ‘data fraud or theft’ and ‘cyber-attacks’ were both listed in the top 5 global risks in two consecutive years in 2018 and 2019.

2.3.3 Technology threats, and IT knowledge deficiencies and skills

The technology-enabled sectors are not only facing the pressures to improve their existing technological infrastructures but also to develop the innovative ways to support the business goals. In web-enabled infrastructures, it needs to advance further to enable the wireless access and mobile access, and it is believed that “the invention, emergence, and popularisation of ICT has been proved as beneficial for the society both economically and socially” (Bhujabal et al., 2021, 42650). According to the International Telecommunications Union (ITU, 2018) report, the evidence of “currently 51.2% of the world population are using the Internet” shows the strong demand for broadband services, though such infrastructures are not available in some areas in the developing countries. “ICT infrastructure continues to improve, especially in the developed countries, as companies implement 5G networks” (UNCTAD, 2021, 87). With the increasing demands for IT professionals among different industry sectors, both in quantity and in quality, Lee et al. (1995, 334) foresee that “the critical human resource needs of our profession are moving targets”. The effects of rapid technology changes lead to the general view on IT knowledge and skills easily obsolete; that can be explained using the ‘technology S-curve theory’ which is “shown empirically that the advantage of improved technology rapidly decreases when machines (and algorithms) become more powerful” (Szabo and Szabo, 1988, 14), leading to the current debates around the threats of digital technologies, automation and the rise in unemployment rate and income inequalities. “When the deployment of digital technologies enables productivity growth that exceeds the combination of demand growth and market share growth”, it is found that some categories of existing jobs will become redundant (Roos and Shroff, 2017, 181). Based on the empirical study and theoretical model developed by Bessen (2019, 615), it is argued that the “elasticity of demand” with respect to labour productivity affects the industry employment and such elasticity “determines the sign of the effect”; according to the historical data and the Bessen’s model, it is expected to have “substantial heterogeneity across industries in their response to new productivity-improving technologies”. Regarding

the impact of automation and the decline in aggregate employment, it is suggested to involve the factors of individual industry responses, the spillover effects on downstream producers and general equilibrium effects on labour demand (Autor and Salomons, 2018), implying that “new productivity-improving technologies will likely bring a disruptive reallocation” (Bessen, 2019, 615). In 2021, UNCTAD report findings do not hide the facts, stating that in a more modest view on jobs and employment, the impacts of automation are estimated to be 8 to 14 per cent across occupations (UNCTAD, 2021, xviii). However, the report also points out that “the distinction between occupations and tasks is critical since even occupations at high risk of automation can perform tasks that are hard to automate” (UNCTAD, 2021, 40).

Radermacher and Walia (2013, 525) conducted the systematic literature review to examine what are those IT knowledge and skills most frequently for the graduating students who are not able to meet the expectations of employers, practitioners, or educators. Knowledge deficiencies, the collective term, is defined as “any skill, ability, or knowledge of concept which a recently graduated student lacks based on the expectations of industry or academia”. The study showed that there were 16 identified knowledge deficiencies and listed by ‘number of occurrences’ in Table 2.1. These knowledge deficiencies are extracted from the identified publications, not serving as a ranking purpose but is only counted by the frequency shown in those papers mentioned. Programming is the only knowledge deficiency is found to meet employers’ satisfaction as graduating students’ programming abilities (Lu et. al., 1999), but more programming skills are needed. Noll and Wilkins (2002) suggest for placing more focus on web-based languages and CASE tools, but Miller et. al. (2010), emphasise the importance of programming language as independent. Code testing (Haddad, 2002) and debugging code (Begel and Simon, 2008b), are regarded as the senior-level student skill but seen as deficiencies by both industry and academia. For graduating students, project management and database were the two deficiencies that graduates learned to acquire the skills largely at work (Lethbridge, 1998; Misic and Russo, 1999). Computer ethics is the most problematic as graduating students did not know how to distinguish between ethical and unethical behaviour (Woodward et. al., 2009). The mostly discussed were the deficiencies of oral communications and written communications, including the great concerns about their ability to communicate with customers and ability to listen (Tesch et. a., 2008), and even their struggle to communicate when they needed assistance or struggling with a problem (Begel and Simon, 2008a). In view of the changes of knowledge deficiencies over time, it is found that teamwork has become most frequently identified within the past 5 years but other knowledge deficiencies like presentation skills that have decreased over time.

2.3.4 IT curriculum design and professional certifications

Regarding the IT curriculum design and structure, it is observed to have evolved over time, but the central theme is career orientation for the graduates. IT knowledge and skills are generally perceived to be easily obsolete and Lee et. al. (1995, 314) hold the similar view that “generic curriculum to meet the educational needs of all future IS professionals is obsolete” and thus it cannot fulfil the needs for all IS jobs (Noll and Wilkins, 2002). It is suggested that IS degree programmes should be career-driven with career path tracks or distinctive concentrations and “the curriculum design must be driven by a clear vision of the career path for the graduates” (Lee et. al., 1995, 333). The central idea is to “target the diverse job market” (Noll and Wilkins, 2002, 152), with the curricula meeting the career path objectives and the selection of separate distinctive concentrations according to the user domains or job nature. There is a set of common core skills in business knowledge and soft skills that are required for all concentrations, where the required and elective subjects are also made available in both core and concentrations; that is, university IT students are more flexible in selecting the courses that they are interested in. Contextually, Srinivasan et al. (1999) and Riihijärvi and Iivari (2008, 11) propose to involve IT practitioners in curriculum design and teaching as their involvements can help ensure both ‘currency and relevance’ in the topics they teach while the latter further specifies the importance of ‘practical relevance’ contributed by IT practitioners in designing the degree programmes. It is a two-stage process (George and Marett, 2019, 222) that the design of the obligatory studies is informed by “the education expectation expressed by practitioners” and the design of elective and optional studies is informed by “the skill requirements of practitioners”, serving for complementing the core curriculum which is focused on those key IT knowledge areas and topics. They assert that IT academics is very dynamic “because the area we study is dynamic”. It is not substantiable to say that all the changes in technology and business needs are the only reasons contributing to all of the curriculum changes in the past 50 years; but rather, “the social and economic factors”, which are “uncontrollable” and often “unforeseen” in nature, have been highly influential in the past and are expected to lead the way on, such as big data trend leading to increasing demand for data scientists. However, “there is a fear of data and identity thefts, as hackers have engaged in large and well-publicised data breaches”, driving for the need of “better data stewardship” and “expanding cybersecurity efforts” (George and Marett, 2019, 228-229).

Certifications are viewed as “skills with a narrow focus” but not implying for not important. Under the market conditions of for “highly specific skills” are extremely volatile, it is worried that the IT professionals may “risk” their careers in making “a niche with a specific technology” (Bailey and Stefaniak, 2001, 98). Comparing to the work of Reich and Nelson (2003, 42), most of the CIOs realise the “need to have project management standards, a common set of practices upon which they manage projects”. One interviewee said that there are 136 people certified in project management in the team, stressing that “our preference is just not to hire a project manager that doesn’t have certification from the

project management institute. That doesn't make them excellent either, but at least it tells me that they understand the concepts that we're going to be challenging them on". It is observed that the CIO's decision for project management certification as a pre-requisite is signalling their management decision to "use people with company-specific knowledge to run their projects and give their people a reason to stay".

2.3.5 Knowledge structures and expertise development in higher education

The essence of knowledge (Anderson 1984) represents the nature of knowledge, affecting the ways of teaching and learning in higher education, especially for expertise development. Tacit knowledge is regarded as the "black box of intuition" (Kinchin et al., 2008, 321) whilst Dreyfus and Dreyfus (1986) and Eraut (1994) agree that tacit knowledge and intuition are critical features of professional expertise. If this opaque phenomenon is not uncovered, the students' tacit presumption in learning can easily "miss the target by miles" whereas the teachers' tacit presumption "can operate like conceptual submarine that learners never manage to detect or track" (Perkins, 2006, 40). It resonates with the work of Novak and Symington (1982) who identify that "the problem of moving from linear [text] structure to a hierarchical [psychological] structure and back again is in some ways the fundamental educational problem" (Kinchin et al., 2008, 321) and it is mainly due to two reasons. First, "the notion that expertise is associated with a qualitative transition from a conceptually rich and rational knowledge base to one comprised of largely experiential and non-analytical instances" (Schmidt et al., 1990, 619). Second, experts often find it difficult to describe the actions they exhibit, and this phenomenon is interpreted by Hoffman and Lintern (2006) simply as "lacked the tools and vocabulary to uncover and explain their practice" by the professionals. Based on the 'skill model' developed by Dreyfus and Dreyfus (1986), a practitioner can develop a skill of proficiency through five levels, namely, novice, advanced beginner, competent, proficient, and expert; when progressing from proficient to expert level, the practitioner is required to apply the analytical skills in decision making and possess the intuitive understanding of the particular situation. For the experts, their performance is "largely automatic, and non-reflective" (Kinchin et al., 2008, 317), and they reassess the initial action only when they need to handle the task particularly difficult or critical because the skill possessed by the experts has become a part of him, therefore, "when things are proceeding normally, experts don't solve problems, and don't make decisions; they do what normally works" (Dreyfus and Dreyfus, 1986, 30).

After reviewing the concept of professional expertise (Dreyfus and Dreyfus, 1986) and the practitioner progression model (Eraut, 1994), Kinchin et al. (2008, 316) discover that the expert do not rely on rules or guidelines at work and "the rules are in fact forgotten" because they can exercise the "intuitive grasp of situations based on a deep tacit understanding". Apparently, the links between expert knowledge and developing practice need to be made explicit, and Kinchin et al. (2008) develop the concept of 'knowledge

structures' to distinguish between expert knowledge and expertise, by showing the relationships between chains of practice and the networks of understanding that they depend on. The criticality of knowledge structure concept adds transparency to the presumably tacit process and contributes to the understanding in the link between invisible expert knowledge and visible chains of practice. The conception defines "expert knowledge as an integrated/holistic framework of understanding", and expertise as "the application of expert knowledge through the selection of appropriate chains of practice"; and by accepting this notion, it can help to explain why teachers can still hold the expert knowledge structures though they lose the expertise (know-how) for not practising anymore (Dreyfus and Dreyfus 1986; Kinchin et al., 2008). When expertise is described as an individual's ability to navigate between underlying networks of understanding and chains of contextual practice, it is analogous to the 'professional artistry' perceived by Manley et al. (2005) and it can give the explanation to Dreyfus and Dreyfus (1986) who do not want to simply accept the efficacy of tacit theories for the development of educational practice as well as the core of expert decision-making to be the intuition in a black box. For learners who are goal-oriented, they can strategically be successful in identifying the essential information from what is made available while "selectively ignoring the rest"; but if for students adopting this strategic learning attitude in studying, they are usually criticised as "a blinkered view of higher education" and it "may reflect disciplinary differences" (Kinchin et al., 2008, 319). But if the networks of understanding for students become the goal of higher education, it may be contested because chains of practice seemingly have more immediate utility than networks of understanding.

Following Kinchin et al. (2008, 319), it is viewed that "expert knowledge structures assumed to be holistic" (Bradley et al., 2006) and "clinical reasoning skills shown to be linear in structure" (de Cossart and Fish, 2005). When applying it in education, the definition of expertise, related to chains of practice and networks of understanding, can work across the spectrum of academic disciplines, while the context of clinical teaching represents "the separation of chains of practice and underlying networks of understanding". Within a clinical teaching environment, it is found that "possession of highly competent skills within a given chain of practice is not sufficient" for educating the future professionals in making informed choices in future because of "isolated chains of practice" or 'broken stories' described by Stronach et al. (2002). That is why it is strongly suggested that the students are "encouraged to make links from his/her chain of practice to a developing network of understanding" (Kinchin et al., 2008, 322). According to Manley and Garbett (2000), it is found that when the expert is seen as holding the 'right answer' by using arbitrary criteria (Kinchin et al., 2008), the students perceive the 'right answer' as a moving target for them to identify (Cabot and Kinchin, 2007; Hay and Kinchin, 2007). Hence, the successful lecturers are those who can demonstrate the link between linear and hierarchical structures (Novak and Symington, 1982), or between chains of practice and networks of understanding. The "hallmark of expertise" refers to the "interactions between these complementary structures and the ease of transformation (from one to the other)" and thus, the development of an authentic pedagogy in higher education should recognise the

complementary nature of linear and networked knowledge structures and their contextual significance, focusing on the transformation of these knowledge structures (Kinchin et al., 2008, 324).

2.4 Curriculum design, teaching pedagogy, and graduate employability

2.4.1 Forms of graduate capitals and the practical implications

The discussions around how graduates can succeed in the labour market and what universities can do to enhance graduates' employability continue in creating pressures in curriculum design and development, especially in those programmes that employers expect to produce work-ready graduates. Tomlinson (2017, 339) conceptualises graduate employability in forms of "graduate capital", described in a variety of interactive forms of capital in human, social, cultural, identity and psychological dimensions. These forms of graduate capital, "cumulative and recursive in nature" (Tomlinson, 2017, 348), are the key resources potentially in empowering graduates to find jobs as well as to make transitions from the university to the job market. Graduate capitals, posited as graduate-centred, can be "acquired through formal and informal experiences" by the students.

Human capital (Tomlinson, 2017, 341) refers to the knowledge and skills that graduates acquire as a foundation of their labour market outcomes and this concept is following the economist Gary Becker (1993) who refers it to the "marginal" productive value attached to higher level qualifications in the labour market. The strength of human capital is the reliance on education preparing the graduates with specified knowledge applicable to their future employment, implying that the "formal education provides a key foundation". According to Pool and Sewell (2007), it is important for graduates to learn how to associate the link between technical knowledge and subject specialism, as well as whatever generic skills they have acquired, demonstrating how these may translate into future performance. Graduates can acquire the 'career-building skills' (Bridgstock, 2009), including CV development, job search and wider awareness around job opportunities (Tomlinson, 2017).

Social capital refers to "the sum of social relationships and networks that can help mobilise graduates' existing human capital and bring them closer to the labour market and its opportunity structures" (Tomlinson, 2017, 342), suggesting that the role of universities can be extended to offer the chances for the graduates in developing the "bridging ties" (Putnam, 1999) with the external social actors to access the information relevant to the future employment. The concept of strong and weak ties introduced by Granovetter (1985) can be used for showing the 'relational bonds' surrounded the graduates who can benefit

from brokering trust, level of information and inside knowledge; and thus, it is valuable for them to extend the weak ties beyond the formal university space because “the strength of weak ties in the form of a relatively thin spread of social connections and contacts”, like employer contacts, can create the diverse and knowledgeable sources for the graduates and the impact is influential (Tomlinson, 2017, 342). Hence, universities can help to arrange some forms of “bonding ties” for the graduates through extra-curricular activities as an example.

The concept of cultural capital, originated from discussions of the transference of individually valued cultural knowledge validated in the educational context (Bourdieu, 1986) or symbolic capital (Lindberg, 2013), refers to the formal credentials and social standing as a form of cultural synergy and alignment for graduates to enter the labour market. Graduates can find ways to develop the social standing through or beyond the academic education; following Lindberg’s (2013) study of symbolic capital in elite occupational contexts, the graduate medics like prizes won, conference attendances and other wider achievements can add value onto the graduates’ profile during the job seeking (Tomlinson, 2017, 344). Besides, “the manifestation of individuals’ desired embodied behaviours and dispositions” can be part of “embodied capital” within a given field, representing the interpersonal and behavioural expectations of a specific organisational field; once integrated “via accent, body language, humour”, the individual can develop the overall “personality package” to demonstrate their own potential confidence and self-perceptions of value (Tomlinson, 2017, 344). So, it is practical for the graduates to build up the informal network like internships, or some formal recruitment training to “harness embodied dispositions and behavioural competencies which better fit employers’ recruitment practices” (Tomlinson, 2017, 345).

Identity capital refers to the “level of personal investment” that can be extended to the graduates’ abilities to “draw on experiences and articulate a personal narrative to align to the employment domain” (Tomlinson, 2017, 345). According to Cote (2005, 225), identity capital shows how the individuals “invest in a certain identity (or identities) and engage in a series of exchanges with others in a variety of contexts (only some of which are economic)”. It also depends on the graduate’s capacity to develop emerging identities of values, social engagement, intellect and performance to form his or her graduate identity; and then to be warranted and negotiated through discourse and action (Hinchliffe and Jolly, 2011). Following Jackson’s (2016) concept of “pre-professional identity”, the graduates’ early professional development and formation can be developed through the wider “landscapes of practice” facilitated by the universities through the provision of “career services, extra-curricular engagement and other forms of experiential learning”; and the role of curricula and learning is potentially helping the graduates in developing self-perceptions and goals that may form part of their wider career development. Graduate development no longer is confined to “walled disciplinary communities” because the informal dimension of the university experience can help the graduates to develop work-related identity through universities’ diverse experiential offerings. Reproducing the description of skills is not

enough, it is important for higher education to constitute practices “appropriate to future work-related roles and practices” (Tomlinson, 2017, 346-347). In addition, the curriculum vitae (CV), “salient mode of identity projection” or “autobiographical practice” (Morgan and Miller, 1993) is a key tool for graduates to encapsulate a formal presentation of oneself through narrative description of one’s lived experiences and the accounts of their employment to “highlight one’s relative employment value”. The accumulation of work-related achievements and experiences are converted into the “markers of potential organisational value” that become attractive to the employers. It is very popular for graduates to use extra-curricular activities as a vehicle of enriching their profile, making them more competitive when compared to other graduates with “identikit educational profiles” (Roulin and Bangerter, 2013).

The resources of psychological capital can enhance the graduates’ career adaptability (Savickas and Porfeli, 2012) to respond proactively and “withstand what is likely to be inevitable pressure and set-backs over the course of a career” while the development for graduates can be ranged from the “overall self-perceived employability and job search behaviours, through to productive coping strategies” (Tomlinson, 2017, 347). Therefore, self-efficacy is the key, and this capital requires the graduates to develop self-perceived ability to accomplish career goals and the capacity to withstand adverse conditions. It is important for the practitioners to help “frame a graduate’s career goals less around single jobs and job markets and more around a range of pathways”, and to “manage expectations around an education-work transition” that might increasingly be understood as a “reality shock” (Kramer, 1974). Tomlinson (2017, 347) also advises that the graduates need to learn about expectation management and develop the “mindsets around flexibility and career malleability”, better preparing themselves before entering the job market.

2.4.2 The USEM model of employability through the curriculum

Based on the literatures written around the employability topics, they are discussed from three major perspectives: educational policies, employers’ expectations and graduate knowledge, skills, and attributes. In terms of multi-dimensional concept of employability, Little (2001) suggests to distinguish between the factors relevant to obtaining a job and the factors relevant to the preparation for work while Morley (2001) posits employability not just about students making deposits in a bank of skills (Lees, 2002). Knight and Yorke (2002, 261) define graduate employability as “near-tautologous, elaborated as the possession of the understandings, skills, and personal attributes necessary to perform adequately in a graduate-level job”; and the examples of computer industry and social work showing the importance to differentiate what kinds of professional expertise needed to be employable because the nature of discipline would demand for its own specific set of knowledge and skills to perform the disciplinary work. Reich (1991) introduces the education of symbolic analysts in four fundamental skills, abstraction, system thinking, experimentation and

collaboration skills, but is criticised as “giving students a fistful of transferable skills” by Knight and Yorke (2002, 263) who are more attracted to capability, defined as “necessary part of specialist expertise” (Stephenson, 1998, 2), and practical intelligence (Sternberg and Grigorenko, 2000) which is “malleable, not fixed” (Yorke and Knight, 2004, 27). The inclusion of personal qualities in understanding employability and the commitment to academic values, Knight and Yorke (2002) introduce the USEM model of employability by integrating the concept of capability and the insights derived from the interpretation of the literature on cognitive and social psychology.

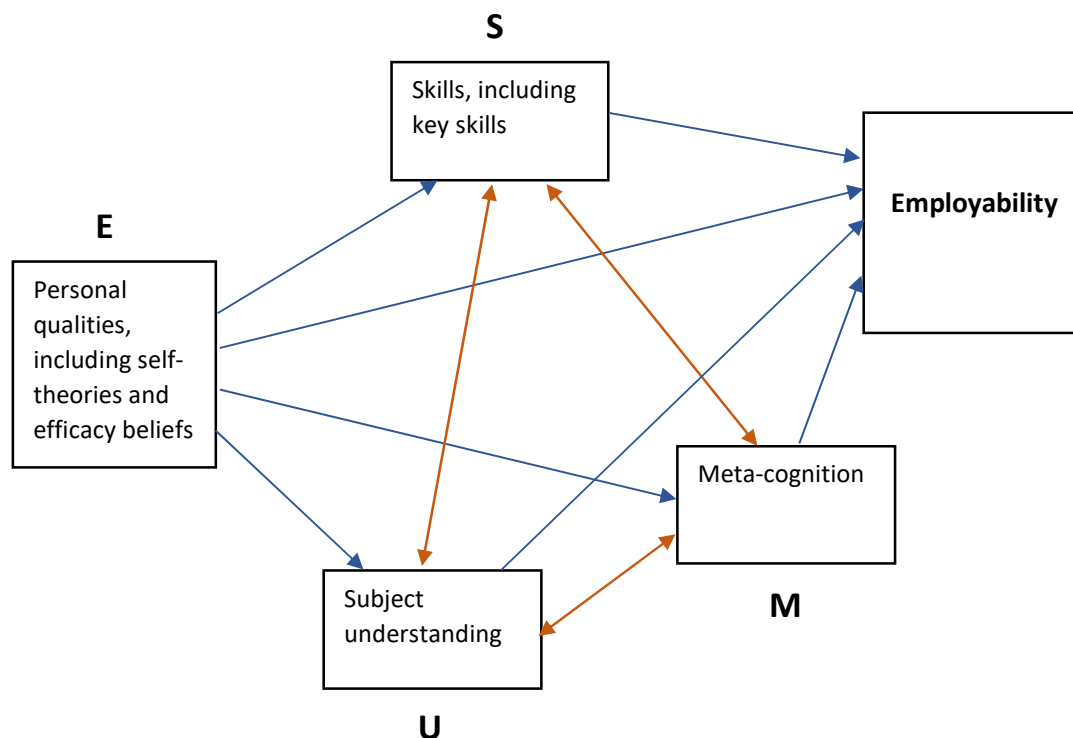


Figure 2.1 The USEM model of employability (extracted from Knight and Yorke, 2002, p.265, *Employability through the curriculum*)

The USEM model of employability, see Figure 2.1 (extracted from Knight and Yorke, 2002, p.265), is a network of interconnected variables, namely, subject understanding (U), and skills, both discipline-based and generic (S), at the expense of the efficacy beliefs, and self-theories generally (E) and metacognition, including reflection (M). This model is distinctive in two aspects: addressing the weakness of traditional curricular design and enhancing the inner potentials of the learners. “Understanding, skills, and metacognition can be mutually supportive and developmental” during the learning process through the learners’ self-awareness and self-reflection; while “the channel between the subject and skills is two-way and the inclusion of personal qualities is a useful corrective to skills-dominated accounts of employability” (Knight and Yorke, 2002, 266). When Knight (2002) comes to explore how

the state of expertise understandings is developed in a knowledge domain, it is impressed that De Corte (2000, 253) gives an insight in addressing the theory-practice gap which can be minimised when learners can manage the “mastery of four categories of aptitudes”, namely domain-specific knowledge base, heuristic strategies for problem analysis and transformation, metacognitive knowledge and self-regulating skills; and positive beliefs, attitudes and emotions related to the subject (Yorke and Knight, 2004, 26). It is suggested that the learning of self-theories and personal qualities in the curriculum can shape qualities, like capacity to cope with error, and problem-working strategies, of the students for their employability in the future. Dweck (1999) describes self-theories as the belief systems and learners’ attributes, like intelligence, are mutable, depicting notion of self-theories in a spectrum spanning from strongly fixed to strongly malleable, and endorsing the power of “malleable” self-beliefs in influencing the way on how a person tackles problems and difficult tasks. “Self-directedness is likely to be needed for success” (Knight and Yorke, 2002, 268) and malleability is more preferred for fostering greater versatility (Yorke and Knight, 2004). However, it does not mean that students with fixed self-beliefs cannot be successful but once facing with some difficulties, they would quickly make judgement in advance on whether they can achieve it or not, making them less persistence in taking on challenging or risky tasks and avoiding any failure. According to Dweck, self-theories are understood to be “strongly embedded”, and these attributes can be changed but “the change will not occur without positive intervention” (Knight and Yorke, 2002, 267). Therefore, “self-theorizing is an important mediator of student learning” (Yorke and Knight, 2004, 26). Metacognition refers to the students’ capacity to reflect on, in and for action (Cowan, 1999) and having it embedded in the curriculum, the students can be developed into mindful and self-regulating persons and in the workplace are “reflective practitioner[s]” (Knight and Yorke, 2003, 7). As what Bevins et al. (2012, 10) suggested, it is worthy for technology and engineering educators to focus some instructional time and activities to enhance the students’ abilities to apply innovation to their thinking, which is “a trait employers seek in workers, a requirement for economic growth, and a trait that can be cultivated through technology and engineering education”.

2.4.3 Work-integrated learning (WIL)

Work-integrated learning (WIL) is a curriculum design intended to integrate theory with workplace practices (Patrick et al., 2008), in which students spend time in professional, work, or other “practice settings relevant to their degrees of study and to their occupational futures”; through specially designed tasks and activities engaged by students who can apply and learn disciplinary knowledge and skills in a real-world context (Smith, 2012, 247). Work-integrated learning curricula and WIL approaches include the commonly notions like placements, internships, supervised practice, simulations, but are not work experience or work-based learning. The rationale behind WIL “goes beyond” the provision of physical environment of a workplace as a site for students to experience work or to learn professional practice and WIL approaches aim for the “close integration” of discipline

learning in university and professional or workplace practice and applications (Smith, 2012, 248; Smith and Worsfold, 2015, 22). Work-integrated learning is a relatively new jargon, but WIL agenda becomes more engaged in universities because of the increasing pressures coming from government policies focusing on productivity gain (Yorke, 2006), the employer demands (Harvey, 2005) for more employable and work-ready graduates (Orrell, 2004) and many students who see education as an investment (Abeysekera, 2006) and study the programme to start a job quicker (Smith and Worsfold, 2015). At the goal of WIL curriculum is to integrate disciplinary or canonical knowledge, skills, professional practice, or identity with those doing in workplace (Billett, 2001). Smith (2012, 259) emphasises that WIL curricula are comprised of the “essential pedagogically relevant characteristics”, “especially the authenticity of the workplace experience and the incorporation of integrative learning as a learning outcome”.

Authenticity is at the heart of all “workplace-situated learning” (Smith, 2012, 250) where the authentic environments and contexts will expose the students to real work settings and situations and they can “observe, interact and respond to that particular context” and WIL curriculum must feature “authentic activities, with complexities” that “match those in real practice”. In addition, authenticity in WIL does not only equate to ‘physical authenticity’ but also refers to ‘cognitive authenticity’ (Herrington & Herrington, 2006), where students can engage in those authentic learning tasks and activities within a particular disciplinary framework (Stein et al., 2001). As what Smith and Worsfold (2015, 37-38) highlighted, the authentic tasks usually not crucial can allow the students learn by mistakes and motivate to achieve real results for a real client. It is very valuable to have such learning process in WIL as it “may help the individual to develop self-efficacy or confidence both as a student (where pertinent learning occurs) and as a practitioner (where useful outcomes or products are generated for the client)”. Observing the correlation between measures of authenticity and other variable factors in the study, Smith and Worsfold (2015, 39-40) consider it the priming effort and the notion of ‘sensitisation to engagement’, saying that when students’ learning experience at university is highly aligned with the workplace, it can prime them to behave differently at the workplace. Just like pharmacy student’s learning task to do medication labelling in a pharmacy, usually seen as a menial task; if the “student rates the labelling experience as authentic given the enhanced awareness of the importance of accurate labelling for avoiding potentially lethal intoxication”, the student knows the consequential nature of this task and thus acts as a profession. In sum, work-integrated learning is thought to provide education that can respond to present and future needs (Alderman and Milne, 2005).

2.4.4 Educational authenticity

2.4.4.1 Authentic experience

In an educational imperative, authenticity is the property of academic curricular and pedagogy, which “calls for a clear correspondence with problems and practices in “the real world”” in the learning process; whereas it is utterly reminded that “this kind of correspondence must be mediated by - or seen as subordinate to - the activities of judgement formation and meaning (sense)-making” (Splitter, 2009, 147); and at the heart of a good teaching pedagogy, it is the “capacity” to let students “make meaning and form judgements based on good reasons” (Newmann et. al., 2001). Within that capacity, it is “each person’s sense of themselves as “one among others” in a community” whereby people can make meaning and form judgements; whilst that sense is refined and cultivated by direct way of dialogical communications among the members in the community. Following Taylor’s (1991) conception about human persons of reason-making and inner dialogicality, dialogue is the ground of learner’s own authenticity and one can make sense of the self and the “one among others” as member of the same dialogical community. The self is “constructed inter-subjectively” (Splitter, 2009, 135); and through dialogical engagement, learners can work out who they are and what they stand for, among the others (Splitter, 2009, 148). In the field of education, authentic experience is the centre in authentic pedagogy and curriculum and such experience is constructed through interactions and dialogue between teachers and their students whose teachers can help them to “acquire and master the cognitive, meta-cognitive, effective and social tools which underlie meaning and judgement” (Splitter, 2009, 147). According to Dewey (1938), lived experience is at the heart of the content and the process in education, and it is reasonably regarded by Splitter (2009, 144) who perceives that there are some kinds of correspondence, or network of relationships underling an authentic educational activity and illustrates that an authentic experience is meaningful and connected, given that the meaning is both “constructed, not given, and transitional, not fixed”. Ideally, if students’ lived experience of the real world is “on a single continuum” (Petraglia, 1998, 27), from the classroom to that beyond it, it is expected that “the need for learning in school is to prepare one for the real world” (Petraglia, 1998, 31); this is an important semantic notion requiring the students to actively engage and perceive in the learning process; and through instruction, they can acquire the desired real world correspondence. To be successful, it is necessary for the students “to develop key cognitive, meta-cognitive and interpersonal skills and dispositions” so as to make senses and meanings out of that correspondence.

2.4.4.2 Construction of knowledge and social constructivism

Splitter (2009, 135) posits that the core of education is to nurture the learners in thinking, meaning and understanding, rather than learning, truth and knowledge; by stating that learning experience in education do not require validation from the “real” world; and thus, he is against the way of analysing authentic engagement simply in terms of relationship between school work and “real” work because “the presence of “real world” connections does not guarantee that teaching and learning will be truly authentic”. Newmann et. al. (1995, 4) observe that students can “process, interpret and negotiate the meaning of new

information” when they are doing exercises collaboratively with other students; and in this learning process, students are active participants in making sense of their experience (meaning-making). Splitter (2009, 139) agrees with Newmann’s constructive view while at the same time, proposes his idea of social constructivism, from which “not only knowledge, but truth, reality, facts, texts, even ourselves, are social constructs, and that learning (knowing, meaning-making) does not depend upon any kind of fixed correspondence with the “real world” out there” because there exists something unknown to people or even cannot figure in any account of knowledge in the world. Considering the epistemological perspective in teaching and learning, when the knowledge claims, as warrantably asserted or justifiably believed outcomes of the inquiries, are not strengthened by adding a conception of truth in the belief or assertion, “such addition would either be redundant” or “meaningless” (Splitter, 2009, 145). Almost in all cases, for learners, as authentic persons engaged in the process of constructing the knowledge for a discipline, their deliberations and findings are linked to the deliberations and findings of relevant “experts” or the “knowledge considered authoritative by others” termed by Newmann et al. (1995, 5). Newmann and his team (1995) are further criticised (Splitter, 2009) by adding the condition that within the discipline, “students’ construction of knowledge must be based on a foundation of prior knowledge” when engaging with “real” problems, tasks and challenges, that is, those produced by the others (Newmann and Associates, 1996a, 24); and once again, Splitter (2009, 139-140), therefore, expresses two concerns in teaching when some teachers practice constructivism to ensure the students’ findings matched with the experts in the field, as that can run the risk of pouring ‘insert’ knowledge on top of “activated” ignorance to the students, as well as, create the risk to “subvert the constructive process”, leading the students to perceive being pushing for the answers that the teachers already knew.

2.4.4.3 Disciplinary inquiry and Authentic intellectual work (AIW)

For authentic pedagogy in constructivist curriculum, in practice, students are required to “master and apply the very disciplinary tools” that successful or expert practitioners use, including the “structured collaborative inquiry with their peers”; and to understand the findings produced by these experts, though “not necessarily accept it as true or as the only truth”. This approach is challenged by Splitter (2009) who is doubtful whether the students can become a truly thinker in this learning environment, where it is possible that the students are conditioned to accept and learn, making the learning engaged genuinely in question. An alternative (Splitter, 2009, 140-141) and better approach, is for the students to internalise both the skills and the dispositions appropriate to “inquiry-based learning and they can examine, test, deliberate over, and really think hard about both the information made available to them, and the responses and viewpoints of their peers who are engaged in the same process alongside them”. At least, those students can accept what they learned as “the (tentative) outcome of their own inquiry” as scientific knowledge in its own right. Promoting students as reflective inquirers within the same disciplinary framework, they

become engaged learners as authentic participants in that discipline, having a genuine place in the ongoing construction of the discipline. The reason for student work becoming more authentic and similar to the work outside, is the authentic process that can promote genuine discipline-based knowledge construction and interactive inquiry, grounded in the disciplines and other activities, that making the work bound to be meaningful and fulfilling to the learners, without the need to going via the “real world”. Nevertheless, Splitter (2009, 142) reminds that “inquiry-based teaching is not context-free” and it is the job of the teachers to provide the appropriate contexts for the classes.

According to Newmann et al. (1996b, 283), disciplinary inquiry is viewed as cognition work featuring authentic academic achievement, consisting three main characteristics: based on the prior knowledge accumulated in a field, one can further the authentic accomplishments; the “striving for in-depth understanding rather than superficial awareness” by creating “relationships among pieces of knowledge that can illuminate a given problem or issue”, and “expressing conclusions through elaborated communication” in terms of verbal, visual, symbolic, narratives, explanations and etc. Following the line of teaching and cognition research, the centrality is on how teachers challenge intellectually the students in applying the core disciplinary theories and knowledge while guiding their learning effectively through the curriculum design. For effective teaching, teachers need to “pose challenging questions and press students to justify their answers with evidence”; and so do “support cognitive autonomy” by encouraging them to generate the solutions to problems that can be applied meaningfully outside the classroom setting (Newmann, 1991; Saye et al., 2018, 866). Newmann and his colleagues, as the core study on authentic intellectual work (AIW), have influenced the international researchers to consider AIW components in their study between authentic pedagogy and student learning. Saye et al. (2018, 870) launched the research project to study the individual teachers’ practices by adopting the model of AIW indicators for classroom instruction, covering higher order thinking, deep knowledge, substantive conversation, and connectedness to the real world. The deeper understanding of AIW (Saye et al., 2018, 878-879) is obtained by seeing the “scores for connectedness and substantive conversation to be notably lower than scores for the other AIW standards” and it is consistent with the disaggregated AIW scores from previous research studies that there is “the persisting difficulty of developing assignments that ask students to address real-world problems” (King et al., 2001, 7); and the difficulty in addressing the quality of classroom discussions that demands for complex skill and intense effort in the planning and implementing of the substantive discussions (Parker and Hess, 2001).

However, Splitter (2009) argues that the criteria of relevance and meaningfulness should be equally accounted for the value beyond classroom on those student activities and assessment tasks connecting to the world. It is valuable to have students’ learning on the authentic tasks, but that value should not be restricted to the single purpose of assessing competence as promoted by Newmann et al. (1996b) and Gulikers et al. (2008). The criterion of relevance is not sufficient enough to be authentic, rather is the meaningfulness

of the experience, which “constitutes a broad array of connections of which relevance, as normally construed, is only one”. When the discussion between students and their teacher is rich in meaning, through “higher order thinking and disciplined inquiry in the subject content”, the discussion and the inquiry were authentic as they stood. Hence, “the additional requirement of relevance to a “real world” issue would have been redundant”. As the nature and depth of the problems can influence the structure of the lessons and trigger a mode of inquiry, it is observed that “subject matter and pedagogy are, or should be, interdependent”. Based on the rationale of a rich and open-ended task, it can let the real thinking begin and students may still find it meaningful in spending time on the task, though it is not attached with any assessment or relevance to the world (Splitter, 2009, 142).

2.4.4.4 Educational understanding of authenticity and its implications in education

As a property of academic curriculum and pedagogy, educational understanding of authenticity can be viewed as very closely related to the common understanding. The authenticity of ordinary material identity is described in absolute term like authentic coin; but when something is described as authentic, it is something to be “worthy of acceptance or belief by reason of conformity to fact and reality” (Petraglia, 1998, 15). According to Splitter (2009, 136-138), “relationships of conformity are relationships of similarity”, it is “a matter of degree”, not kind, in terms of “greater or lesser authenticity”, not authenticity per se. It is important to understand that perceptions of similarity are “highly subjective” (Gulikers et al., 2008, 402) and “contextually relative”, and the “sameness of type is a relation of similarity”. Therefore, the relation between classroom work and those activities taken place beyond the classroom can be assessed by the kind or type of conformity. The work of Newmann et al. (1995) posit the object of authenticity as an object or an entity external to one’s consciousness; whereas some scholars offer an opposite view that Gulikers et al. (2008, 402) see “authenticity is not an ‘objective’ quality” in the study of assessment authenticity in professional practices which is “dependent on perceptions” (Gulikers et al., 2004, 69); while Splitter (2009, 136) sees persons or entities, which are both “constitutive of and dependent upon persons, such as experiences, thoughts, actions, and lives”. Based on moral grounds, persons are “in being subjects (of awareness)”, and thus not objects at all. Following the philosophy of authenticity, it can be declared that with respects to the self, what is inner is true and genuine and what is outer is a mere shadow and something derived. Splitter (2009) accepts the concept of authenticity as defined by “privileging the inner over the outer” (Guignon, 2004, 81).

Being authentic, it is necessary for a curriculum, problem, pedagogic method, or mode of assessment to correspond both what is in the world beyond the classroom, and to what ought to be; it is the sense of normative ideal in making value judgements in the claims of authenticity. For authentic learning, learners should be persuaded and not just told, and

that the desired correspondence is between what we want them to learn and their own understanding of the world, not the world per se. As what Petraglia (1998) said, it is very demanding to have the transformation from presenting the students of new and improved 'reality kits' or 'pre-packaged' pieces (Splitter, 2009) to that of persuading the learners. Again, this transforming process involves value judgement, as this kind of educational experience can demand the students to make sense of what they learn by connecting them to theories, principles, and experiences that matter to them (Splitter, 2009, 143). Inquiry and deliberation are dialogical processes involving reasoning and when all the inquiry is probable to be fallibilistic, it implies the possibility that some knowledge, previously as the result of inquiry and claimed as truth by some exemplary students and scholars, might be mistaken; that is why Splitter (2009, 145) follows Dewey and Peirce to admit that "truth is ideal, but only in a temporal or transitory sense". Assuming that "inquiry lies at the heart of all good teaching and learning", it is reasonable to accept "teachers and students operate within a fallibilistic framework". Following this understanding, given that the centrality of constructivism is built into "a dual sense of commitment to which is claimed as knowledge, and to the process of inquiry that ensures a warrant or justification so to claim, then constructivism is safeguarded against accusations of relativism". In other words, this commitment is good for motivating students and their teacher "to tread cautiously and watchfully in the realm of claims to know", as well as, encouraging both parties to act collaboratively, by way of inquiry into what they believe and why, as those relevant experts in the field.

2.4.5 Authentic learning environment and authentic assessment

2.4.5.1 Instructional technology learning environment

Splitter (2009, 135) articulates classroom environment to become "classroom community of inquiry" as an environment, having the "dual function of cultivating disciplined inquiry and facilitating the kind of personal development"; but that is not equivalent to the authentic learning environment for practising the workplace practices. In classroom, working in practice for competence development, the students are assigned with the learning tasks whose authenticity in resembling the work practices is relative to a situation, place, or profession (Gulikers et al., 2006). The theory of situated cognition or situated learning (Lave and Wenger, 1991) can help to promote a model of instruction with implications for classroom practice (Brown et al., 1989), having the capacity to promote authentic learning as Herrington and Oliver (2000) observe that the instructional technology community is the constructivist computer-based learning that can promote the model of situated learning in conventional classrooms as a model for teaching with practical classroom situations. Wineburg (1989) acclaims that "the abstract representation of knowledge was at least as effective as the situated learning approach and much more readily implemented in the classroom" (Herrington and Oliver, 2000, 24). But this approach is criticised as not cognitive apprenticeship because the model of instruction is based on how closely the learning

environment is resembled. Tripp (1993, 75) stressing that “computer-based simulations are not sufficient and reiterated that true expertise is learned by being exposed to experts”; and Hummel (1993, 15) strongly emphasising that “[electronic] courseware becomes the learning environment and not the authentic situation”. Nevertheless, Herrington and Oliver’s (2000, 41) study of multimedia program in mathematics education, their findings confirm that “authentic assessment can be used successfully in multimedia, albeit not encapsulated with the software itself, but as part of the learning environment”. McLellan (1994, 8) acknowledges the learning in context requirement in situated learning model and states that “context can be the actual work setting, a highly realistic or ‘virtual’ surrogate of the actual work environment, or an anchoring context such as a video or multimedia program”.

From students’ perspective (Herrington and Oliver, 2000, 41-42), they appreciate the blurring of the two in the multimedia program, where “theory and practice were combined” in the authentic context, no need to be challenged in the engaging process of “application” and “generation” (Henderson et al., 1994), implying that “the situated learning framework appeared to pre-empt the need for these interventionist strategies”. To conclude, situated learning can be an effective instructional paradigm to guide the learning of an appropriately complex task and “cognitive apprenticeship” is considered as useful instructional paradigm (Collins et al., 1991, 45) while the reflective report produced by the students can become the authentic product. Khaled et al. (2015) argue that teachers’ view on the profession may develop the hands-on simulations too complex for young and inexperienced students, possibly creating the problems like information processing overload (Merrienboer and Sweller, 2010).

2.4.5.2 Authentic assessments on students’ learning for professional practice

Authenticity is the quality criteria in competence-based assessment, comprised of the tasks reflecting the competence to be assessed, the content of assessment involving authentic tasks to represent real-life problems, and the thinking processes following on how the experts do in solving the problems in the knowledge domain (Gielen et al., 2003). With respect to the context of assessment goals, Gulikers et al. (2004, 69) define authentic assessment as “an assessment requiring students to use the same competencies, or combinations of knowledge, skills, and attitudes, that they need to apply in the criterion situation in professional life”. The educational goal of authentic assessments is to stimulate the students to have deep learning on those work-related activities and to develop more professionally relevant skills or competences (Boud 1995; Gulikers et al., 2006, 2008). Serving for this orientation, authenticity is defined in terms of its “resemblance to students’ (future) professional practice” (Gulikers et al., 2004), making authentic assessments become the tools to show students the link between learning and working in practice and direct their learning towards professional skills’ development. This practice is highly concentrated

in vocational-based curricular, used for achieving the correspondence between learning and working. According to Boud (1995, 36), learning can be influenced by assessment in three ways, including by the intrinsic or objective qualities of the assessment, by teacher's interpretation of the to-be-assessed material, and by student's interpretation of the task on hand and the context of the assessment.

With respect to assessment authenticity, if authenticity is interpreted by the degree of resemblance between the assessment and students' professional practice, it will make authenticity as an objective construct but "authenticity is not an objective quality" (Gulikers et al., 2008, 402). "Something is only authentic with respect to something else, for example a situation, place or profession" (Gulikers et al., 2006). When a person considers an assessment as authentic or not, he or she creates a "reference point in mind against which the authenticity is measured" (Gulikers et al., 2008, 403). Moreover, a person's perception of authenticity can be changed and affected by the amount and kind of practical experience, schooling, or age (Lizzio and Wilson, 2004; Petraglia, 1998). Gulikers et al. (2008, 403), therefore, conclude that in reality, "authenticity is in the eye of the beholder". In schools, it is observed there are differences between teacher and student perceptions of a learning environment or assessment (Boud, 1995; Gulikers et al., 2008). Teachers often use an assessment to send a 'message' to their students about the expected requirements in the learning; but students' perception of this message is not necessarily synchronising with their teacher's intention. Coping with the learning, students create their own 'hidden curriculum' to interpret the assessment practices based on their own perceptions (Boud, 1995).

There are some issues on authentic assessment between teachers and students that can affect the authentic educational practice. Firstly, the gap of assessment authenticity is observed between teachers' beliefs and their actual assessment practices (Orrell, 2003) as there is "no one-on-one relationship" between the teachers' belief of implementing and what they actually implement. Many educational practices are criticised as the "existing assessments that are 'dressed up' with some realistic elements" (Cummings and Maxwell, 1999) as those teachers are "not yet internalised or accepted the underlying beliefs about these kind of assessments" (Gulikers et al., 2008, 409) whereas the impact can hamper the learning of the students (Cooper, 1994) who are those experiencing the actual practices only. Therefore, Maclellan (2001) argue that the "greatest disjunction" between beliefs about good assessment practice and actual practice can be associated with authentic assessment (Gulikers et al., 2008, 408). The second issue is on authenticity of professional practices as teachers have a more detailed frame of reference for interpreting authentic assessment than student do (Gulikers, 2006). Based on their educational and practical experience, teachers develop the assessment practices according to how and what they think of the authenticity for the professional field (Lizzio and Wilson, 2004) without the need to take students' ideas into account; and it is called "pre-authentication" (Petraglia, 1998, 53), referring to "the attempt to make learning materials and environments correspond to the real world prior to the learner's interaction with them". The problem is

the learners or students may have different perception of authenticity in the real world, but their perceptions of the assessment practices determine their learning. According to Gulikers et al. (2008, 409-410), the discrepancy between student and teacher perceptions may come from both sides, for “students do not have an accurate or complete picture of what professional practice entails” while many teachers do not work in jobs they are educating, or their beliefs of the professional field are unrealistic or outdated. Students’ perceptions about the real world of work creates another problem after they graduated for work as they experience a ‘reality shock’ (Pena, 1997), which shows that what they experience in graduate job is different from what they expected while studying, and some findings suggest that “students remain in a ‘school-based frame of reference’ for interpreting their assessments that is changed after leaving school and entering the labour market”. When teachers and students can have misconceptions in perceiving authentic assessments, it is worthwhile to develop the authentic assessments collaboratively for those competence-based curriculum.

2.4.6 Experiential learning, learning space, network space, and networking

2.4.6.1 Experiential learning

Based on constructivist theory of learning conceptualisation, knowledge is the learning outcome generated in the learning process where the learner goes through two kinds of experience, the grasping experience in taking in information, and the transforming experience in understanding and actioning. Following experiential learning theory, social knowledge is created and recreated in the personal knowledge of the learner, and that can become new form of contextual knowledge in socio-historical context. The experiential learning theory (ELT) developed by Kolb and Kolb (2013) is based on the learning-oriented propositions with some inherited from the famous foundational scholars of experiential learning. Learning is best conceived as a process, not in terms of outcomes, meaning that the process and the goal of education are one and the same thing. When all learning is re-learning, the key for success is relying on the learner’s ability to make proper interpretations and comparisons during the re-learning process. The learner needs to learn how to balance the opposing modes when facing the conflicts, differences, and disagreement with the external world. When the learner decides for taking on a new experience, the learning can be influenced by the actual occasions he or she is currently experiencing, which in turn, are determined by the characteristics of the learner and the learning space where the learning transactions are taking place, in higher education, classroom environment and the beyond. Therefore, learning is a holistic process for whole person development and for adaptation to the world.

2.4.6.2 Learning space

Learning space refers to the learning spatially multi-dimensional in terms of cultural, social, institutional, and psychological levels, extending the learning process from the traditional physical classroom environment (Kolb and Kolb, 2013). This conception is built on Lewin's field theory on life space where the person and the environment are interdependent in the learning process, in addition to activity theory of social cognition (Vygotsky, 1978) and situated learning theory (Lave and Wenger, 1991). Therefore, social knowledge contributes to the understanding of the learners who are encouraged to participate in the wider community of practice. With the knowledge creation theory (Nonaka and Konno, 1988), the learning in the shared space promotes care, trust, and commitment among learners and their interactions with the others. Learning space is becoming more important, Brown and Long (2006, 9-10) highlight the three emerging trends on the design. Following the learning principles, the design of learning space requires the alignment with the understanding on how people learn, enabling the configuration of constructivist learning spaces to promote active learning and deliver value for learning. Second, human-centred design can put focus primarily on the learners, demonstrating on "why is the design" accommodated the learning activities intended for them. The third one is the design that can facilitate the learning spaces by "learning-driven" rather than "teaching-driven" in the future.

2.4.6.3 Network space

According to Huggins et. al. (2012, 204, 207), network space is defined by "the nature of the relationships, interactions and ties" across a range of "interpersonal networks" occupied by "inter-organisational network actors". The distinction between social capital and network capital rests on individual level versus enterprise-level, including regional and global level. Under the conceptual network space, social capital is focused on the individual members' social interrelations while network capital is "in the form of more calculative and strategic networks designed specifically to facilitate knowledge flow and accrue advantage for firms" (Gulati, 2007; Huggins, 2010). Functionally, the value of "social structure" is the resources in the network that actors "can use to achieve their interests" (Coleman, 1998, S101) and thus, inter-organisational networks are regarded as the strategic resources for firms to facilitate effective knowledge exchange and innovation in the long run. In summary, social capital is capital assets and network capital is "relational assets", serving as a complementary concept to social capital in the creation of network space (Huggins et. al., 2012, 224). When social capital's culture of obligation, norms, and trustworthiness (Coleman, 1998; Huggins et. al., 2012, 207) is posited as secondary to the fulfilment of social motives for approval and prestige, aiming for attaining the personal interests and advantages, "Locke (1999) argues that there is a potential loss of objectivity in linking business and social relationships" as the ways people communicate are becoming more selective and subjective. However, Coleman (1988, S100, S117) states that "the value of social capital can be both economic and

noneconomic” and he does not reject the economic value of social capital and describes those people as “rational actors”.

2.4.6.4 Networking

Networking is an individual behaviour that can create many forms of valuable social capital including advocacy, introductions, and mentoring, through these activities to enjoy the “information benefits” derived in forms of “access, timing, and referrals” (Nahapiet and Ghoshal, 1998, 252). When the ‘know-whom’ is valued almost as much as the ‘know how’, networking becomes a key imperative of contemporary capitalism (Grabher and Ibert, 2006) because the participants make new contacts and enhance the scale of their “personal knowledge networks” which are “perceived as homogeneous, cohesive, and local personal ties”, and that can be seen “to compensate the shortcomings of the formal organisation” (Grabher and Ibert, 2006, 251) through informal network (Cross and Prusak, 2002). So, networking is seen as goal-directed behaviour to promote a system of “interconnected and cooperating individuals” (Luthans et al., 1998, 120) that can improve the structural dimension of social capital and to gain access to valuable information and resources (Adler and Kwon, 2002). If “relationships are nurtured” through sharing resources and supporting each other, “it boosts trust and identity formation” (Batistic and Tymon, 2017, 376); and through a history of interactions, the relational embeddedness in personal relationships is developed and strengthened (Granovetter, 1992) because of the presence of personal and emotional attachments. When there is personal bond created, it promotes the quality of networking as strong ties (Granovetter, 1973). Lin (2001) proposes that strong social networks can elevate the credential of job seekers because these networks can bring them the resources, potentially positive recruitment referral through “putting in a good word” which can be decisive in selection situations (Stiff and Vugt, 2008). Social relationships are seen to provide access to career management resources in enhancing employability (Burt, 1992; Granovetter, 1973) and a good example is the arrangement of instrumental and targeted networking through use of “calculative ties” (Huggins et al., 2012, 204).

Based on the observation of Bourdieu (1986, 249), the existence of connections is “the product of an endless effort at institution”, not a natural given or a social given. Baker (2000) identifies distinct attributes and measures of social capital through use of sociometric techniques and this approach can make possible for people to develop their social capital profile. To develop a person’s career, including “practitioners” (Nahapiet and Ghoshal, 1998, 262), it is advised that deepening and developing new relationships can be of comparable benefit as “people can accumulate social capital just as they can accumulate knowledge or wealth” (Tymon and Stumpf, 2003, 18).

2.4.7 Knowledge retention

2.4.7.1 Intellectual capital and absorptive capacity

In economic sense, knowledge is the most powerful engine of production (Marshall, 1965). Nahapiet and Ghoshal (1998, 243-246) refer intellectual capital to “the ‘knowledge and knowing capability’ of a social collectivity, such as an organisation, intellectual community, or professional practices. The rationale underpinning this definition is two-folded. Firstly, it recognises Polanyi’s (2009) to consider knowledge as object and knowing as action or enactment, actively shaping of experience performed in the pursuit of knowledge. Secondly, it reflects “the significance of socially and contextually embedded forms of knowledge and knowing as a source of value”. Fundamentally, knowledge and meaning are always embedded in a social context, where the shared cognition, “through the existence of shared language and vocabulary”, and “through the sharing of collective narratives”, can help to facilitate the creation of intellectual capital (Nahapiet and Ghoshal, 1998, 253). According to Nonaka & Takeuchi (1995), knowledge can be advanced through development of new concepts and narrative forms; and shared language and codes can help to enhance combination capability through social exchange, provided that “different parties must have some overlap in knowledge” during the exchange process (Nahapiet and Ghoshal, 1998, 253). Regarding the shared narratives in creation and transfer of new interpretations of events, Clark (1972) proposes to use myths, stories, and metaphors to articulate the rich sets of meanings while Bruner (1990) suggests two forms of cognition modes for knowledge creation, the information or paradigmatic mode and the narrative mode. Specifically, metaphors can cut across different contexts by combining the imaginative and literal observations with cognitions (Bateson, 1972) and the work of Orr (1990) shows the power of narratives in the exchange process of practice and tacit experience between technicians, through storytelling, they can discover the problems and develop the improved practices accordingly. According to Nahapiet and Ghoshal (1998, 248-249), the creation of intellectual capital can be conducted through combination process and exchange activities as pre-requisite for resource combination, while the “combination capability” is contributed by ‘absorptive capacity’. Examples of intellectual capital, in form of intellectual properties, are technologies, copyrights, patents, and trade secrets (Tyman and Stumpf, 2003).

Absorptive capacity (Cohen and Levinthal, 1990, 128-129) as innovative capabilities is the presence of prior related knowledge as the pre-condition, together with the “ability to evaluate and utilize outside knowledge”; and that can simply refer to basic skills or a shared language, or even the knowledge of some scientific or technological developments in a given field. It is observed that absorptive capacity is supported by the studies in cognitive and behavioural sciences at the individual level; and prior knowledge can enhance the learning in the general knowledge, in subsequent learning tasks as well as in problem-solving skills. According to the research on memory development, the accumulation of prior knowledge increases both “the ability to put new knowledge into memory” and “the ability

to recall and use it", allowing "the more objects, patterns and concepts that are stored in memory, the more readily is new information about these constructs acquired" that the individual can use them in new settings (Bower and Hilgard, 1981, 424). Associative learning is interpreted as those "recorded into memory by establishing linkages with pre-existing concepts" that new knowledge is affected by the breadth and varieties of categories in the prior knowledge acquired by the individuals (Bower and Hilgard, 1981). However, Estes (1970, 16) argues that even without the prior experience with a learning task, an individual knows how to learn better, and the accumulation of prior experience may simply imply the need for relatively less learning in attaining a given level of performance. In terms of problem-solving methods and heuristics, Pirolli and Anderson (1985) found that almost all students using "analogy-to-example" programs and their understanding on how these examples worked determined their success in developing new programs. Cohen and Levinthal (1990, 130) argue that learning capabilities and problem-solving skills have similar mode of development and thus, the effect of prior relevant knowledge and skill can enhance creativity, "permitting the sorts of associations and linkages that may have never been considered before".

Based on the learning sets identified in Harlow's (1959) work, the behavioural phenomenon of "insight" typically refers to the rapid solution of a problem (Ellis, 1965, 35). Considering the psychology literature, both creative capacity and absorptive capacity can be regarded as the same. Firstly, when the material is processed more deeply in association with those learned previously, the later retrieval of the item will be better (Lindsay and Norman, 1977); and secondly, the foundation of learning-set theory is based on the rationale that learning in solving problems is accumulated by many practice trials on related problems, though Harlow (1959) discovers that if practice is discontinued before the learning in solving a particular type of problem is reliably acquired, little transfer of knowledge will occur to the next series of problems. Learning is cumulative, and thus the richness of the pre-existing knowledge structure can affect the power of assimilation, implying that an individual's expertise will change only incrementally; but knowledge diversity is a more robust basis in learning environment, meaning that the innovative process of an individual is enhanced in making better novel associations and linkages. Therefore, Cohen and Levinthal (1990, 131) point out that organisational absorptive capacity is "not" simply "the sum of the absorptive capacities of its employees" but tends to "develop cumulatively".

2.4.7.2 Notions of encapsulation

Through exploring mathematics discipline and object constructions, Tall et al. (2000, 239) find that encapsulation method can be used for turning a process to an object or an entity, and this way of thinking can allow a rich concept image converting to be a manipulable entity, in part, by "using mental processes and relationships to do" mathematics and in part, to "use a name or symbol to mentally manipulate, and to think" about mathematics. This

concept is largely contributed by Piaget's notions of abstraction, empirical abstraction defining the perceived objects, reflective abstraction constructing the platonic objects, and higher-level reflective abstraction enabling the pivot between process and concept. Leveraging this notion, the academic value of encapsulation method can be perceived for examining the transformation and retention efforts during the learning process and this concept is borrowed in this study. The subtle meaning (learners' understanding in my study) of the perceived objects (can be a task or a step when doing the lab exercises or can be a solution in tackling a problem in a case study) in the learning environment (in context) can be sought through the verbal descriptions and definitions (like experience sharing). The process on the real-world objects (like practical solution, industry practices in my study) can be performed and symbolised in the same way. The properties of the axiomatic objects (learning tasks) can allow specifying criteria and those properties can be deduced by formal proof. It is worthwhile to look into how encapsulation can be articulated. Tall et al. (2000, 235) study Piaget's proposed idea in turning actions and operations to thematised objects of thought or assimilation through abstraction, admitting that pseudo-empirical abstraction focuses on actions and their subsequent symbolisation and conception as "encapsulated objects". Dubinsky et al (1988, 45) consider Piaget's notion of permanent object and offer a single, unified theory of encapsulating cognitive processes as "cognitive objects", in which "encapsulating the process of performing transformations in space which do not destroy the physical object"; and the individuals possess the ability of repeating the actions. Tall et al (2000, 225) interpret that when the individual can describe or reflect upon all the steps in the transformation without necessarily performing them, "the action becomes a process". When coming to the next step, after noticing the totality of the process, the individual realising that transformations can act on it, and then able to construct such transformations, "a process becomes an object". The key for success is whether the learner can possess the ability to view the self-contained whole entity as a permanent object in its own right and then convert the already condensed process from an operational to a structural mode of thinking (Sfard, 1994) into an object-like entity in his or her mind (Tall et al., 2000).

The saliences of conversion in states of human thinking, imagination, and comprehension is central to the meaning and understanding of the world by the learner (Sfard, 1994, 45). Meaning is characteristic of signs and concepts and "it is a kind of externally determined "cargo" carried by symbols and sentences". Sfard supports Johnson's (1987) objectivist view in defining meaning, understanding and knowledge. Meanings are "disembodied" and received by a human mind rather than shaped by it. Understanding is considered as "grasping the meaning", the process mediating between an individual mind and the universally experienced, absolute, ahistorical realm of facts and ideas. Objectivism views understanding as "somehow secondary to, and dependent on, predetermined meanings" (Sfard, 1994, 45). When it comes to the process of locating the understanding related in the inner sensations, Sfard (1994) admits that there is no better than the means of inquiry into the learner's meta-cognitive skills.

2.4.7.3 Transferability

According to the works of Mason et al. (2009) and Wilton (2011), there is limited efficacy of formal skills-centred provision to promote graduates' employment outcomes. The key issue is the "contextual barriers", making the employability skills acquired in universities not "simply be transferred given that so many of the actual skills graduates deploy are derived from, situated in, and further generated through, the actual work context in which they are utilised" (Tomlinson, 2017, 340). Both hands-on laboratory practices and case-based exercises are considered as the teaching methods used for strengthening the integration between theory and application, which can in turn support for knowledge retention. During the laboratory sessions, students can practice the laboratory exercises designed to demonstrate concepts previously presented in the lectures and these hands-on learning activities can enable the students to acquire declarative knowledge by performing the practical tasks. The weakness is this incidental learning unlikely to have permanent or longer term of memory until there are follow-up repetitions and practices (Shell et al., 2010; McFee et al., 2018). For case-based exercises, they are designed in case-based learning or problem-based learning, organising around authentic problems and projects. Both designs, though, are problem-centred approach with problem-based scenarios (Bevins et al., 2012), new knowledge is acquired differently. Case-based learning exercises require the learners to apply both what they learned and their prior experiences in solving the current problems; and thus, forward reasoning is expected in learning. Problem-based learning exercises involve the open-ended exploration of the problems, requiring backward reasoning, and is considered more difficult because the design rationale for open-ended problems is "no one best solution" (Bevins et al., 2012, 11). Hence, case-based learning approach, used for supplementing a more traditional curriculum, is relatively easier because the basic concepts covered in the case studies are usually taught in classes before discussing the case (McFee et al., 2018). Bransford et al. (2000) cite that problem-based learning is highly applicable for medical schools for crafting the excellent educational experiences and best preparing for the medical students' competencies (Barrows, 1985); whilst for technology and engineering programmes, it can support the students to "develop their innovative powers to solve technical problems" while localised problem-based scenarios "whose solutions will make a difference to the growth of the students" (Bevins et al., 2012, 11). Case-based learning, on the other hand, is deemed to be guided learning, making the traditional classroom learning, like in business school and law school, more relevant to the subsequent workplace.

There are three major factors that can hinder the flexible transfer of knowledge. Firstly, is the context of original learning as people may fail to transfer the learning from one context to other contexts. Secondly, is how stickiness is the learning in context at the time the knowledge is acquired (Eich, 1985) because learning transfer across contexts is very difficult, especially when a subject is taught only in a single context rather than in multiple contexts (Bjork et al., 1989). However, if the learners can learn the subject in multiple contexts, supported by some examples, they are more likely to abstract the relevant features of

concepts and to develop a flexible representation of knowledge (Gick and Holyoak, 1983). Thirdly, is related to the overly contextualised learning, with case-based and problem-based in particular, undertaken through instructional programmes that the information presented in a context in attempting to solve complex, realistic problems (The Cognition and Technology Group at Vanderbilt, 1997; Barrows, 1985). It is because overly contextualised learning content makes flexible transfer to new situations very difficult. In response to the above obstacles in knowledge transfer, Bransford et al. (2000) proposes three teaching guidelines for teachers. First, teachers need to prepare additional but similar teaching cases, in addition to the first but specific teaching case as this approach can help the learners to abstract general principles from a list of similar case-based examples. Second, learners need to learn both “what-is” in a specific context and “what-if” by solving the problem. Third, learners need to learn how to generalise the case and it can be done by learning how to create a solution that can apply for a whole set of the related problems.

2.5 Conclusion

In the 21st century, the role of higher education is very much varied in according to the stages of economic development in the respective nations. Human capital is the pre-requisite for economic growth, implying the importance of educational attainment of the labour force (Benhabib and Spiegel, 1994), and the competencies and capabilities acquired by the workforce (Tyman and Stumpf, 2003). According to Coleman (1988), social capital can influence the development of human capital while network capital (Huggins, 2010) is embedded resources in knowledge networks (Maggioni and Uberti, 2009), supporting the individuals to take more effective action (Drucker, 1989). Universities are regarded as the largest ‘knowledge-based institutions by the policymakers whose policies can influence the supply of graduates and the occupational skills through the government funding allocations. Together with the popularity in the political world of university ranking league tables, higher education is increasingly engaged in the triple ‘economic-social-political’ role in the 21st century and universities are described as knowledge factory (Aronowitz, 2000). The massification in higher education has been viewed as worldwide phenomenon, leading to the issues of credential inflation (Tomlinson, 2008), overcrowded graduate labour market (Anderson and Tomlinson, 2021), and possibly the imbalance supply and demand in the labour market while increasing the pressure on individuals’ human capital and thus, it is recommended for the graduates to build up more “behavioural competences” (Tomlinson, 2008, 51) to strengthen their personality package (Tomlinson, 2017) so as to distinguish themselves from the other job seekers. When knowledge is perceived as easily obsolete by both employers and educators, the employers hope that the university education can help the graduates to develop more key competencies whereas they look for competent candidates in the recruitment process and even turn the graduates to become ‘social magic’ (Ashley et. al., 2016) if unable to find the suitable candidates.

Employability agenda can be interpreted as the process model (Forrier et. al., 2015) or the personal resource model (Peeters et. al., 2019). The process model refers to the movement capital (Trevor, 2001) in the labour market while the conceptual employability capital is developed in a matrix of 'employability distinction' and 'capital distinction and the work of Peeters' team finds that social capital is loaded on all dimensions of employability, implying that social capital is the essential resources in all stages of employability, job-related, career-related, and development-related. There are primary and secondary IT sectors (Trauth et. al., 2007) to demand for IT professionals and the technological advances create new sets of knowledge and skills required in the existing job roles, and new job groups but less jobs for low-skilled labour. The top two most identified knowledge deficiencies in the IT graduating students are oral communications and written communications (Radermacher and Walia, 2013). Tomlinson (2017, 339) proposes the conceptual forms of graduate capital as the resources for graduate employability, in terms of human, social, cultural, identity and psychological dimensions, and it is regarded as the key resources potentially in empowering graduates to find jobs as well as to make transitions from the university to the job market. For IT curriculum structure and design, career path or distinctive concentration is commonly adopted, and the involvement of IT practitioners in curriculum design and teaching is also proposed. The USEM model is designed through embedding the understanding, skills, efficacy beliefs, and metacognition in the curriculum design, to influence the graduates' employability. In terms of integrating theories with the workplace or professional practices, work-integrated learning approach is considered as the curriculum design for learning disciplinary knowledge and skills in a real-world context. To assess the authenticity of university learning for professional practices, there are some differences between constructivism approach and social constructivism approach, as the latter stresses the need for meaningfulness on top of the relevance, but authentic learning is no need to go via the real world. Outside the classroom, experiential learning can help the students to acquire the social knowledge, through the shared space during networking, meaning that the extra-curriculum activities can play a role for supporting the students' learning in the field. For graduate employability, it is viewed as both getting a job and doing a job.

CHAPTER 3 RESEARCH METHODOLOGY

3.0 Introduction

This chapter describes the journey in planning, learning, revisiting, and decision-making process that is experienced as a novice qualitative researcher when designing the methodological approach in this research study. Familiar with the IT industry, it is observed that the effort made by the practice-led teaching staff imparting their professional experience in the industry onto the students is highly appreciated and meanwhile, it is important to understand the learning experience of the IT university students and so does the impact on their graduate jobs and the career development. IT has become a very dynamic field since the emergence of the internet technologies, and it has already changed the business landscape of many different industries, requiring them to compete for their market survival. The emergence of the e-commerce business models promotes the new channels of online businesses supported by the electronic payment systems which can be made available for both organisations and individuals, creating the globalised world of 24 hours in doing businesses for 7 days and for 52 weeks. When every company can easily set up their own website to communicate with the external, the global marketplace is virtually formed because, though you are not reaching out, it is possible that other people or companies can be looking for you. Correspondingly, there is increasingly demand for new innovative IT systems, new internet-enabled infrastructure, and more IT professionals, implying the split between “old knowledge” and “new knowledge” in IT field, requiring for upskilling the existing knowledge and new sets of IT knowledge and skills. This phenomenon of knowledge easily obsolete is known by both the employers (Humburg et. al., 2013) and the educators (Lee et. al., 1995; Noll and Wilkins, 2002). Many of the existing IT products and applications are no longer upgradeable to new business platform or many new IT products or applications cannot be installed and running on the existing IT infrastructure of the companies. Based on the field I am familiar with, I am keen to study a group of teaching staff, possessing the working experience in the IT field or the technology-enabled sector, prior to joining the teaching profession in universities. The university students taught by these teachers are also included in the study as the students’ perspective can help to find out their learning experience in the courses taught by them as well as in the programme activities involved by these practice-led teachers.

3.1 Philosophical underpinnings and worldview paradigm

Before discussing the research design process, I set out the philosophical assumptions and the paradigmatic considerations for my methodological approach in this study. It is challenging because both qualitative and quantitative methods are adopted in this research

project. Creswell and Plano-Clark (2011) point out that even the norms and practices for mixed methods are still developing in progress, researchers ought to provide an explicit philosophical rationale for their methodological choices (Biddle and Schafft, 2015). As Creswell is an applied research methodologist, taking his advice that “good research requires making these assumptions, paradigms, and frameworks explicit in the writing of a study” (Creswell, 2007, 15).

The philosophical terms in academic research are very abstract and covering different areas, such as the nature of reality (ontology), how the researcher knows what she or he knows (epistemology), the role of values in the research (axiology), the language of research (rhetoric), and the methods used in the process (methodology) (Creswell, 2003, 2007, 16). It is found that the schools of thought representing qualitative and quantitative research methods are actually having some opposing minds, which are pushing the philosophical assumptions to the two extreme ends. From the early 1980s, academic researchers began to explicitly make the division by assigning the qualitative research methods to constructivism (or interpretivism coming up later), and the quantitative methods to positivism, leading to the subsequent ‘Paradigm Wars’ and the ‘Incompatibility Thesis’ (Lincoln and Guba, 1985; Bergman, 2008, 2). In the book written by Punch and Oancea (2014), it mentions about the “paradigm-driven approach” and “question-driven approach” for planning a research project, representing ‘top-down approach’ and ‘bottom-up’ approach respectively. This research study is planning to explore the teaching pedagogies adopted by the practice-led teaching staff, and through the investigation, to understand any clues about the influence on the learning experience and the employability of their taught students. Based on this reflection, the ‘bottom-up’ approach is considered in this study.

Ontological Considerations

Ontology refers to the assumptions about the form and the nature of reality and its characteristics, what is there that can be known about it (Creswell, 2007; Punch and Oancea 2014). In this research project, “by embracing the idea of multiple realities and so do the individuals being studied and the readers of the study” (Creswell, 2007, 16), I will study the perspectives both from the teachers and the students because I believe both sides carry their own meanings – their own contextual interpretation – about the reality which can be true when standing at their side at a particular point of time. The real world is a complex system, not a set of variables; according to Brierley (2017, 13), the position of the realist philosophical stance promotes the integration of a realist ontology and a constructivist epistemology because the reality is independent of our perceptions, theories and constructions, no need for verification and falsification. For practice-led teachers, they can interpret their way of teaching in supporting their students to understand something related to what needs to be accomplished in the workplace while their students can express their doubts about the usefulness of this kind of learning. Once the information gathered from both sides, their perspectives, and their interactions – ‘teacher-student interface’ – in

classes, a more complete picture can be formed as the reality. Therefore, “realities are apprehend-able in the form of multiple, intangible mental constructions, socially and experientially based, local and specific in nature” (Guba and Lincoln, 1994; Cobern and Loving, 2007) and thus, my ontological consideration “assumes to be a socially constructed dynamic reality through a framework which is value-laden, flexible, descriptive, holistic, and context sensitive” (Yilmaz, 2013).

Epistemological Considerations

Epistemology refers to the nature of knowledge and knowing; what is the relationship between the researcher (or the knower) and that being researched (what can be known) (Guba and Lincoln, 1998; Creswell, 2007; Punch and Oancea, 2014). Realities are complex, dynamic, and ever-changing. Knowledge can be constructed through people’s learning, understanding and discovery and these knowledge claims need to be justified by the researchers throughout the whole study. The notion of fallibilism is becoming increasingly a responsible epistemic position, as it “admits to the uncertainty of knowledge but does not end up with the relativist conclusion that all beliefs are equally valid” (Holma and Hyytinen, 2015, 342). When groups of people get together, they can create different sets of collective wisdoms, which can be in the forms of ‘tangible’, ‘intangible’, ‘implicit’, ‘explicit’, multi-layered, and multi-faceted, all that can be shared with other people. In this study, both the researcher and participants are making contributions in the process of knowledge discovery and creation and then shared it with the readers. With the above epistemological assumptions, I conducted my study in the field where the participants are working and studying, that is, universities, classrooms, and their work offices because I want to get as close as possible to the participants being studied, for the sake of minimising the ‘distance’ or ‘objective separateness’ (Guba and Lincoln, 1988, 94) between myself and those being researched (Creswell, 2007, 18).

Philosophical worldview assumptions

A paradigm or worldview is “a basic set of beliefs that guide action” (Guba, 1990, 17) and these beliefs can “shape the practice of research” advanced by the researchers. Creswell (2003, 2007) describes four worldviews, they are post-positivism, constructivism, advocacy/participatory, and pragmatism. Post-positivism requires “an emphasis on empirical data collection, cause-and-effect oriented, and deterministic based on a priori theories” that my study is not following this approach. The basic tenet of advocacy or participatory worldview, focusing on “the marginalised groups” and looking for actions to help these individuals, is not related to my study too. For social constructivism, the goal of the researchers is “to reply as much as possible on the participants’ views of the situation” and “these subjective meanings are negotiated socially and historically”. My study has some similarities with this worldview, such as the participants’ view on the situation which can have socially negotiated meanings; but my research is not working towards to develop a

theory or pattern of meaning (Creswell, 2007, 20-22). Pragmatism as philosophical stance advocates the “use of multiple data sources and interpretations in research” and acknowledges that “the values of the researcher play a large role” in the interpretations of results. (Christ, 2013, 116).

Pragmatism is the emergent worldview, with the “focus on the outcomes of research – the actions, situations, and consequences of inquiry” (Creswell, 2007). The notion of “what works” (Patton, 1990) or “what works as the truth” (Christ, 2013) becomes the ongoing driving force during the whole process of conducting the research study. “Pragmatism does not reject the relevance of concepts of the philosophy of knowledge” (Brierley, 2017, 16) but it also does not accept the privileging of ontology over epistemology or vice versa. In other words, both methodological approach and philosophical approach can be organised to offer a mix of quantitative and qualitative methods to answer research questions (Onwuegbuzie and Johnson, 2006), implying that the researcher needs to work out practical research, and it is how my study plan is designed for. To sum up, let me take the quote from Onwuegbuzie and Johnson (2006), “pragmatism includes a healthy dose of pluralism by which we mean that it is not logically contradictory to claim that quantitative and qualitative research are both useful, even if, at times, they appear to be contradictory; perhaps what is seen as contradictory are different perspectives that are complementary and enable one to more fully to see his or her world” (Onwuegbuzie and Johnson 2006, 54; Brierley, 2017).

3.2 Mixed-method approach

This study adopts the mixed-method research approach, allowing me as a mixed researcher to address the interests, values, and standpoints of multiple stakeholders, including the teachers, the students, and the fellow classmates, in the research process in the study. It is believed that this approach can provide “the fullest and best answers” to “many research questions” as the perspectives of multiple stakeholders can be recognised through the notion of “multiple stakeholder legitimization” (Tashakkori et al., 2020, 19) or “sociopolitical legitimization” (Johnson and Christensen, 2020, 622). Methodology refers to “the way we go about discovering knowledge in a systematic way” (Killam, 2008, 9) and the process for researchers to create their knowledge claims. In this research project, how the professional experience and practice-led teaching of the teachers informing the educational experience of their students, to be examined through interviewing, the centrality in this study whilst the student surveys and the class observations are used for providing the students’ perspective and the teaching-learning interaction perspective to make the study become multi-perspective research. The mixed methods include semi-structured interviews with teachers, student surveys, and class observations, in achieving the creditability.

The use of semi-structured format in the interview can allow the interviewees, i.e., practice-led teachers, to share their views and ideas freely but in a set of high-level scoped questions. This setting, in my study, is the best application of qualitative approach to make their sharing central to the research theme but flexible enough to extend the scope of discussions within each of the high-level questions. Practice-led teachers are the whistle-blowers of this research, whose professional knowledge embedded with industry experience to inform the students' educational experience, is the main theme to be explored. The student survey is used for collecting the feedbacks from the role of receivers, and class observations can provide the snapshots on the field interactions between the teachers, the students and possibly the fellow classmates. The collection of these two data sets can help to show the cues about the learning experience of their taught students about the course and in the class. The question set of student survey is designed in 5-point Likert-type scale. Some questions are set in a pair, having the second question in open-ended format as a follow-up to the first question by letting the student respondents give some elaboration to the previous question being rated. For instance, one question is asking them to rate the effectiveness of course assignments and projects in practising on what they learned in the course. The second question in the pair, is to encourage the students to give examples: "The areas that you had practised were (please give examples)". In the student survey, the purpose of having 3 open-ended questions asking for some examples in the areas of most difficult topics, most practical skills, and IT professional qualifications, can act as the function of cross-referencing to the interviews conducted with the practice-led teachers.

For the class observations, the discourse can expose the dialogic interactions between the teachers and the students in the feedback loop process right after the individual project presentations in front of the class in the last lesson of the course. It is the "moments of truth" that can reflect partly the outcome of teaching and learning in the course while both sides can get to know it together. Both parties are holding 'their own assets' on hand and it is the authentic engagement as the teacher and the students are proactively 'discussing' with each other on that particular piece of project work prepared by the students after attending the course. In other words, the group projects, or individual projects in one course, can be regarded as the intellectual work asset held by the student group, who designed and developed the project based on what they learned in the course plus their own reflections and self-learning through further research work done for the project. Contextually, each of the student groups is supposed to be more knowledgeable about the presented group project than that of the practice-led teacher. In this sense, student group project is the tool, once mastered by the students who can substantiate the learner's standing in front of the teacher, used for showing their learning and articulating their understanding, and ultimately, to defend their work. For the practice-led teachers, they listen to what the student groups presented, to understand what they have done, to assess how much and how well they have learned in according to the presentations delivered by the students. It becomes the student-led or 'learner-driven' process where the feedback of the teacher is, on the continuum, the last stage of teaching process in the course through

the real-time assessment on the student learning. The teachers, leveraging their professional experience to inquire about the materials presented, exercise their judgement on the student groups' effort, their learning and understanding. Through the questions raised and the answers given as a loop process, the above process of discourse can be observed.

When these three sets of data are combined for analysis, it becomes a very powerful mix, generating the credible understanding of complex real-world contexts in this study. During the analysis, student surveys and class observations "can help by validating, interpreting, clarifying, and illustrating qualitative findings" (Miles et al., 2014, 43) collected from the semi-structured interviews, as well as through the theoretical framework and conceptualised notions, the research findings can be strengthened. As a researcher, my methodology involves the "procedures" in doing research, which are "characterised as inductive, emergence, and shaped by the researcher's experience in collecting and analysing the data" (Creswell, 2007, 19). Lincoln and Guba (2000, 164) proclaim that "methodology is inevitably interwoven with and emerges from the nature of particular disciplines" whereby my study sits on the educational discipline in the contextual nature of information technology. In other words, methodology reflects my beliefs about "the knowledge and values inherent in the paradigm within which the study is conducted and implies a concern and commitment to construct a particular type of knowledge" (Klenke, 2008, 18). In this capacity, to my best understanding, the knowledge is related to the threads of professional experience, practice-led teaching pedagogy and graduates' employability.

My commitment to this mixed methods approach reflects my pragmatic orientation, in which I seek to reconcile different ontological and epistemological traditions in order to build a comprehensive picture of the phenomenon being studied. It is the case that some knowledge forms can be incompatible, however in this study quantitative data is only ever supplemental to the substantive qualitative study. In this sense the study is technically mixed methods, and I locate my work in a pragmatic paradigm, however, the study is fundamentally one shaped by a constructivist orientation and hence my argument is that the data sources, and the knowledges they reflect, are compatible.

3.3 Identification and recruitment

3.3.1 Selection of practice-led teaching staff in universities

Practice-led teaching staff is defined as those who, prior joining the teaching profession in universities, possess the working experience in IT industry or technology-enabled sector. These practice-led teaching staff conducting teaching in IT-related degree programmes and

their taught students are the core subjects in the study and thus, first, I needed to locate where they are working for, that is, in which academic departments and the universities. In Hong Kong, there are eight government-funded universities where the IT-related degree programmes are offered by the academic departments with different naming conventions in different universities, namely, Computing, Computing & Decision Sciences, Computer Science & Engineering, Computer Science, Information Engineering, Information Systems, Mathematics & Information Technology. There are totally 10 academic departments as two of the universities have more than one department to offer IT-related degree programmes.

It is generally understood that it would be extremely difficult in succeeding if I invited the heads of the above academic departments in different universities to nominate those teaching staff whose background can fulfil the selection criteria for participation in my research study. Even some might be willing to support for this study, it would take a lengthy time to go through the internal approval process that they might not want to do so. Hence, I decided to go for a more direct way by looking at the websites of all the ten academic departments and conducting the search for potential participants in the academic staff directory. Broadly, practice-led teaching staff can be found in two of the sections: academic and honorary/adjunct professors. For honorary/adjunct professors, they are surely qualified to be my study participants because they are either joining the universities after retirement or still having their full-time job in the industry. I found that there are 10 staff relevant in the search, but it happened only one staff who agreed to join my research study. Therefore, I moved on to study the main section of the academic teaching staff list, it was very tough for me since the number of academic staff working for each of the departments are ranged from 30 to 50. To be bias-free, I needed to study the staff profile of all the academic staff in each of the department one-by-one before the selection. Based on the staff profile published on the departmental website, I found that there are 18 academic staff who are relevant to my research study. Through the formal email invitation, there are total 5 academic staff showing interest to join the study. One of the agreed academic staff, replied my email to suggest for meeting me by inviting me to attend an academic-industry event launched in the university conference hall where we met and surprisingly, he introduced another delegate to me and told me that he may be the suitable candidate in the study. After his introduction, I had the chances to talk to the delegate and he gave me his name card. After the seminar, I sent him the formal invitation through email, and he confirmed to join the study. Finally, I have obtained the formal consent from the 6 practice-led teaching staff who are the research participants in my research study. The initial profile of the practice-led teachers is depicted in Table 3.1.

3.3.2 Recruitment of students taught by the practice-led teaching staff

The perspective collected from the students taught by the practice-led teachers can help to understand the educational experience of the students about the teaching of professional

knowledge and skills during the process of teaching and learning in the study. Therefore, it is necessary for the students, who are recruited for filling in the student survey, being taught by the practice-led teachers who agreed to attend the research interviews. When I sent the email invitation to the potential interviewees, the practice-led teachers, I stated clearly in the letter of email that it was the research invitation, including one research interview with the teacher and one online student survey by enclosing these two research instruments, one set of interview questions and one set of the student questionnaire. When the six practice-led teachers replied my email, they only mentioned that they were available for the research interview and proposed their preferred time slot and the date. Therefore, I tried to do the follow up on the student survey after the interview with each of the practice-led teachers. Four of them said that it was going to be very difficult to conduct it in their department. One teacher sent an email to introduce me to the programme director and let me approach the director seeking for the approval; however, I did not receive the reply from the programme director. One of the practice-led teachers was my previous course instructor and the department head has known me before. So, I visited the office of department head and he said that it was too lengthy process in getting it approved and thus recommended me to approach the teacher directly to see whether she is willing to do it for me as an individual course. Per his advice, I talked to my previous instructor, one of the practice-led teachers and she finally agreed to email the online student survey to the students whereby the student survey was positioned as the academic research project conducted by the alumni's doctoral study. Thus, the student surveys in this study could be arranged in the classes of one practice-led teacher only.

3.4 Methods of data collection

The methodological approach adopted in this study is the pragmatic worldview, and therefore, I deploy both qualitative and quantitative research methods as mixed-method approach in my study plan, and the respective justifications will be provided accordingly.

3.4.1 Semi-structured interviews

The central study is how the practice-led teachers inform their professional knowledge and experience on the educational experience of the university students studying IT degree programmes. They possess the years of IT industry experience ranged from 18 to 35 years, some are acquired before the teaching profession, while some are still working in the industry though having the teaching duty in the university. The long years of industry experience possessed by the research interviewees is observed to have extending the central theme, making the interview much longer with wider topics being discussed. As the key focus is to explore what is the practice-led teaching approach and how do they teach the students with respect to supporting the graduates' employability. Therefore, the design

of the question set is the high-level blueprint of their teaching approach in loosely-related questions and it consists of four dimensions, their motivation and perceived contribution to teaching, their view on the importance of industry learning in university education and its relationship with graduate employability, any gaps or challenges between their teaching and student learning, and their recommendations. The correspondent format of the set of questions is semi-structured, enabling the flexibility for the teachers to express their views and opinions freely in each of the questions or topics, giving the examples as they like. Research interview is scheduled to be 45 to 60 minutes and it is stated in the participant information sheet (Appendix 3.1) and it happened 5 out of the 6 research interviews exceeding the scheduled duration, with some almost doubling the time. The participant's consent form (Appendix 3.2) is also attached with the information sheet in the email invitation to the potential research participants. I brought the hardcopy of the participant consent form for each interview, and I invited them to sign it before starting the interview. As they have read the consent form as attached in the previous email invitation, they all signed it in front of me. The set of interview questions is depicted in Appendix 3.3. During the research interviews, all are audio-recorded and then transcribed for analysis.

3.4.2 Student surveys

The design of student survey was originally referenced to the course experience questionnaire sets (Ramsden, 1991; Wilson et al., 1997) and the extended CEQ version (Griffin et al., 2003). I have conducted a very detailed analysis on how they come up the CEQ measurement scales adopted in those three sets of questions. The first version of CEQ proposes 5 measurement scales: good teaching, clear goals and standards, appropriate workload, appropriate assessment, and emphasis on independence (Ramsden, 1991, 134) while the second version contains 6 scales, having the scale of generic skills being added (Wilson et al., 1997, 34). Griffin et al. (2003, 260-261) point out the need for addressing "the more holistic range of factors in the contemporary undergraduate experience" as some student learning can be experienced outside the classroom. The design in the previous version of CEQ version is commented for the inability to address the current trend as it was "based on a theory of learning that emphasises the primary forces in the undergraduate experience as located within the classroom setting". Hence, the extended CEQ version in 2003 constructs a new set of 6 sub-scales, including student support scale, learning resources scale, course organisation scale, learning community scale, graduate qualities scale and intellectual motivation scale (Griffin et al., 2003, 263) and the total number of questions is increased from 37 to 81 questions in the survey. In my study, student survey is used for collecting the data specific to the IT courses taught by the practice-led teachers, not for the course assessment of the whole degree programme. The long set of student questionnaire is too much to be relevant and to be adopted in my project. However, the rationale in defining the sub-scales gives me very good insights and "teaches" me on how to prepare my own set of questions in the survey.

In the student survey, I have divided into 6 sub-sections, see Appendix 3.4. The first three sub-sections are set for course design, student learning experience and student learning outcomes, with survey questions related to the areas of course design, appropriate workload and assessment, learning resources, teaching approach, professional skills and graduate qualities. The fourth is open-ended questions seeking for student feedback on the most difficult topics in the course and the most practical skillset learned. The fifth is related to the rating on a list of course items and activities in terms of the usefulness in the course learning and the perceived helpfulness in future graduate job. The former question is set for IT degree course-level while the latter is set for IT degree programme-level. The last sub-section is related to the topic of IT professional certifications. As the student survey is invited by the practice-led teachers directly, it is prepared in the format of online student survey and the operation of collecting the responses is done through Google Forms online platform. I created the online student survey form and the survey's weblink and then emailed it to the practice-led teachers who can just forward the weblink to the students as an invitation for online survey participation. For me, I can login to my email system to view the survey responses and download the survey data for analysis.

3.4.3 Class observations

After the research interviews, the participants and I get familiar with each other, and they have some trust on us. Therefore, I contacted them again and asked them whether class observations can be conducted in their classes. The first reaction from them was asking me what I wanted to do during the class observations; and I told them that I wanted to know how the students interacted with them during the classes. Most of them replied me that the students are very quiet in lectures and thus they suggested me to do class observations during the group project presentations in the last lesson of the class because it is going to have question-and-answer session after each group presentation. The observations conducted in the two classes from the first practice-led teacher is recorded through field notes taken. All the subsequent class observations are audio-taped and then transcribed for analysis. Two industry seminar talks are covered for class observations as one of the practice-led teachers, who does not involve in teaching, is responsible for organising the extra-curricular activities for the department.

3.4.4 Pilot study

Each of the research interviews was arranged and conducted according to the date and the time proposed by the practice-led teachers and all were done on separate days. The interview question set has been sent over in the email invitation and the email mentioned to welcome for any comments; but no teacher raised any concerns about the questions. I would take the set of interview questions in this study to be appropriate. So, the first

research interview was used as the pilot to find out whether any adjustment on the questions was needed. The whole research interview was conducted very smoothly and there was only one question that the interviewee felt difficult to answer it because he asked me, what the question 6 was asking for – “In what ways do you monitor the learning progress of your students in acquiring the professional skills and understanding in your course(s)?”. After my elaboration on the question, he indicated for no monitoring specific to the professional skills, provided that the students passed the course, they showed their understanding. For those research interviews followed, therefore, I was prepared to elaborate this question to the interviewees. For the first round of the student survey, the set of questionnaire questions was set for the course-level and the data collected could reflect that the respondents understood the questions and no responses inconsistent to the nature of the questions were found. Positively, most of the respondents were very eager to write down their responses in the open-ended questions. Therefore, the same set of student survey is adopted in the second round of student survey while there are three additional sub-sections added for exploring the usefulness of the course items and the helpfulness for graduate jobs, and IT professional certifications.

3.5 Data analysis

There are three sets of data collected in the study. The first set and the third set are qualitative data collected through interviews and class observations, respectively. The second set is the survey result, mostly in quantitative but having some open-ended questions serving for the purpose of seeking the elaboration from the students. Interview data set is the centre of the study, whereby both survey data and class observation data are smaller sets of data, which are used for providing other perspectives in some of the key topics being explored in the interview data set.

As the interviews' question set is semi-structured, there are some derived sub-topics coming up from most of the questions during the interviewing. All interviews were very interactively conducted, just like sharing session by the teachers, and thus it ended with the inter-related data being scattered in more than one question. Therefore, it makes the process of data analysis become very challenging. Over 50,000 words transcribed from 6 audio-recorded interviews. As the clear direction is to explore the practice-led teaching approach with specificity to the professional knowledge and industry experience being informed on the students, I adopt the structural coding method in data analysis. The application of structural coding is “content-based” (MacQueen et al, 2008) or question-based coding approach, which is “appropriate for semi-structured data-gathering protocols to gather topics, lists or indexes of major categories or themes”, particularly for interview transcripts and open-ended survey responses (Saldana, 2016, 98). It “acts as a labelling and indexing device, allowing researchers to quickly access data likely to be relevant to a particular analysis from a large data set” (Namey et al., 2008, 141).

First, I extracted the whole chain of questions, both original list of questions and the derived sub-topics, from each transcript to form the actual question set for each interviewee, and it is done the same for all the interviews. It can help me to have a very high-level awareness about the actual scope of content discussed in each of the field interviews. All the chains of questions are placed in Microsoft Excel spreadsheet so that I can have a complete view of all the topics covered in all the interviews. In other words, it forms the repository as the indexing of all interview topics. Second, I started to go through the transcripts one-by-one so that I could read the data slowly. When I was reading it, I highlighted the phrases on the transcripts. I did it twice and in the second round of reading and doing phrase highlights, I picked some key phrases and populated all the topics in the Microsoft Excel spreadsheet, that is, each topic index to have some key phrases as the original expressions of the interviewees. It was a very lengthy process, but the effort was worthy. The factual picture of each interviewing is formed, such as their motivation, their views, their actions and so on. I can say, I can feel about the data and so does each interviewee as a practitioner-teacher role. Based on this high-level touch of the interview data, I moved to the third step, to draft the sub-themes for each of the semi-structured interview question. It was the data exploration process that I did it on papers and I bought A3 blank paper booklet to do it. When I did the sub-themes drafting, it was prepared by looking at three dimensions, the data under each interview question, the same question across all the 5 transcriptions, as well as some data scattered in other questions, which were located by key word search in the Microsoft Excel.

Fourth, it came to the data identification process on the ground, from which the sharing and the expressions of the practice-led teachers can be categorised according to the sub-themes. Meanwhile, comparison effort was exercised to identify the similarities and the differences on what were expressed by the interviewees. In this process, some sub-themes were located but overlooked in the previous step and it was necessary to bring out the next step as the make-up process for completeness. The fifth step was used for ensuring the alignment and revision of sub-themes (the third) and data identification and categorisation (the fourth). This step was served to compensate the shortcomings in the second step conducted by me in populating the key phrases in the Microsoft Excel spreadsheet. Some co-related data were scattered in more than one question while the key word search in Microsoft Excel was not 100% sufficient enough to locate all the scattered data, the fifth step was treated as the reversing process by leveraging field data to confirm, revise or update the sub-themes which were finally adopted in the write-up of the findings. The purpose of this last step is to ensure all key sub-themes were identified and included in the findings, and the word of “key” means the identification of the relevant sub-themes is done by cross-checking among all the 5 transcriptions, the outcomes generated from the consolidated view of all the interviewees. The word of “relevant” means the relevancy of the sub-themes to the research questions and sub-questions. Hence, it is an incremental

process in formulating the whole set of key sub-themes relevant to the research study, based on the collection of interview data set.

The data analysis for student survey result was done by the Microsoft Excel spreadsheet whose functions can perform tabulation and calculation for Likert-type scale. The graphical data display was also created by Microsoft Excel. There were two versions of student survey adopted in the study. The analysis for both versions was based on individual course taught by the practice-led teacher. In the first version, it was focused on the taught course itself, in the areas of course design, learning experience, learning outcome. In the second version of student survey, there were two more aspects added, one aspect was about the course items and activities to be analysed in terms of usefulness in course learning and helpfulness in graduate job, respectively; and the other aspect was IT professional certifications added. Other than quantitative data, the survey data set contained some qualitative data collected from some open-ended questions seeking for some examples as the elaboration for the previous question being answered. Those open-ended questions were set, in response to some key topics in the interview set of questions, such as professional experience and the course's practicality. Therefore, the qualitative data collected from the student survey were analysed as the student views, another perspective towards the same topics as expressed in the research interviews by the practice-led teachers.

The class observations were arranged in the classes where the students presented their group or individual projects. The data analysis was conducted for analysing the interactions between teachers and students, during the feedback sessions of questions and answers. This part of analysis was targeted for understanding the practice-led teaching approach and techniques which were the key sub-themes in the interview data set. Therefore, class observation data analysis provided the teacher-and-student interactions' perspective, in response to the teachers' perspective on their teaching and student learning. It was supposed to indicate whether the two perspectives were aligned or different through the observation of the real-time interactions during the teaching-and-learning process in the classroom environment while the context was resided on the work done by the students who applied what they learned in the course and paid their study effort, and the practice-led teachers who were observing and assessing the understanding of the students at the end of the course.

Project management is the common topic across the three research instruments, research interviews, student survey and class observations. IT projects are also central to IT discipline as every project needs to be managed by IT project manager. During the analysis conducted on the research findings, there is one sub-section to offer an integrated view on project management, supplemented by the online research for the professional body related to the certification for project management.

3.6 Ethical considerations

This section provides the evidence, based on the ethical considerations, that I have taken the appropriate actions in conducting the field research in this study. The collection of research data and information are guided whilst the research participants and their respective organisations need to be protected without being identifiable. According to the ethical guidelines for educational research published by The British Education Research Association (BERA) 2018, I would like to provide the details in this section accordingly.

3.6.1 Access to participants

This study involves two groups of participants, practice-led teachers, and their students. I conducted the online research by visiting all the university websites to locate the portal of the academic departments which offers the degree programmes related to the information technology or the related subject areas. Once the relevant academic departments located, each of the academic staff profile was reviewed to see who are suitable for this study. So, I accessed the potential research participants through their public profile and then invited them to participate in the research interview through the formal email invitation. The invitation of the student participants for the online survey was directly invited by the respective practice-led teacher; and for me, I needed to prepare the student survey in online format through Google Forms platform and emailed the weblink to the practice-led teachers for their pursual. The access to the online platform to review and download the data collected from the student surveys are protected by the secured password and the folder can only be accessed by the researcher; therefore, the guideline of BERA (2018) under section 50, “researchers should ensure that data are kept securely”, has been followed accordingly.

3.6.2 Consent

According to the guidelines of Consent set out in the BERA (2018) under section 8, the researcher is expected to fulfil the requirements that “participants’ voluntary informed consent to be involved in a study will be obtained at the start of the study”, and according to the section 31, it is “the right of all participants to withdraw from the research for any or no reason, and at any time, and participants should be informed of this right”, and it is suggested that the researchers to “provide their own contact details to participants”. Before the field research, all the potential practice-led teachers were invited through the letter of email, which was comprised of two parts, the first part was a short summary written according to the participant information sheet and the second part was the

message, indicating that if they showed interest to participate in the study, they could propose their available date and time slot to me. The participant information sheet with consent form was enclosed in the email sent to the potential participants. It is implied that when they gave me a positive reply in the email, it is regarded as the intention to consent. When we met up and sat down for the research interview, I handed the hardcopy of the participant consent form for each of them to sign on before the research interview was formally commenced. Therefore, both the intention to consent and the formal consent of the research interviews were obtained in the study. Besides, my contact detail is provided in the email invitation, whereas the contact details of my academic supervisors and my own contact are all provided in the participant information sheet and the consent form.

3.6.3 Anonymity and confidentiality

According to the guidelines of BERA (2018) under section 40, “the confidential and anonymous treatment of participants’ data is considered the norm for the conduct of research”. For the identity protection of the research participants, all the possible identifiable elements are removed from the write-up. For example, the name of practice-led teachers is named as A to F, that is, the practice-led teacher PLT-A, PLT-B, PLT-C and so on. The names of degree programmes, academic departments and universities are not mentioned in the study. It is because once the academic department is identified by the readers, the identity of practice-led teachers participated in the research interview can be located easily. The above arrangement is adopted to ensure anonymity and confidentiality in the study.

3.7 Limitation of this study

There are two limitations in this study. The research participants of practice-led teachers are IT veterans possessing very extensive professional experience and IT practices in the field and thus making the research findings rather unique and limit its application to other groups of teaching staff, for example, less than 10 years or 5 years of industry working experience, though in the same context of IT degree courses or in the similar context of degree courses in practical and applied orientations. Second, the sample size of student surveys is small, with 47 student respondents, all of them are taught by one practice-led teacher. Therefore, the survey results cannot represent the overall student perspective to respond to the teaching efforts contributed by all practice-led teachers in the study, and it also cannot be positioned for confirming or rejecting the perspective from the practice-led teachers. For the class observations, they were conducted for course project presentations delivered by the students while the practice-led teachers provided feedbacks during the question-and-answer session after each project presentation. Though the scope of observation is limited to the student project presentations, the class observations were

done for 5 out of 6 practice-led teachers, implying that class observation data set carries its weight in this study and is valuable and relevant for understanding the interactions between teachers, the students, and the fellow classmates.

CHAPTER 4 FINDINGS

4.0 Introduction

This chapter discusses the field research findings through the analysis on the research interview in semi-structured format with the practice-led teachers, through the student surveys, and the class observations conducted for attending the university students' presentation on their academic projects on disciplinary work at the end of the courses and two industry seminar talks. IT project management is the essential topic across different industry sectors, including IT and technology-enabled sector, as every company needs to have good project manager. Hence, there is a separate sub-section to have an integrated view on project management certification. There were 6 practice-led teachers participated in the semi-structured interview, coming from six academic departments from four different universities. All of them are graduated from the technical-oriented degree programme and thus they all possess technical background and are/were working in the IT industry experience before joining the teaching profession in the university. As mentioned in the chapter of methodology, only teacher PLT-D agreed to invite her students to participate in the online student surveys and it was conducted in two semesters, project management course for both semesters and risk management course in one semester only. Total 47 survey respondents collected, with 19 and 28 respectively. The version one consists of three sections: course design, learning experience and learning outcome while the version two has added three sub-sections: the level of usefulness in 15 course items and activities for course study, the helpfulness in terms of future graduate jobs, and IT professional certification. For the fieldwork of class observations, there were 16 individual student projects, and 20 group projects were observed; and the analysis is focused on the dialogical conversations between practice-led teachers, project presenters and the fellow classmates. Two of the industry seminar talks are also observed but the analysis is focused on those non-technical questions and answers only.

4.1 Practice-led teaching profiling, motivations, and perceptions

4.1.1 Practice-led teachers' profile as capital distinctions in teaching

The study of the six practice-led teachers and their interactions with the students is central in this research study; and thus, the socio-demographic (Kuckartz, 2014; Saldana, 2016) profile of these teachers is firstly to be examined. According to the information of the staff section published in the departmental websites of the respective universities, I can source the public profile about their academic background, their past and current job history, their membership in the professional bodies as well as their representative role in some of the

industry bodies. During the research interview, each of the teachers also shared with me about their professional experience in the first question. Based on these two sources of information, I consolidate the details collected and then create the summary of their professional profile in Table 4.1. There is a note for teacher PLT-F, whose public profile is not made available, and his profile is created according to what he told me during the research interview.

There are three of the teachers, PLT-A, PLT-B and PLT-C, who earn the PhD qualification and they continue to make academic research contributions in their current role in academia, with PLT-A and PLT-B supervising the PhD students while PLT-C said that he wants to do so if any students show interest in cyber security. All the teachers in this study possess the university qualification in technology discipline and are/were working for the giant global technology companies or technology-enabled sector after graduation. That means, their tertiary education and the graduate jobs are in the same field; and they are demonstrating the lived experience of the real world “on a single continuum” (Dewey, 1938, 27). As three of them studied in the university outside their home country and the remaining were studied locally, and hence, the “academic mobility” (Altbach et. al., 2009, 3) of the research interviewees in this study is 50 per cent. Teachers, PLT-C and PLT-D, possess many years of training experience as IT technical trainer, with the former focuses on corporate level like government departments while the latter on individuals’ training in public classes. For teacher PLT-E, his career profile started with a graduate job as trainee programmer in a global financial institution, though in between, he had ever changed job to work for another top-tier financial institution overseas, he was invited to re-join the company he firstly worked for and later, promoted to the top of the career ladder as the regional Chief Information Officer, overseeing several thousands of IT staff and software development centre in the region, till the retirement.

Based on their public profile, except for PLT-F, they all have memberships in professional bodies, such as BCS, HKCS, IEEE, ISACA, PMI, as well as take up the role as committee member in some of these professional institutions. These professional bodies indicate the conventions for practices or social practices which are embedded in the institutions. as a form of social capital (Sambasivan and Smyth, 2010). Before his retirement, teacher PLT-E was representing the organisation to become chairman of the technology committee of the international regulating body for financial institutions; regarding the position held as advisory board member in some of the statutory public bodies, he is now still holding the current positions in some of them. These are ‘knowledge networks’ (Nahapiet and Ghoshal, 1998), “based on a logic of business and professional expectations” as network capital (Huggins, 2010, 348). For teacher PLT-A, his public profile mentions that he won several local and regional awards in artificial intelligence (AI), including research and IT professional excellence, showing that he possesses good social standing as a form of symbolic capital (Lindberg, 2013) or cultural capital (Tomlinson, 2017). In terms of industry working experience, for all the six practice-led teachers, they possess the industry working

experience ranged from 18 to 35 years in full-time mode and have been working in the university ranged from 10 to 25 years. They were graduated from technology discipline and thus they all have technical background. Interestingly, their work focus area is different from each other. In terms of sub-fields in the industry, or the team setting within an organisation, the nature of work for teacher PLT-A is related to IT applications (software team), teacher PLT-B to IT infrastructure (hardware & network team), teacher PLT-C to IT security services (consulting team), teacher PLT-D to IT project delivery (IT services delivery team), teacher PLT-E to IT management (C-level executive), and teacher PLT-F to IT business executive (business head).

4.1.2 Teaching motivations as caring, obligations, and commitment in social capital

Most of the practice-led teachers are passionate in helping the young people while teaching job can provide the best opportunity for them to care about them, to get in touch with them. They were rather attentive to the needs of the young graduates in their previous commercial jobs and said to understand the young graduates, not feeling the distance from the university students, like PLT-D who previously taught the conversion courses to those university students graduated from non-IT subjects but wanted to move to IT industry through the intensive conversion course. PLT-A feels the joy from teaching young minds while PLT-E clearly shows his motivation to teach the students to understand the alignment between business and IT and to apply what they learned for the practical use so as to “make a big difference to the student’s proficiency”. The teachers also show their love to academic field, particularly for PLT-B who said, “I like academia” and they see teaching as “a very rewarding profession”. The personal motive of PLT-D is about learning, explaining that “for teaching, I had to know every single function and features in the database because the students might ask me”. Some teachers sense the urgency in the field, showing obligations (Coleman, 1988) to the industry sector they have been working for. So, they hope that the course taught by them can support the students to obtain accreditation from the professional institution. PLT-C feels worried for not do anything to encourage the students to enter IT security’s technical field; “five years later, this field may be vanished locally”. For PLT-E, based on his previous experience of advisory role to some universities, they are totally lost when asking the students whether they have the knowledge about industry; hence, he shows the dedication to fill in this academic knowledge gap by joining the teaching profession after retirement.

All the six practice-led teachers understand the value of possessing IT industry experience in their teaching job whilst each of them views their contribution in a specific way towards the students’ learning and their graduates’ jobs, and even one teacher supporting the academic peers. Two-third of the teachers thought to offer effective teaching pedagogy and better student support for graduates’ job. For the remaining two teachers, one is not sure about

the effectiveness of his teaching but is certain in articulating the practicality of the students' research projects while the other one does not involve in teaching but helps to line up the relevant industry resources for the department and other professors. For instance, they can make a balance between academic and commercial experience for student learning and prepare the students to better adapt to the working environment in their graduation jobs, making them a better IT professional. But for PLT-B, he is not sure, leveraging his previous industry experience and his ways of sharing and explanations in classes, to be sufficient enough to make a difference in teaching, but he agrees that if the academic staff possesses the industry experience, they can make lots of differences in the research work because they tend to supervise the students doing more practical research projects. One of his supervised final year projects made an extraordinary achievement as the graduate student set up his own start-up company to develop the software product whose idea was based on his final year project.

4.1.3 Role of industry learning in university education and graduates' employability

4.1.3.1 Purposes and values of industry learning in IT discipline

From the viewpoint of the practice-led teachers, the industry learning as part of university education is consisted of knowledge and skills, work code of practice, expectations of employers and clients, industry sense and the latest updates about industry changes, which are listed in the following:

- practical skills,
- practical knowledge,
- business knowledge,
- professional knowledge,
- professional code of conduct in workplace,
- what they need to perform in the job,
- the requirements of the employers,
- the expectations of the clients,
- industry sense,
- the requirements of the industry,
- what the industry is doing,
- how the technology to enhance the business,
- the impacts of changes in the industry, including advancement and threats,
- the kind of knowledge the people are acquiring in the market.

Out of the six practice-led teachers, only teacher PLT-B disagrees to cover industry learning in the university education because he refuses to make university education become vocational training and that is not required or useful for the students. He only recognises the value of “practical knowledge” and “professional type of things” for the students to learn in the university but that should be handled in a special course, separated from the core theme and the core units of the programme. And he developed a new course which is to commence ***an industry sense*** on the students before they go to the industry, but further clarifying that “I hesitate to make any minimum professional training to students from university”. For the other five practice-led teachers, they hold the similar views about the value of industry learning in university education. Teacher PLT-A articulates the value of practical skills from the industry as ***an integral part of student learning*** and he further posits “industry experience to be crucial to the student learning; unlike other subjects, for example, like history, the art, there is no industry much learning”. Teacher PLT-D views the industry learning in university as the pre-learning for ***adaptation*** in the workplace like professional code of conduct by the graduates, such as the self-awareness on those mistakes that they are easily made in the practical assignments and projects. For teacher PLT-E, graduates’ ***competitiveness*** is the key for success in their career because technical excellence is not something that will give the students to a very high position at work as there are millions of technical experts in India but knowing nothing the local business. He posits the essence of knowing what the industry is doing and how the technology to enhance the business as part of the curriculum. For teacher PLT-F, his comments were made mostly based on his own self-reflections derived from the negative observations on those previous global or giant companies vanished from the market one by one through time, including those he worked for. As the technological advancement can create drastic changes in the industry to threaten the bottom-line of many IT companies, he emphasises that learning for ***survival*** is the key as we cannot provide all the knowledge to the students facing these industry changes and they need to face the difficulties once start working after graduation. Practically, teacher PLT-C posits the industry learning as the actual ***market needs***, and it is necessary for the students to know the market requirements, the expected knowledge, and skills stated in the job profile’s requirements.

4.1.3.2 Consensus over students’ readiness for graduate job and inter-dependence between industry experience and job seeking

All the practice-led teachers agreed that nearly all the students are looking for a job upon graduation, with only a small number of graduates will plan for the academic route towards research degree. For instance, “all the students found job at the back instantly” (PLT-A); “for computer science, we are expecting more students to find jobs in the industry than to do research after graduation” (PLT-C); and “there’s not a lot of positions for computer scientists. So, in most cases, people learned about the technology, and they go out try to find a job” (PLT-E). When most of the graduates look for a job, it indicates that IT degree programmes should at least teach the students something relevant to their future career

(Lee et al., 1995). However, both teachers PLT-A and PLT-C point out the dilemma between job seeking and student experience, describing it as the dead-looping and the inter-dependence. What PLT-A said, “finding job is caught current two situations where you can find a job unless you have experience, but you don’t get experience unless you have a job”; whilst this perspective is echoed by PLT-C, saying that “if you did not work in this field before, how can you have the related experience? If you do not have the related experience, how can you start to work in this field?”. Therefore, it is signalled by PLT-E and PLT-F that there are some possible adverse effects on graduates’ employability if teaching in the universities do not cover some relevance to the industry context, implying that as such, “the students would be at a disadvantage when they are looking for a job” (PLT-E).

4.1.3.3 Their perceived students’ self-efficacies on graduates’ employability

Three of the practice-led teachers, through lab practices and experiential programme activities, observe the students and specifically describe a set of good personal qualities more advantageous for the graduates in job seeking and planning for their career development, see table 4.2. It is observed that if students are more mature, more curious and sociable, and taking self-initiation to learn new things, self-motivated to acquire professional skills and plan for career ahead, all these positive beliefs and attitudes can enable them to become “highly attractive” job candidates. It is shown that some students treat the alumni speakers as role model and start to imagine their own graduate job during the mentorship’s networking activities. As expected, if the graduates have good personal qualities and good learning motive, they can keep up the learning momentum to learn the specific things at work and become fast learner to catch up with the industry pace in their job. For teacher PLT-C, he said, “I don’t need to hire staff with excellent academic result, but I need the candidates to have good attitudes”; for IT security jobs, “even though the graduates are very outstanding, they are still under learning mode in the first two years to learn the technical skills”. On the contrary, there are some poor behaviours and attitudes affecting the student learning negatively, such as those less mature students who are “selectively listening” to the exam-related, and “less participation in classes”. It is interpreted that how they behaved in classes can be extended to how they will behave in the workplace in the future.

4.1.4 Pedagogical approach on students’ understanding and practising

4.1.4.1 First principle’s teaching approach versus Vocational training approach

Regarding the role of university education, it looks like the contradictory view between teachers PLT-B and PLT-C. The perspective on foundational knowledge from teachers of PLT-D and PLT-F is very close to the first principle’s teaching approach advocated by PLT-B.

First principle's learning approach: Distinctively, PLT-B defends the position of university education from the vocational training approach. He trusts that it is paramount important for university to teach the students “the more fundamental knowledge, the more basic principles and how to think”, trying to develop the students to possess more general knowledge about certain discipline but not very specific [product] knowledge. It is the approach to promote the “learning how to think” on the general knowledge initially before the students learn the specific applications and even at the product level at a later stage. When the university teaches the students to think more broadly, and to think more fundamentally, through the process of thinking to acquire the knowledge, the students can learn more general knowledge from the first principle's approach. It is echoed to the positioning of foundational knowledge in education and the perspectives of teachers PLT-D and PLT-F, with the latter regarding the foundational knowledge as the goal of education – “when you know one thing well, you can understand all related to that one thing”. As what teacher PLT-B said, the acquisition of the fundamental knowledge can help the students to understand more specific things more easily in their graduate job. Conversely, if the university education focuses too much to teach very specific things, he worries about the students who may be, “miss[ing] the point”, maybe, “not appreciate how to”, and they learn how to do one thing but probably “don't know the principle how to do other things”. Hence, he cites the example of learning programming languages and the rationale behind the teaching is to emphasise what are the differences between different languages, what's the trade-off when using one language over the other, in terms of easier to program, faster to program, more efficient in running the applications and so forth. His belief in university education is to teach the students “more on those issues, rather than make you proficient in using a particular language because using that is a skill, you can learn it – it's just a skill”; and he concludes that “the university is not the end, especially for IT industry”, because the graduates are required to continue the learning at work.

Vocational training approach: Teacher PLT-C is apparently supporting to deliver the teaching as the industry training approach for the students in the university. Strictly speaking, he was invited twice by the university to help for designing and teaching the new courses related to IT security and computer forensics on professional diploma level, which could offer the opportunity for the students to get accreditation from the professional bodies. He understands very well the fast pace of changes in the field, and perceives that university education can, theoretically, provide a foundation for the students to know how to do their job as he emphasises that university education cannot overlook the need for practising in IT security courses. He cites the similarity between football training school and IT vocational training school, and he poses the challenging ideas: If the students show interest in IT security and choose the course to study in the university, why not to train them up as the field does during the undergraduate study? If we can make it, the graduates do not need to be trained in the company after they joined. He said, “why not we introduce this kind of training in the undergraduate course so that university education can make it for them?”. However, he is mindful to mention that the university also needs to make a balance between different factors and considerations.

4.1.4.2 Skill proficiency versus Work proficiency

Another research finding is the topic of students' proficiency that teacher PLT-B rejects the student requirement for skill proficiency while proficiency at work is required by teacher PLT-E. It was seemed to be contradictory at the first sight, but they are referring to different types of the proficient requirements. For teacher PLT-E, through his teaching approach and the experience sharing of the industry practices in classes, he hopes that the students can become more knowledgeable in applying the theories they learned for practical use and can understand how the business is doing. "When they graduate and come out to work, I think that will make a big difference to the student's proficiency". In terms of the course content that are embedded with his own experience in the industry, he expects that his students, by absorbing the lecture materials, "can take some of those and that become part of their competency", implying that they can apply the similar principles in their graduate job. Whilst for teacher PLT-B, he does not agree with the requirement for the proficiency of skills because the centrality of university education is to teach the students how to think, what are the differences between different programming languages, what are the trade-offs, and what are the considerations, stating clearly that university would teach more on those issues, rather than make the students proficient in using a particular language as it's just a skill.

4.2 IT disciplinary knowledge and skills, and the implications for teaching and learning

Part A: Teachers' perspective

4.2.1 IT disciplinary knowledge and skills, and the business applications

Based on the findings of the research interviews, all the practice-led teachers indicate that IT discipline equates to practical and applied, and it is fundamental and essential for all IT degree students to keep up-to-date knowledge and skills if they want to stay in the IT field. There are two teachers trying to denote what IT is, and the denotation can largely conclude what is IT. IT is hands-on profession as it is to get things done, and to design and apply; and unlike other subjects as history and art, that is no industry much learning (PLT-A). IT is an applied discipline, for IT is relating to what is going on in the industry. It is not purely theoretical, for a professor without industry experience or with industry experience, IT would be described as something that's applied (PLT-B). IT knowledge and skills can be categorised into different levels; according to PLT-C and PLT-D, cybersecurity and risk management are regarded as advanced courses because the topics like risk governance and

system hacking are involving “high-end knowledge”, “higher level of knowledge”, “high-end skills”, “more advanced skills”, and “higher level of understanding”. Even within a course like database management, database design is treated as advanced skills with complexity though other topics are relatively more general hard skills. Programming is regarded as “more skill-based”, which can also be segmented as advanced programming skills and basic coding skills, for the latter is coded just by following the syntax. Furthermore, teacher PLT-F points out that nowadays, the learning focus in programming languages in academia is mainly on high-end coding, which can be learned merely by “drag and drop”, and thus, is very different from those low-level coding, like machine code, taught in his old days. Robotics, as quoted by him, is a popular topic and it involves lots of programming effort in low-level coding for development whereas the applications of robotics for commercial use are written by the high-level programming. Based on the experience sought by teacher PLT-C, some of the new knowledge creation in IT is found to be industry-driven rather than academic research-driven; that means, the emergence of some IT knowledge, not originated from academic research outputs, are coming from the new forms of technical solutions driven by the market direction. There were two examples quoted and explained by teacher PLT-C. The concept of cloud computing was emerged from the professional journals written by IT practitioners offering solutions for the industry, which was not used for solving the philosophical problem. For IT security, the knowledge of computer forensics was emerged from the phenomenon, requiring the industry or cross-discipline to firstly define the requirements, and then to locate a theory relevant to the definition, and finally to practise on how it can be applied. It is, therefore, regarded as “theory on industry-defined requirements” or “theory on cross-discipline-defined requirements”.

In addition, there is inter-dependence between IT and business, observed by teacher PLT-E; and based on this rationale, he developed the whole set of lecture notes by combining these two perspectives into every single lecture topic. For example, “How companies use big data to enhance the business?”. If for banking, the first question to ask is “how does the bank make money?”; and the second question is “how do you make use of technology to make the bank make money?”. So, he concludes that the teaching direction for this lecture topic is about the actual deployment of technology to enhance the bank’s business. He further explains that the formula for profit is ‘revenue minus cost’; when you have technology to enhance the revenue and minimise the cost, “the profit would look a lot better”. The above is how he articulates the inter-relationship between technology and business.

4.2.2 The most difficult set of IT industry skills and knowledge in teaching

In the research interview questions, there was one question specifically asking the practice-led teachers to comment the most difficult set of IT industry skills and knowledge for them to teach the students and the summary is depicted in table 4.3. The findings show that the most frequently mentioned is the soft skills, including process and methodologies,

organisational issues, teamwork, professional report writing, negotiation skills and presentation skills whereas the IT knowledge and hard skills are more difficult only when it comes to the advanced level.

For *IT projects*, the main difficulty is for the students to understand the process and methodology in real life projects because it is a key challenge to “really project that work environment”, such as the architecture’s scalability, timeline, and implementation decisions, in the virtual class. Regarding IT project implementation decision-making, there are different considerations, like the factors for consideration in selecting the languages, in terms of easier to program, which program can use less memory and storage, less processor power, easier to maintain and so on. For *organisational issues* in project management course, though the teacher can share a lot of the previous experience in project delivery, it is the “most difficult [topic] in student learning”. For instance, in IT project, it is common to involve many different stakeholders and some of them may disagree with each other as “each stakeholder can have their own agenda” in terms of the benefits derived from the project. As most of the students do not have the working experience, and even for some smarter students, they can only memorise the conventional terms like leadership role, executive support and top-down because they “do not possess that level of maturity to understand the meaning”; for example, without leadership support, “nothing can be happened or implemented” in a commercial organisation but the students may not be able to understand the implications in the classes. Compared to the programming courses, students can simply follow the given coding steps; and through the output display, the looping logic can be proved as “a workable method” and thus, they can fully understand the coding method.

In terms of the *soft skills*, they include teamwork, professional report writing, negotiation skills and presentation skills. Teamwork is described to have project level and company level, and the latter refers to the corporate blueprint set by the organisation; once given a job, you are part of a team, and the job of the staff is to understand the company goal and do the job very well to help the company to achieve that goal. The professional report writing refers specifically to the client’s report which is used to document security risk assessment work, including the practical solutions and recommendations. So, it is more than just writing the technical findings. The difficulty in teaching presentation skills is about the skills of presenting oneself as a professional, say, making 15-minute presentation in front of a large audience. That means, IT students can be very good technically but if they can be good at these soft skills, they can be “one step ahead of the fellow students” when looking for a job. The negotiation skills are referred to any person once in a job, who need to know how to survive in a commercial world, negotiating with the others or external parties like contract negotiations for business deals, even for IT project team, to negotiate the project plan with the business users to get the project budget.

Relatively, for IT knowledge and skills, the difficulty in teaching is more on the advanced level, such as cybersecurity and risk management courses because these courses require the students to possess more prior working experience, and for the latter, the nature of knowledge can be understood more easily in company setting. To take cybersecurity as an example, unless the students have the foundational knowledge in terms of IT environment setting and some knowledge about the types of security schema, they will know how to locate the loopholes in the systems before coming up the security solutions. In terms of some advanced IT hard skills, the level of difficulty is varied, largely depending on the learners as some may feel it very difficult to learn. To take database management as an example, database query is rather straightforward, such as SQL - “select * from table A”; but database design requires for very complicated skillset and so do some advanced programming languages like low-level coding for robotics, whereas programming can be very interesting learning for some students.

4.2.3 Some cannot be taught for student understanding in the university

Some of the practice-led teachers share their thoughts that for some knowledge, it is unable to be taught in the university environment; and for some kinds of learning, it is required to be done wrongly for several times before the graduates can get to it finally. Some industry experience or practice cannot be put in the course, and he tries to have the student learning in some forms of techniques as “practical practice”. In any IT project, the most basic task to start with is to collect user requirements through meeting with the customers, but this kind of learning cannot be taught in classes; and in the workplace, it may be done by having the senior colleague to bring the junior one along to attend the customer meeting where the junior staff can acquire the experience by observing the senior colleague on how to discuss with the customer. Risk governance is regarded as the high-end knowledge whose teaching approach is conducted through complex case sharing as higher level of learning. It is known that the students cannot understand the meaning, the teacher needs to keep teaching this topic to the students who are required to be aware of these concepts at work though they can only memorise the notes. Someone even has been working for a company before, he or she could never have the chance to involve this area in the company; and thus, it is said to be too visionary for the students to understand this kind of topic in the classes. Lastly, it is about the basic job codes or requirements in the workplace, such as “more well-defined deadlines, more well-defined tasks and how to make different people working together”; all of these are very important in the workplace, but it is very difficult to teach the students to appreciate that until they get to the industry.

4.2.4 Controversial over the minimum set of industry knowledge and skills

Regarding the minimum set of industry knowledge and skills to be acquired by the IT graduates, the practice-led teachers have very different perspectives, even controversial. Except for one teacher, the others are referring it to the programme design's intended learning outcome, to have the combination of business skills and IT skills, to meet the industry requirements, or the logical thinking as the minimum.

Teacher PLT-B rejects the concept of imposing the minimum set of industry knowledge and skills on student learning and he reiterates his standpoint, "I don't think, I don't believe university's job is to train students for particular industry"; and it is no need for the university to do something very concretely to require the student to be professionally qualified by certain way. He equates the minimum set as the training for any specific job and thus, he disagrees with this expectation; however, he can accept that the university can give the students a chance to learn some knowledge in a particular discipline, and to get more mature before going out to work. There is no such thing as minimum for industries as told by teacher PLT-A. If for the minimum set, teachers PLT-A and PLT-D are trying to map it to the intended learning outcome in the programme design, which is identified as a set of skills, that all the graduates would possess when they graduated. Teacher PLT-A appreciates the set of skills – half are technical skills (like programming skills, database skills) and half are soft skills (like communication skills, teamwork skills), because that "will make our students highly attractive in terms of employability"; while teacher PLT-D elaborates that there are different sets of skills expected in core units and speciality streams in the programme design. Teacher PLT-E approaches the minimum set from both business side and IT side, expecting the IT graduates to have some business knowledge like some basic accounting principles and some project management skills. For the pure technology side, knowing at least one programming language is the basis because most people, nowadays, are talking about Java and thus, learning one more programming language can have the additional advantage. Teacher PLT-C takes the perspective from the employer and the industry; as the graduates need to prepare for themselves to find jobs, the minimum set should refer to the set of knowledge and skills as required in the industry. He also explains that commercial organisations do not expect to teach the newly hired graduates from the scratch, expecting them to be able to "speak the common languages", at least. According to the personal learning experience and reflections, teacher PLT-F suggests having the logical thinking as the basic and the good foundation in Mathematics.

Part B: Students' perspective (Student surveys)

4.2.5 Analysis on student feedback on most difficult topics learned

*Q1: What do you think to be the most difficult topic(s) that you learned in this course?
Please give example(s).*

Based on 45 out of 47 students provided their feedback, the most difficult topics in the course were summarised into four categories: technical skills (42%), project management knowledge and skills (40%), soft knowledge (11%), and some theories and concepts (7%). Some of the examples are:

- Technical skills: Java, agile software development, information security, software application, risk assessment technique, business intelligence, regressions, data mining
- Project management: (16 responses)
- Specific project management concepts: Scope management (5), cost management (3), schedule management (2), risk management (2), stakeholder management (2), critical path analysis (2)
- Soft knowledge: IT industry standards, risk control, conceptual knowledge areas

4.2.6 Analysis on student feedback on most practical skills learned

Q2: What do you think to be the most practical skills that you developed in this course? Please give example(s).

Based on 46 out of 47 students provided their feedback, the most practical skills that they developed in the course were summarised into five categories: Microsoft Project management software (35%), soft knowledge and skills (20%), technical skills (20%), project management (13%), and risk management (13%). For clarity, the examples of soft knowledge category include, how to construct a plan, analytical thinking, critical thinking, problem-solving skills, group work, knowing how to read data, and problem reframing.

Part C: Summary of perspectives between teachers and students

4.2.7 Highlights of both views on most difficult knowledge and skills

Regarding the most difficult topics, both practice-led teachers and the students feel that project management knowledge and skills are difficult; but for project management's theories and concepts and the soft knowledge and skills, only 7% and 11% of the students respectively expressed the difficulties versus the teachers in the interview who perceived the soft knowledge to be more difficult. Regarding the technical skills, there were 42% of student respondents, the highest percentage, felt it as the most difficult but the teachers in the interview perceived only the advanced technical skills to be very difficult. When I reviewed the list of technical skills written down by the students in the student surveys, it is found that those skills can be regarded as more advanced technical skills, like agile software development, information security, risk assessment technique, business intelligence, regressions, and data mining; even for Java language, these are generally regarded as high-level learning with advanced knowledge and skills. In other words, the viewpoints between

teachers and students are consistent, except for some soft knowledge like risk control, which is not perceived as difficult as that of the teachers.

4.3 IT Curriculum design, the USEM Model of employability, and Work-integrated learning (WIL)

Part A: Teachers' perspective

4.3.1 Summary of IT academic courses and programme activities

Based on the findings from the research interviews, below is the summary of IT academic courses and programme activities that the practice-led teachers have been involved in teaching, arranging for the experiential learning activities, and/or serving as the internal mentor or academic supervisor during the course of student learning, see Table 4.4.

4.3.2 Professional practice-oriented courses

4.3.2.1 Required: Co-curricular design with experiential learning

This was the course newly developed by teacher PLT-B. He plans to focus on “more soft skills, more practical skills, more practical knowledge and professional knowledge”. The details of the course design have been summarised in table 4.5. The course objectives aim for helping the students to understand the IT industry and the arrangements of company visits and the sharing session are treated as “professional training” for the students. The course design includes part one for industry learning and part two for student learning through the company visit. The objective of industry learning is to let the students “get a sense of the industry”, which serves as the industry background information or the foundational knowledge for the students to conduct the company visit. Based on his professional experience in the commercial field and the current academic experience, he prepares the “first-hand” lecture materials on the background of IT industry over the past thirty years and the analysis on the industry players in the most recent five years. He believes that this part is “very important knowledge” and practical for the students, and can “fit the course curriculum very well” because that can provide the students with the professional view about the IT industry’s evolution before and after the emergence of the internet, and how the Internet age make all things become connected and how the mobile devices make all people connect as well as the current landscape of the IT industry through an analysis of the industry players in the last five years. These course materials are prepared by the teacher who read those companies’ published documents like whitepapers

and then come up the analysis; these materials are taught in a few lectures before each student group starts to conduct the company visit. At the end of the course, all the student groups are required to deliver group presentation and it is a good time for the whole class to be able to have “a glimpse of different kinds of companies in different types of industries in IT and see how they operate” through the sharing made by all the student groups. It is well-designed in purpose because all the companies identified, selected, and invited are carefully considered to show a rather complete picture of the IT industry because each identified company is viewed as part of the full picture; that means, it is done by the teacher’s thoughtful course design. Regarding the grading, every student group needs to submit the written group report on the company visit, together with the group presentation delivered in class, both are graded as the assessment for learning and teamwork.

The company visit is designed as the professional practices for all the students, for example, teamwork to conduct the company visit, to interview with the company representative, and to deliver the group presentation after the visit. From the teacher’s perspective, each student group is supported by one internal mentor from the professor in the department and the company representative visited by the student group becomes the external mentor. The role of internal mentor can teach the student group on how to prepare for the company visit, such as how to set up an appointment, how to prepare the interviewing questions, how to discuss in a group, how to behave with an external party, how to seek career advice from an external person and so forth. The twenty and more industry contacts are known by the teacher who has pre-invited each of them, phoned to them to explain about the purpose of the student visit and the expected support from them; and thus, they can be served as the students’ external mentors who can “help the student groups to appreciate more about what the industries like”; when each student group conducts the interview with the company representative, they need to seek some career advice from the visited company.

4.3.2.2 Required: Co-teaching for theory-and-application course

It is a co-teaching course that teacher PLT-E and the course director are sharing the teaching effort equally and the design of the six lecture topics in the course is constructed by the teacher, see table 4.6. In each of the lecture topics in IT professional practices, the different sets of principles or guidelines are supported by the real-life examples in the teaching; through the close integration between the theories or the guidelines and the examples adopted in the real world, the students are expected to know how to apply it in their graduate job. His teaching rationale is to “maintain the academic, the theories behind the learning itself, but knowing the industry is doing and how the technology to enhance the business would be the essential part of educational students”. Therefore, the lecture topics are focused on the usage of technology rather than the technology itself, and the teaching approach is to integrate the application side and the business side to form the holistic view

on how these two sides can work together to facilitate the better understanding for the students. To take the lecture on data security in banking sector as an example, the technical knowledge, like firewall and database management system design, to be covered by the other professor, his teaching is to focus on how the banks use the technology to protect the customer data in the banks and the best practices for the banks to implement the solutions. In the lecture, the regulatory requirements like the implication of GDPR, the European Data Protection Regulation in the course are covered. Leveraging on his real-life professional experience in the business-IT environment in the global financial sector, and the previous committee member in some of the statutory public bodies, these international experiences can allow him to prepare and design the whole set of lecture materials as well as come up the respective group assignments in project case format. His passion in teaching is to nurture the IT graduates to understand the value of technology deployment, how can it enhance the business in the financial sector, in addition to the traditional focus purely in technology; for example, how to use technology to protect the personal data for banking sector in complying with the data privacy ordinance. All the group assignments are designed in research-based group projects, and “the project scope is loosely defined by design” as it can allow the students to find out more around the assignment topic by themselves and each student group is required to deliver the group presentation at the end of the course. During the group presentation, the teacher can assess their learning effort as well as their understanding through the Q&A session after each presentation. If there are any important information missing but that is supposed to be covered in the presentation, the teacher can inform the whole class so that everyone can learn about it.

Samples of the lecture topics mentioned by the teacher during the research interview:

Topic 1: IT security and banking

- Content: Why do we need IT security in banking? Why is it important? What is two-factor authentication, such as one-time password? How do people use it?
- Examples: SSL encryption, two-factor authentication, different types of security schemes that banks can use, what are the common technology adoptions like security tokens
- Group assignment: Compare and contrast the 3 top-tier banks in online banking, with a set of questions prepared for the students to do research and presentation

Topic 2: Big data in banking

- Content: How banks use big data to help the business
- Examples: Customer profiling, analysing profitability, predicting customer behaviour

4.3.2.3 Elective: Lecture-and-lab course for practical practices

Teacher PLT-C did not mention about the lecture part in the course but said to consolidate both the lecture and the lab session for the sake of having longer lab sessions in the classes. The lab sessions are designed for practices on those project steps and tasks derived from the real case project written by his team and the system hacking practice. This course design is summarised in Table 4.7. His rationale in designing this course is based on the question of, why the students choose this course and what the course can benefit the students in their future job; that is because he believes that most of the students chosen this course as they are interested in IT security and he affirms, “our focus is to put effort to let them know the needs of the external world in security, the current knowledge in security that are required in the industry and the foundation where the current security knowledge is sitting on”. Other than the IT security theories, he wants to train them up the practical skills. The system hacking practice is covered in the course because it is aligned with the course aim to do more practices and based on the three-step approach in doing the actual industry practice, including how to do the security risk assessment, how to interpret the findings from the assessment exercise, and how to hack into the system running the web application. It is understood that many students feel excited to hack into a system; but he reiterates that to do hacking practice, students need to know at least how to set up a system before doing the practice. “It is not something you like hacking and then you can hack it!”. Even the students can easily find those hacking techniques in books, they cannot understand how to do it unless they can practice it in the lab.

Though there is onsite teaching assistant arranged by the university department, he has arranged more manpower resources, two to three staff, coming from his own company. Due to the experiences in the previous years, the teaching assistants did not know how to do the lab exercises and some students are expected to do something wrong in the lab exercises that would require for more support in the lab practices. The purpose of the group project is to encourage the students to continue the learning, to find out more about the field and more practices, requiring them to pick an advanced topic which needs to be related to the latest development in IT security field. “If the students show interested in this area, they can continue to learn it by themselves after the course is completed”. Once they go out to work, hopefully, they can tell people what they have learned. If they do not throw away all the class notes, they should be able to read the class notes again to recall what they had ever practised in the labs in the future. At the end of each academic year, the teacher will update the course materials and the updates are based on the industry changes and the students’ learning progress observed in the lab sessions, to find out how much they can understand the course contents. Moreover, the course design is prepared for providing the updating knowledge relevant to the latest requirements of the professional certifications because some students are expected to seek for the certifications later.

4.3.2.4 Required: Final year project designed for practical-oriented

The final year project, whose credit is counted for two courses, is compulsory for all the final students for graduation and it can be one person project or a team up to three students. Over 70-80% of the projects are designed by professors, and the students are allowed to provide some input but they “need to convince the professor to take that [their idea]”. Some of the final year projects are linking up with some industry players or some experts in the industry as it is aimed for helping the students to “do something creative, and very practical”, and sometimes can be related to the industry or the professional training. The project grading system is to have all the final year projects to be graded altogether so that all the projects can be compared before deciding which project can get A, A-, B and so on. There was one proven practical and outstanding final year project mentioned by teacher PLT-B that the student initiated the project idea whose project design was to prevent losing something important like the wallet. The student’s project idea was triggered by his father who lost something very important and that have struck in the student’s mind always as his father was very frustrated on that. As the student got a very clear idea, PLT-B decided to let him do the project and just gave him some feedback; and upon graduation, the student set up his own company to develop the product based on what he did in the final year project, which turned out to become the goal of the company. The teacher is proud of “using some of his industry experience” to help the students appreciate what can be done.

4.3.2.5 Required: One-year industry placement in work-and-study mode

Out of the 4-year degree programme, it is compulsory for all the students to spend one year working in the industry to gain some industry experience and they can gain credit on it. The characteristic of this placement is work-and-study in parallel during the entire one year and is arranged on the third year of the programme. That is, the students go to work for 4 days, Mondays to Thursdays, after 5pm and on Fridays, they go back to the university to attend classes. The main objective of the placement is to make sure the students who can gain new skill set and new knowledge and thus, their learning progress is monitored by “work supervisor [from the company] and an academic supervisor”. The course itself is a pass or fail course; but the students need to submit several reports as well as the weekly log on what they have been doing in each week. According to teacher PLT-A, it is a win-win scenario between the students and the companies because those companies can get to learn about the university students joining the field while the students also learn about the companies they are working for. Very often, “the company after spent one year training the student, they would like the student to stay”; and it is this reason that many companies want to offer placements to attract more students to work for them.

4.3.2.6 Required: Summer workshops for practical skills training

The summer workshops are designed to deal with the need for very practical skills training, and the students can pick up those practical skills, such as programming languages, how to

use the system command lines in a specific type of operating system. It is required as part of the programme requirements but is non-credit bearing, that is, the attendance is printed on the academic transcript, but the students do not get such grade for that. In other words, the university that teacher B working for, distinguishes the practical workshops from the regular curriculum.

4.3.3 Outside the classroom: Work practices

The work practices are found on three types of elective courses. The *consulting project Course* is a relatively light-weighted consulting project practice for student learning; and the course objective is to let the students have the chance to perform the feasibility study and then submit some recommendations to the company. It is also designed as a credit-bearing course for the students to claim for the credits after completion. Three out of the six practice-led teachers mentioned about *summer internship*, and it is commonly seen as a good chance to let the students have some industry knowledge so that they can have a better understanding on those learned in the classroom courses. There is *work-study programme* more suitable for the senior students to acquire some basic knowledge about the discipline as some professional experience in the industry which is different from the placement. For every student being sent to a work-study, the department assigns a mentor to serve as the student mentor who needs to visit both the student and the company to get some feedback from them.

4.3.4 Extra-curricular activities for experiential learning

All the extra-curricular activities in this study are optional for the students, supporting their experiential learning and it includes industry seminars, mentorship programme, and site visits.

4.3.4.1 Industry seminar talks and University-wide Industry week

Teacher PLT-F is playing the role of industry liaison for the department, and the industry seminars arranged by him, welcoming the current students and the alumni to join. There is one example about the FinTech agenda set out in Table 4.8. It is expected that “these industry seminars are useful for helping the students understand further on textbook knowledge as well as about what the society is expecting from the university graduates”. One important point is worthy of addressing at here, some industry speakers told him that they were “very impressive” to see different audiences to attend the seminar, “not just the students, but also some professors”. Based on the two class observations conducted for the industry luncheon talks, I did see the programmer director sitting on the first row in the

lecture room and he was the one to ask the first question during the Q&A session. Other than the industry events launched for the degree-level programme, there is also the university's yearly Industry Week that he needs to support the department to liaison with the industry speakers. In the first year, all students are studying the generic courses and they need to select the major stream in the new academic start of the year two. Therefore, "all faculties would make use the Industry Week to invite their respective industry speakers to deliver the speeches about the future jobs and the career prospects in the field if the students choose to study in the degree programmes related to their respective industry. It is said that even within the same faculty, each academic department is competing to get more students to stay in the department.

4.3.4.2 University ranking comes into effect in experiential learning

It is common to have the mentorship programme in the university but for one teacher, the scale of the mentorship programme is the university-wide, made up of 4 levels. Level 1 is the senior students to mentor the junior students; Level 2 is to have alumni mentors; Level 3 is to have industry mentors; while in Level 4, is the university-level that helps to look for the executive mentor to support the elite students. It is the university's overall direction to support the student learning and once they joined this programme, the mentorship support is kept running within the four years of study in the university, however, the resources allocated to this arrangement is decided by the individual department. Basically, the student feedback can be divided into two areas; firstly, they can have some ideas about the daily tasks, the job nature, and what kind of jobs available in the market; and secondly, for those who have decided to go for a particular career path but no ideas about job interview process, such as the aptitude test, group interviews and etc., they can ask the alumni speakers to share some tips with them. It has been evolved over time, mainly contributed by the university ranking. When the university wants to do better, they want to allocate more resources to support the students so that "it can help to raise up the bar of their students". The teacher added, it is heard that some universities of higher ranking are relatively spending less resources in this aspect to support the students because those universities' students are relatively more active, and they are taking more self-initiative and looking for the chances by themselves. Very interestingly, another teacher also mentioned about the mentorship programme is useful for the students, but in the university, it is heard that the students' participation rate was very low. Checking with the Times Higher Education's university ranking, the ranking of the teacher's university is higher than that of PLT-D in Asia and globally, that may be the reason why the student participation in that university was very low. Three of the teachers are involved in setting up the company visits or site visits for the students, and the objectives are having more connections and more technology updates directly from the industry. As the students can have the chance to meet up with the company representatives, the question is who will be the representative to show up during the visit. It is found that if the students are coming from the higher rank's universities, the more senior executives or even the CEOs are more interested to meet and talk to them in person. During the visit, the company executives do want to understand

more about the current university students from different universities; and secondly, they would observe the students and see whether they can find some good potential candidates that they want to hire in the future.

Part B: Students' perspective (Student surveys)

4.3.5 Analysis on course items and activities on the level of usefulness in the study

Based on the list of 15 course items and activities, students were asked to rate each of them on “the level of usefulness” in the study of IT degree programme, see figure 4.1. The course item of “real-life case studies and examples” was the only item rated by all the 28 students as useful and the above and no students thought it to be not useful. For the course item (b) of “experience sharing of industry practices”, 96% of the respondents rated the same level of usefulness as three of the traditional course items in category (a) understanding of the subject knowledge, practical lab exercises and class exercises and assignments; and had 3% more respondents when compared with that in technical skills (93%) and summer internship (93%). Both the work practices activities (e) and the extra-curriculum activities (d) had more respondents rated it as useful-and-above than that in the co-curricular activities (c). The co-curricular course activities like guest lectures and company visits, having 68% to 75% of respondents rated them as useful and the above, were relatively less useful than all other categories of course items, whereas this category of course item was also rated as not-useful-scale by the most respondents at 7%.

	Course items or activities	Ranking	Total (%) = 3+4+5	1 - Not Useful (%)	2 - Less Useful (%)	3 - Useful (%)	4 - More Useful (%)	5 - Very Useful (%)
b	Real-life case studies and examples	1	100%	0%	0%	32%	39%	29%
b	Experience sharing of industry practices by professors/ instructors	2	96%	0%	4%	29%	43%	25%
a	Understanding of the subject knowledge in the field of study	2	96%	0%	4%	39%	29%	29%
a	Practical lab exercises	2	96%	0%	4%	29%	32%	36%
a	Class exercises and assignments	2	96%	0%	4%	36%	46%	14%
a	Technical aspects like programming skills, database design, network architecture & etc.	3	93%	0%	7%	29%	32%	32%
e	Summer internship	3	93%	4%	4%	14%	25%	54%
d	Industry seminar talks	4	89%	4%	7%	50%	25%	14%
a	Group projects and presentations	5	86%	7%	7%	25%	36%	25%
a	Theoretical frameworks and methodologies	5	86%	0%	14%	29%	32%	25%
e	Work placement	5	86%	4%	11%	7%	25%	54%
d	Mentorship	6	79%	4%	18%	36%	32%	11%
c	Guest lectures	7	75%	7%	18%	39%	29%	7%
c	Company visits	8	71%	7%	21%	25%	29%	18%
c	Field trips	9	68%	7%	25%	25%	29%	14%

Figure 4.1: The ranking of course items and activities in the level of usefulness in the study of IT degree programme. Note: Total (%) = total percentage of respondents to give the rating on 3 - useful, 4 - more useful and 5 - very useful.

- (a) *Traditional course items: Understanding of the subject knowledge in the field of study, Theoretical frameworks and methodologies, Technical aspects like programming skills, database design, network architecture & etc., Practical lab exercises, Class exercises and assignments, Group projects and presentations*
- (b) *Teaching tools and techniques: Real-life case studies and examples, Experience sharing of industry practices by professors/instructors*
- (c) *Co-curricular activities: Guest lectures, Company visits, Field trips*
- (d) *Extra-curriculum activities: Industry seminar talks, Mentorship*
- (e) *Work practices: Summer internship, Work placement*

4.3.6 Analysis on course items and activities in terms of helpfulness for graduate jobs

Based on the list of 15 course items and activities, students were asked to rate each of them “in terms of helpfulness” for their jobs after graduation, see figure 4.2(a) and 4.2(b). The highest percentage of respondents (89%) perceived both summer internship and work placement to be helpful in their future jobs after graduation. Real-life case studies and examples got 71% of respondents said to be helpful. It was found to be consistent that the top five ranks of course items or activities perceived to be helpful, which did not have any respondents or as low as 4% of respondents rated them as not helpful. Experience sharing of industry practices by practice-led teachers, though no student thought it to be not helpful, was the most uncertain course item as 43% of the respondents did not know whether it will be helpful or not in their future job. The second rank of the most uncertain course items perceived by the respondents were field trips (36%), mentorship (36%) and guest lectures (36%). Class exercises and assignments was ranked as the third, about two-thirds of the respondents (61%) perceived it as helpful but one-third of the respondents (32%) were not sure whether it will be helpful in the job after graduation.

	Course items or activities	Ranking	Yes (%)	Ranking	Maybe (%)	Ranking	No (%)
e	Summer internship	1	89%	8	11%	1	0%
e	Work placement	1	89%	9	7%	2	4%
a	Understanding of the subject knowledge in the field of study	2	82%	7	18%	1	0%
a	Technical aspects like programming skills, database design, network architecture & etc.	3	75%	5	25%	1	0%
b	Real-life case studies and examples	4	71%	5	25%	2	4%
a	Practical lab exercises	5	68%	4	29%	2	4%
a	Class exercises and assignments	6	61%	3	32%	3	7%
a	Group projects and presentations	6	61%	4	29%	4	11%
a	Theoretical frameworks and methodologies	6	61%	6	21%	6	18%
b	Experience sharing of industry practices by professors/instructors	7	57%	1	43%	1	0%
d	Industry seminar talks	7	57%	4	29%	5	14%
c	Company visits	8	54%	4	29%	6	18%
c	Field trips	9	46%	2	36%	6	18%
d	Mentorship	9	46%	2	36%	6	18%
c	Guest lectures	10	43%	2	36%	7	21%

Figure 4.2(a): The ranking of course items and activities in the terms of helpfulness in graduate jobs

In the graphical presentation of figure 4.2(b), it was clearer that no respondent rated the following four course items as not helpful: understanding of the subject knowledge, technical aspects, experience sharing of industry practices and summer internship. However, guest lectures (21%) were ranked the most as not helpful for their future job while the second rank as mostly not helpful was theoretical frameworks and methodologies (18%), company visits (18%), field trips (18%) and mentorship (18%).

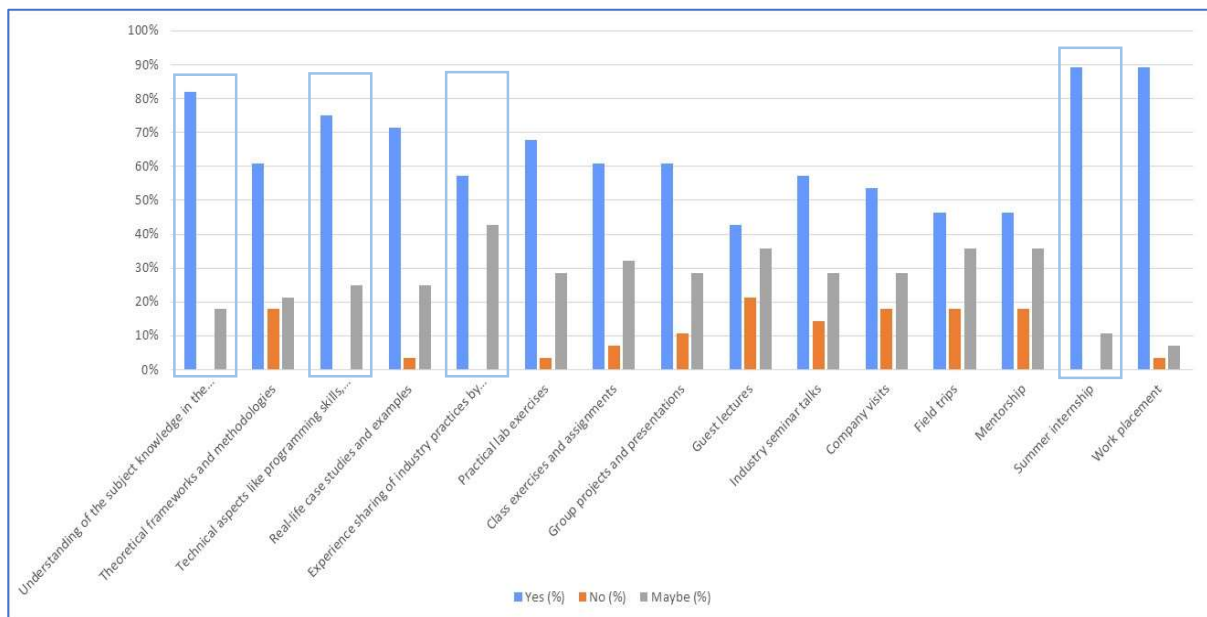


Figure 4.2(b) Graphical: The ranking of course items and activities in the terms of helpfulness in graduate jobs

4.4 Practice-led teaching pedagogy, educational authenticity, and disciplinary inquiry

Part A: Teachers' perspective

4.4.1 Experience sharing

4.4.1.1 First-hand, concrete examples and the best practices

Based on the working experience in the field, all the practice-led teachers can share the first-hand experience with the students. The characteristics of the sharing are lived, more realistic, more practical, and highly relevant to the student learning because they can explain the problem practically as the first-hand experience, which are different from the

other teachers who “just explain examples from theoretical point of view or from a third party’s view” through the reading from some textbooks. In terms of technology use, the sharing of teacher PLT-E for the best practice is relating to its support to the business in compliance with the guidelines and principles involving the legal and security concerns. Another simple but useful example for website design, is the criteria of internet security and some of the basic principles, like 3-clicks rule for e-visitors who can get to the webpage on what they want to have the information. These are the guiding principles that the taught students can put it back into the practice at work. When the practice-led teachers articulate the theoretical standpoints and explain on those questions of what, why and how, they use the concrete examples as these can provide more practical scenarios, more realistic and highly relevant for the students’ understanding. It is very common for them to use real-life examples that they have experienced as the teaching materials and the practical scenarios can give the reasons on how the theories work, such as how information is encoded and communicated, and why the protocol is “designed one way versus the other way” (PLT-B); and the actual examples from the field can promote the understanding of the students in the real environment as those are “highly relevant to the students they need live, something that they can relate to easily”(PLT-A); those practical practices learned in the labs can allow the graduates to recall the practices if they do not throw away the class notes (PLT-C), as well as job mapping in the future (PLT-D and PLT-E).

4.4.1.2 Embedded work practices

As the experience sharing is contextually lived and practical, there are work practices embedded in the contexts, including the trade-offs between different choices, the soft skills and even the hard skills. In making the technical decision, the IT staff needs to consider the trade-offs between different choices in addition to the understanding of the technical piece itself, like the scalability to meet the future expansion, the selection of programming languages for coding maintenance when doing the system updates. Knowing the existence of some trade-offs is sure to be one type of learning for the graduates. For those soft skills requiring higher level of understanding, the experience sharing of the practice-led teachers is extremely valuable and useful, such as the topic of authority during IT project delivery quoted by teacher PLT-D, as some staff can have more authority (positional power) while some others can have more say (leading domain experts). It is the reason why there can be different bosses to ask you to work things out in a project, and how you should handle their different requests. Teacher PLT-D states that having experience sharing is better than not, and it is true “even in those seemed to be hard skills” and the example quoted is the coding practice. It is very common to have typo-errors in coding, (if....., the syntax), and very often, students were at loss in the lab when the program was not working after all the codes had entered but no result was displayed on screen; her immediate instruction is to tell them to do “self-checking” because the set of sample codes is 100% working. By her experience, it is highly likely due to the reason of typo errors, semicolon but in comma, capital letter but in small letter, single-coded but in double-coded; it is almost 99.9% fallen into these errors.

Or, the students can use the desktop checking. For problem-solving in programming, there is debugger tool to help locating the errors. That is the reasons why experienced teachers can offer more than one way for the students to learn more effectively.

4.4.1.3 Work code of practices

The work codes of practice in IT projects can directly affect the completion of an IT project or even fail it. Every time when teacher PLT-D conducts the project management course, she reminds the students on the work practices in doing IT projects; for example, every time “after you collected the requirements from that person (the user), to remember – the most important thing – putting down the requirements in black and white, and then to meet up that person again to ask for feedback on whether my (the student) understanding of the requirements was this and that” as yours previously said. She explains that it is not because we are worrying about that person to come back to change the user requirements, but rather there may be some misunderstanding about the requirements during the collection process of user requirements. If there is some misunderstanding existed but you do not know, and then, you just go ahead to start the software development right after that round of the collection of user requirements; and waiting until the project is delivered to the user, the person tells you that it was not what he wanted to be the requirements. The value of her sharing is to teach the students to learn “how to minimize the many possible problems at the later stage during project delivery”. She said, “do not be lazy”. Even the writing is just in point-form, emailing it back to the person you collected the requirements can do; and this work code of practice was to document on what you have done – the requirements were collected from the user. In addition, it is common for the students to make mistakes in doing the assignments like writing the numbers, but teacher PLT-D emphasises that there are some mistakes, such as “missing one digit of zero”, which can be totally unacceptable at work.

4.4.1.4 Analogy as an option

Due to some experience learning very difficult in teaching, it is suggested to use analogy as an option to help the students to convert what’s heard to become their own experience. Teacher PLT-D cites the example on how to learn what is ‘yogurt’ for the person who never tried it before. Explaining what yogurt is, you may say, you ever ate ice-cream and drank juice before, and then you tell the person that yogurt is not as thick as ice-cream and you can imagine by mixing the juice into the ice-cream, in which the texture is turning a bit to fluid but not as heavy as ice-cream. This approach is to leverage something the students have some experience on it before, and then to explain how it is similar to what you want to teach the students for understanding. When one had ice-cream and juice before, the simple way is to treat it as a mixture of the two things, ice-cream, and juice; and it is said to make it easy for memory and the learning of yogurt is ‘juice plus ice-cream’.

4.4.2 Practical lab sessions, educational authenticity, and authentic intellectual work (AIW)

4.4.2.1 Practical lab design and the learning environment

There are four practice-led teachers required to conduct the lab sessions in the taught courses. Teacher PLT-D has not mentioned about how the lab sessions are conducted in the interview and thus, this sub-section is covering the lab teaching of teachers PLT-A, PLT-B and PLT-C and is summarised in table 4.9. They understand very well about university's teaching and learning environment which is different from the workplace, and it is impossible to impart the industry practices to the students. As they recognise the differences, they work around the constraints, by allowing the students to make mistakes and to re-do it in the lab; and through the design-in-purpose, they are not fully resembling the work practices, which are suggested by Gulikers et al. (2004, 2006), and rather making it as practical practices and technical understanding through visualisation in the computer lab environment for the students' learning.

4.4.2.2 Scenarios-setting with industry-context versus without industry complexities

In the lab sessions, both teachers PLT-A and PLT-B have designed the lab practices on scenario-based but treating the industry elements totally different. PLT-A prefers to let the students solve the real problems, "not toy problem", from the real data sets related to artificial intelligence (AI), collected from the industry in the lab sessions. With the real-life examples of industry scenarios in aviation, railways, and some others, together with some local industry details, it is expected that the students can "design and code the program to demonstrate their understanding". And such understanding is further articulated through "lots of project-based works" completed by the students who can be able to frame a more realistic picture of the respective industry and in different practical scenarios between these industries. The teacher is confident that the students can relate to the learning easier because what he does is "definitely" practical and up-to-date knowledge followed closely in the technology development. For teacher PLT-B, he promotes the learning both the classroom teaching and the practical lab sessions are equally important, whilst he sets up the lab environment as "ideal live" and posits the lab as "an ideal situation but it helps to understand what's in the textbook". The purpose of lab practices is hands-on, for the students to "understand the theoretical things in a more concrete way" as well as to reinforce what they learned in the class. However, he reiterates that the hands-on thing is not the same as the product in industry which targets to produce very concrete products. In the industry, there are many mess situations that they need to solve them; but in the lab sessions, all the mess situations are "extracted out" so that the students do not need to deal

with all the complexities, thus making the environment suitable for student learning. For the students, they just do the lab in “the extracted scenario but hands-on”. For instance, the lecture teaches “there is network, there is router and the two nodes connected together”. In the lab, it would have a router for the students to look at the signals, to make the connection between the two nodes and then they would see some information get transmitted from one side and then received by the other side. In the middle, they have the monitor to display what are the data packets back and forth to make it happen. The students can see all these things are working, and it is very practical. “The lab is the ideal live thing, which is closer to the industry, but it is not the same”. He clearly reaffirms that “there is a gap between the lab and what is going on in the industry”.

4.4.2.3 Real project case converted into learning tasks for practical practices

The lab sessions prepared by teacher PLT-C is resembling the practices at the customer sites, through a set of practical assignments in the design of work steps or tasks derived from the real case projects in the industry, by claiming that “the lab assignments we prepared are very close to the industry. The steps practised by the students in lab are the same kinds of steps that we are performing at the customer site”. Briefly, the students are asked to set up servers and virtual machines assuming in data centre environment, to configure some network equipment, and to install some applications. The teacher explains that though many textbooks wrote about how to do servers setting, how to do machine hacking, firewall settings and the detection mechanisms, the students need to practise it before they can really understand how to do it. However, the students are facing the difficulties to follow the lab practices in the lab and commented it as very demanding course in the course evaluation. As discussed in the earlier part, some students cannot follow the lab exercises or instructions and thus, it interrupted his original plan which was set for the very minimum teaching instructions in the lab practices. He is required to refresh the approach in lab teaching that for the simple steps, just let them look at the instructions as given; while for some critical steps, the students are told to hold on the practice but to think about how to make the selection in that step, and then to listen to the instructions before moving forward to continue the lab practices. Most of the students do not have industry experience, and it is understood that the course cannot be covered too much professional or industry practices. The alternative for the teacher is to put “some techniques” into the lab exercises only; and it is seen as more towards putting “practical practice” in the course, that is, to impart some knowledge about the practice. Basically, the students are expected to “use common sense only” in doing the lab exercises in front of the computer but he does not know why some students not even able to make a choice if there are more than one option in the tasks. According to some of the student feedbacks in the course evaluation, it is found that the students felt the course too much to be learned, and it is very rush for them to learn so many things in the course. Besides, some of the course contents were totally new to them and they were unable to manage the lab exercises. Even those students serious in learning, they prepared some materials at home before the lab session in the next

day and they also could not finish it in the lab. Only for those extremely hardworking students could make it because “they brought the exercise of the whole computerised lab session back home to do trial and testing to make sure they can really get hold of everything in the lab practices”.

4.4.3 Tailored-made industry case studies for professional practices

Project solution cases with best practices: Teacher PLT-E is the one, giving me the most real-life examples during the research interview. There is one example he quoted that most of the people should do it before, the cheque clearance operations for banks. After the sharing on how technology works in cheque clearance, the students said that they learnt a lot because previously, the only thing they know is, I write a cheque to deposit money and the money will be in my account; but for now, they said that they have the idea about how the workflow is working and what is the technology behind. It implies that teacher’s sharing can add “a lot of the value to the learning process” and makes a big difference in student learning. There are other actual examples adopted in PLT-E’s lectures, including some horizontal project cases, like data privacy, internet banking; and some industry-based cases, like business process automation and workflow analysis.

Both teachers PLT-C and PLT-E leverage heavily on the industry cases in conducting the teaching in the lab assignments or the lectures. The preparation of the practical lab exercises is based on the two real project cases written by teacher PLT-C and his team. The first project case is an e-commerce system implementation completed several years ago, and the recent project case is related to the university’s election system. For teacher PLT-E, he designed the group assignments to let the students do some research work around the topic on the actual technology deployment, like in the banks, and how these kinds of deployment can support the companies to make it as the services to the customers, such as security token and one-time-password for online banking. The scope of the assignments is open, not restricting the scope of research work and not dictating the answers. It is welcome if they want to dig out more information to show their learning effort. Based on the content and the quality of the presentation delivered by the students, plus the feedback loops after the presentation, the teacher can assess how much they have been picked up from the lectures and how much they learned it from their own research. *Examples of Project case assignment:* The background of each group assignment forms part of the contents in the lecture because the theory like principles for business process re-engineering (BPR) is taught under the lecture topic of workflow analysis. All the students possess some basic knowledge and some understanding before they start to do the research-based assignment. One of the lecture topics is about IT security and Banking. In the corresponding group assignment, three top banks’ website and some technology websites are provided. Students are asked to “compare and contrast” the three top banks according to the following list of questions:

- How do they do the two-factor authentication for IT security in banking?
- What devices they use?
- What security schemes they use?
- What are the pros and cons because they have different options, like security token, short message for one-time password?
- What are the transactions allowed for different types of security login?

The project case assignments are done by student groups, 2-3 students a group, and all groups need to do group presentation in class at the end of the course and the feedback session can be served for giving them the “feedbacks and critique on what they have done in the research”. According to the course evaluation, the teacher said that some students wanted to have more time to do the research project. Surprisingly, there were two student groups exceeding the teacher’s expectations. In terms of *breadth*, one student group spent the extra research effort to discover one of the banks on the assignment list, which has extended the same level of online security to the mobile logon services. In terms of *depth*, one student group did the extra research effort to locate the actual coding, causing the security incident of data breach of a national bank in Southeast Asia a few years ago.

4.4.4 Final examination in practical lab, and authentic assessment

The design of the practical lab examination is identical to the lab exercises in the computer lab, and it aims for practical, not like those paper-based examination to test for “the memorising stuff” and to let students get higher marks by memorising the notes. According to teacher PLT-C, the preparation effort for the lab examination is significant and it takes more than 2 weeks’ preparation time for a 3.5 hours’ examination paper and is required to involve the coordination effort from the university’s IT department to help setting up the virtual environment for that specific practical lab examination. One of the examination questions is to do system hacking and thus, must involve the university’s IT team to set up the protected virtual environment in the university for that practical lab examination. However, it is found that some students repeated the same issue as that in the practical lab sessions; that is, some students did not read through the lab instructions during the examination and were required to re-do the system set up again, costing them to have less time for completing the remaining examination. Strictly speaking, before the examination, teacher PLT-C has alerted the students that “there is one step that they must do it first before they can start to do the lab examination”. According to the examination result of the class, out of the 60 students, about one-sixth of the students (about 10 students) who did not follow the exam instructions to do what needed to be done during the preparation time, and once the students did it wrongly, they could not get back the preparation time in the examination.

Part B: Students' perspective (Student surveys)

4.4.5 Students' feedback on course design and learning

4.4.5.1 Analysis on course design

There were 98% of the students agreed that they had a clear idea on what were learned and expected in the course; and they indicated both technical skills and IT industry knowledge were covered in the course. Students were asked to rate the level of usefulness in terms of five types of course items or activities in their study, see figure 4.3. When grouping the percentage of “more useful” and “very useful” scales together in each course item, “understanding of the course subject in the field of study” was regarded as the most useful with 73% of student rating, followed by technical aspects with 63%, class exercises and projects with 62%, experience sharing with 54% and the others like company visits with 35%. But the surprise is, 15% of the respondents rated technical aspects as less useful in their study, just seconded to course activities like guest speaker and company visits, which were regarded as the least useful with 20% of the students rated it as less useful or not useful. Only 11% of respondents claimed the course item of experience sharing of industry practices and real-life examples, less useful or not useful. For the category of others like guest lectures and company visits, there were 20% of students in total responded as not useful and less useful, the highest percentage among all the five types.

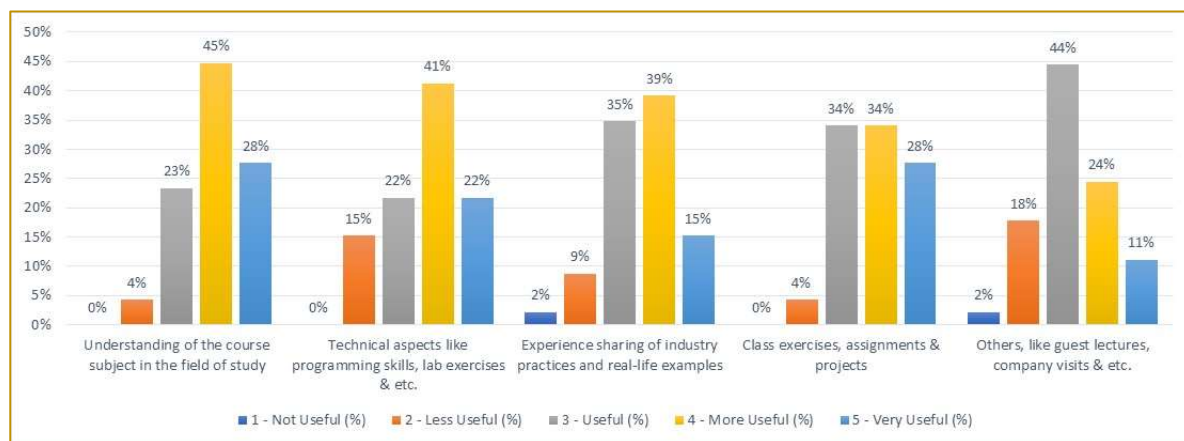


Figure 4.3: The level of usefulness on five types of course items or activities

In terms of course workload and assessment, 96% of students agreed that course assignments and projects were effective to help them practising what they learnt in the course and 98% of students agreed that their course understanding was consistently assessed through the course assessments. According to the comments collected from the respective open-ended questions, the top three mostly practised areas were project management and its related technical knowledge, technical skills, and business knowledge; and the examples are listed in table 4.10. Based on the student responses on course

assessments, it was found that the students understood those in-class exercises, used for assessing their learning and understanding in addition to the standard course assessment in the course. The examples of in-class exercises quoted by them included, writing up a project charter, a risk registrar, project interim report, critical path analysis, business analysis by using the analytic tool, risk analysis on different frameworks on a case-level, and developing a database using MySQL.

4.4.5.2 Analysis on student learning experience

For the analysis of student learning experience, it covered three dimensions: learning resources support, practice-led teaching, and learning environment:

There were 94% of the student respondents agreed that the course materials were comprised of theories and applications in IT industry, whereas all respondents agreed that the study materials covered the relevant case studies and industry practices in IT field. It is meant that all the respondents perceived the study materials, like case studies, were closer to the industry than that of the course materials. It can be explained that the study materials prepared by the teacher were viewed by the students as the supplementary materials in the course. In terms of learning resources support, only 6% of respondents said not to be clear. According to the responses collected from the open-ended question, the vast majority of 94% gave some examples which could be categorised into four main sources of learning support: the first and the mostly cited was online resources like some project management templates offered in some websites and online manual of some software applications. Second was the lecture materials, third was the support from teacher and tutor like demonstrations and the last one was guest lecture and career talk.

For practice-led teaching, 94% of the student respondents agreed that the teacher was very experienced in teaching the course more practical and interesting while 62% very agreed with this statement. When asked how useful to you if teachers possess the IT working experience, they showed very positive responses, which could be seen in a comprehensive list of different written expressions, 18 wrote for “very useful”, 4 for “useful” and 2 for “quite useful”, one for “really useful” and one said it was perfect “10/10”. In addition, there were other expressed responses which were consolidated into four categories, namely, understanding the IT industry, real-life experience sharing, career support, and academic support. Their exact quotes are provided in table 4.11(a). Over 70% of the students very agreed that the teacher made a real effort to understand the difficulties in their study. When they were asked for what the teaching staff had done, they gave a whole range of examples of teaching support they received. See examples of direct quotes in table 4.11(b).

Basically, all respondents agreed that they learnt to express ideas confidently with teacher and classmates and no students disagreed with it. Over 65% of them were very confident in expressing their ideas. Only 4% of the respondents disagreed, but there were 96% of the students agreed that the teaching staff always encouraged them to understand the course from different angles.

4.4.5.3 Analysis on student learning outcomes

In this section, the objectives are to collect the student feedback in the courses taught by the practice-led teachers in three areas: “professional skills”, “graduate qualities” and “intellectual motivation” around the topics of technical skills, problem-solving skills, teamwork, confident in facing challenges, applying what are learnt, creating new ideas and the ability to do self-reflection.

Professional skills: There were 96% of the respondents agreed that the course helped them to develop IT technical skills and prepared them as a good IT project team member in the future while 94% agreed that the course sharpened their problem-solving skills in handling IT tasks in the future. Looking into the specific scales of very agreed and strongly agreed, more students (83%) felt that the course helped them to improve their problem-solving skills than that (68%) in the IT technical skills. The same applied to the soft skills in teamwork, 79% of the respondents felt the course prepared them very well as good IT project member than that for IT technical skills. Among all questions in this section in the survey, the responses to this question of tackling unfamiliar problems indicated it to be the toughest for the students, having the highest percentage (13%) of the students who could not tackle unfamiliar problems and the lowest percentage (4%) of students could have full confidence in handling it.

Graduate qualities: Based on the student responses, they showed the very consistent pattern of consensus about their learning on IT field of knowledge, applying the learned principles to new situations, and the confidence to investigate new ideas. The total number of respondents rated for very agreed and strongly agreed were 70%, 72% and 70% respectively. All the respondents considered what they learned in the course were valuable for their future. When they responded to the open question to elaborate how the course is valuable to their future, their responses (total for 46 responses and only one student not answered) can be categorised into four major areas, including, future careers (39%), project management knowledge and skills (28%), practical knowledge and skills (26%), and mindset (7%). Their direct quotes are summarised and provided in table 12. There was one student who wrote, “the course can help me not to afraid [of] when I have IT project in the future”.

Intellectual motivation: According to the student responses, 57% of the students were very agreed and strongly agreed that the course has stimulated their interest to study in IT field as well as has inspired them to pursue job in IT field after graduation. However, there were 8% of respondents not agreed to stimulate their interest and 11% not agreed to inspire them in IT job. In terms of personal development, there was 94% of respondents agreed

that the course developed their ability to do self-reflection on what they learned and 66% were more agreed with it.

4.4.6 Analysis on disciplinary inquiry through interactions between teachers, fellow classmates, and student project presenters

As suggested by the practice-led teachers, class observations were arranged in the end of the courses by attending the group project presentations. It is believed to be the good time to observe the interactions between group project presenters, the fellow classmates, and the teachers in the classes. There was total 20 student presentation groups, covering 11, 7 and 2 group projects in the classes of teachers PLT-C, PLT-D and PLT-E respectively. The class of teacher PLT-B was 16 individual projects and there were 2 industry luncheon talks observed for teacher PLT-F. The analysis on class observations is focused on teaching pedagogy and learning environment. It is observed that the practice-led teachers deployed different teaching approaches to check for the level of student understanding, to encourage them to do self-reflections on what have been done in their own project, and to find out whether the students can apply some of the key technical concepts in their chosen projects.

4.4.6.1 Observation analysis on learning environment during Q&A sessions

One practice-led teacher created the open discussion learning environment for the students so that they could exchange ideas with each other, and it could also support the learning for the entire class. When the students could not answer the question, he tried to give them pointers to recall the technical concept. Blockchain technology is increasingly wider adoption and hence, the teacher wanted to leverage two of the student projects which were using two different implementation solutions to handle the same problem. After the two presentations, teacher said, “for the benefits of the class, we discuss the two presentations together”.

Teacher: “Each of you, explain from your view.... What is the key difference?”

Presenter 2: “Blockchain do not

Presenter 1: “I don’t agree with him

Teacher: “Let me use another way. What is the key difference between these schemes?”

Presenter 2: “There is no mining.”

Teacher: “Yes, that is one difference.”

Teacher: “What additional thing you have to do? One thing you forgot to mention. One ingredient..... in proof of work, the Byzantine agreement

It was also observed that if the fellow classmates felt the presentation topics or contents which were close to their daily lives, that could arouse their interests and they were enthusiastic in asking questions in the Q&A session. Students 1 and 2 were asking questions from the same project presentation while the remaining were asking the separate project presentations.

Student 1: "I want you to take consideration, people may not want to drive for 10-mins to enjoy 30-mins in traffic congestion.....need to consider the distance between"

Student 2: "After doing the study, do you think the ultimate solution is to build one more tunnel? Then, we will have three tunnels."

Student 3: "How can e-learning replace field trip? Do you think staying in simulated environment to be the same as natural environment?"

Student 4: "If I donate money to crowdfunding, do I take risk? May be some illegal projects that do I commit crime?"

Student 5: "How long do I need to wait if I want to become an investor?"

4.4.6.2 Observation analysis on teaching pedagogy (1) during Q&A sessions

The practice-led teachers adopted multiple dimensions in assessing the group projects completed and presented by their students. Except for the project management projects, all the other projects were highly technical in nature. Therefore, I managed to have the high-level understanding about what they presented in classes; but I could not understand the exact technical details like blockchain algorithms and system hacking techniques when the students responded to the teachers' questions. Regarding the project management project presentations, I can have full understanding on what the students presented, and the questions raised by the teacher. In this section, my analysis is focused on their interactions and their dialogical conversations, and the Q&A sessions were about 10-15 minutes for each group.

First, they adopted two teaching tactics to evaluate the first level understanding of the students after they presented their group project, (1) seeking for elaboration or explanation, and (2) asking for doing comparison; and the examples are quoted in 4.13(a).

Second, they looked for the deeper understanding of the students in their project and the teachers were trying to do the learning assessments in terms of the solutions' deployment, feasibility and effectiveness as proposed in their projects, such as, how to coordinate, what to install, how to perform, how effective, is it feasible? See examples in table 4.13(b).

Third, responding to what have been presented by the students about the shortcomings or vulnerabilities in their projects, the practice-led teachers wanted to test for the problem-solving abilities of the students in their chosen project as that should be the topic they are interested. The questioning techniques included simple question setting, and scenario-type question setting. See examples in table 4.13(c).

Fourth, they assessed the students on whether they could apply the technical term or concept learned from the lectures into the group project they have chosen. Example one, the teacher asked, “To use the term, ‘indicator of compromise’, how can we determine that this type of machine learning can be detected?” The answer given by the student group was not very concrete. Example two, was about the concept of ‘proof of work’ in Byzantine agreement for blockchain and the students could not answer it, therefore, the teacher provided the answer to the presentation group as well as the whole class so that all students could know the answer.

4.4.6.3 Observation analysis on teaching pedagogy (2) during Q&A sessions

There were 7 group project presentations observed in the project management course. Each presentation was followed by 2 questions, but one group got one follow-up question only due to long discussion in the first question. The practice-led teacher had placed a mini alarm clock in front of her desk to do time count for each presentation. Total 13 questions were raised by the practice-led teacher, and it was observed that she adopted the knowledge areas under project management methodology to frame her approach for questioning. The questions were summarised as 4 on project time management, 4 on project quality management, 3 on project scope management and 2 on project cost management. Her ways of asking questions were up to the points and meanwhile, she expected the students to give the exact answers. If the students did not answer it properly, she continued to try getting the answer from the student groups. It seemed that the teacher hoped to make sure the students have clear understanding about the knowledge areas of project management from the perspective of their own presented project. It was also discovered that some technical terms in project management could easily be mixed up with some other words looked similar.

Project time management was the knowledge area that the students made the most mistakes or overlooked very easily. Through the question-and-answer sessions, practice-led teacher wanted to educate the students on what is meaning of “date” in the project plan, why it is so important, and the logic in deciding the project task schedule. See examples in 4.14(a). Project quality management was the most confused knowledge area encountered by the students because they mixed up the terms of quality control with other words easily. See examples in 4.14(b). For project scope management, the teacher wanted to make sure that the students knew the meaning of project scope, all out-of-scope work must be justified though requested by the business users. See examples in 4.14(c). For project cost management, it was relatively easier for the students as they could provide satisfactory answers per the teacher’s questions. See examples in 4.14(d).

4.4.6.4 Observation analysis on Q&A session after industry seminar talks

Two industry seminar talks were conducted the class observations and the topics were related to new 5G applications, and the acceleration of digital transformation for business, respectively. There were total 14 questions and answers at the end of the presentations and thus, the Q&A sessions were very engaged. All the questions asked were technical-oriented, except for two of the questions which were related to industry jobs and asked by the course director who wanted to seek comments from the industry speaker about IT job prospects and whether technical people need to have people skills. The dialogue between the course director and the industry speaker, see table 4.15.

4.5 IT certifications

4.5.1 Recognising the difference between university education and industry certification

Both teachers PLT-B and PLT-C recognise the difference between university education and industry certification, but they take a different approach in handling such difference, which is largely reflecting their contrasting perspective on university education that was discussed in the earlier sub-section. Teacher PLT-C admits that university degree certificate is a proof of academic achievement, and that can help to reflect the person's ability in their learning in longer run; however, he encourages that the universities can support the students to get more certificates from the industry. For teacher PLT-B, his department ever received a proposal from a giant global IT vendor, and they suggested a whole series of technical classes which could be developed into one course for the department. Once the student completed the course, the vendor could offer the (vendor) certificate to the student. It looked very attractive to the students as that vendor's IT certificates are very prestigious in IT field and their certification examinations are very difficult to be passed. After careful consideration internally, his department turned down the proposal; and it was based on two reasons, the department hopes to retain what they believe to be good for their students, to learn more on the fundamental principles and the general knowledge, but "not very specific to certain vendor's approach"; and it is very subtle difference. If the university learning is so specific to a particular vendor, it not only violates the academic objectives of the department, but also creates a risk or a vendor bias, making the department and the students towards the vendor's view. It also exists the commercial bias, too specific for the trade in that particular industry. Once again, he reiterates, "there is definitely, having some difference, student learning in university versus industry; and we try to distinguish that. Though there is difference between university education and industry certification, some of the university courses are following some of the accreditation frameworks in the respective professional bodies, such as The Hong Kong Institute of Engineers and Project Management

Institute, so that those courses can be endorsed by the professional bodies and the students can get some exemptions during the certification process in the future.

4.5.2 Interview-and-online-research analysis on IT project management and its path to professional certification

Project management skills is found to be mandatory for all students studying IT degree programme because all practice-led teachers do touch something related to project management in their respective research interview. Some mention about the difficulties in teaching IT project management while some highlight its importance for the students to work for the IT industry and the subsequent professional development. According to teacher PLT-E, project management is important from the technology perspective and “every company needs good project manager”.

In the interviews, I got the following pieces of information about how to count the length of working experience in IT jobs and how it can be recognised in the industry.

- *First 2 years for industry learning after graduation:* Teacher PLT-C emphasises that even for very outstanding IT graduates, they are still under learning mode in the first two years to learn the technical skills.
- *Total for 7 years from university study to become a project team member (IT security services project):* Based on the observations of teacher PLT-C, the maturity of the IT security staff is at least 7 years, counting from studying the 4-year university programme and then joining the field to involve in some projects until “he is confident to place them into the project as a project member”; because it is expected that when they start to work in this field, they need to spend 3 years’ time to accumulate the experience before they can be a ‘real’ technical person.
- *Become a project manager, after 5 years of working experience in the field:* Teacher PLT-D mentions that she invited one alumni speaker in the mentorship event and he has been working in the industry for 5 years and is now promoted to be IT project manager. It is told that his sharing can successfully attract the attention of many of the students who are started to think about to be “him” in the future.
- *Project management certification: 4-year degree plus 3-year leading projects experience:* The certification of project management professional® (PMP®) is widely recognised as the professional qualification for project manager in different industry sectors, particularly for IT industry; and basically, many commercial organisations and government sector accept this certificate as a formal qualification of a qualified project manager. Referring to PMI website (Project Management Institute, 2020), there are currently over one million of PMP® certification holders worldwide. In the website section under how to get your PMP®, it states that “before you apply”, the

candidate needs to possess the experience of “36 months leading projects” for “a four-year degree holder”.

As a summary briefly, the above information is very consistent with each other. Project manager is the essential staffing in the IT industry, to take project management certification, PMP®, as an example, that requiring the degree holder to possess 36 months of experience in “leading project”; that means, the candidate needs to work for IT job longer than 3 years because probably, no company will place a fresh graduate into IT project team once hired. In according to teacher PLT-C, he requires the graduate staff to spend the first 2 years to learn in the job and starting from the 4th year, he is confident in placing them in the IT security services project as project member. In this scenario, to become a project manager with PMP® qualification in IT security project, it requires the staff to spend 10 years’ time including both university study and industry experience. Back to the alumni speaker invited by teacher PLT-D, he is a project manager after possessing 5 years of working experience; together with the 4-year degree study, it is for him to spend 9 years to get to the position. One very important point, he successfully passed the formal PMP® examination, too. Based on the above analysis, to become a project manager in IT security project is expected to take longer than that in the other IT system projects.

4.5.3 Analysis on students’ interest in IT Professional certifications

There were 82% of the respondents who show interest in pursuing IT project management certification, 18% will plan to go for the certification before completing the degree programme, 28% will plan to go for it after the graduation but 36% are not sure when they will go for it. However, there were 11% of the respondents not showing any interest in getting the professional certification. For the remaining 7% of the respondents, they said that the professional certification will not be relevant to them, and it implies that they do not plan for applying the jobs which are related to IT projects.

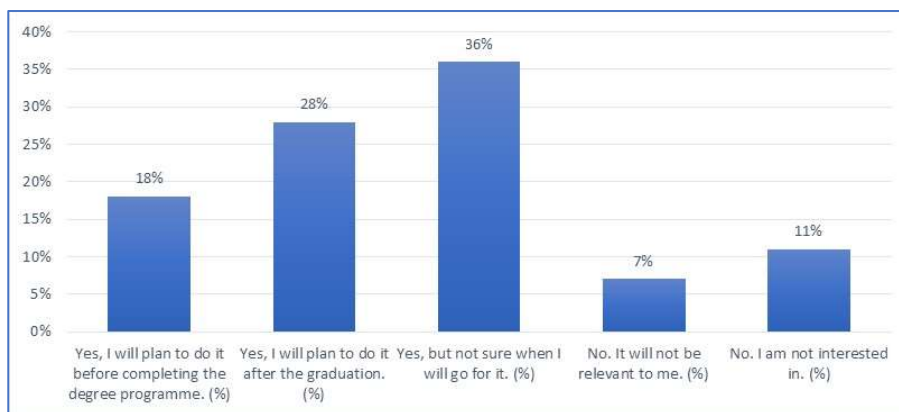


Figure 4.4: How do the university students plan for IT project management certification?

In addition, when they were asked, was/were there any IT professional certification(s) that they would be interested to pursue for, there were total 93% of the respondents said “yes” while 57% of them were not sure which one they want to go for and will look for more information. Only 7% of the respondents said “no” and this percentage was equivalent to the percentage of the ‘not-relevant’ responses made in the previous question of IT project management certification. There were 36% of the respondents showing interest to pursue the IT professional certification, meaning that some of the students in the survey show the interest in the IT certifications, from which project management certification is only one of them. In the last question inviting them to provide the list of IT professional certifications that they showed interested in, there were 15 responses which could clearly mention the exact name of PMP® or Project Management Institute (PMI), that is, 54% of the survey sample.

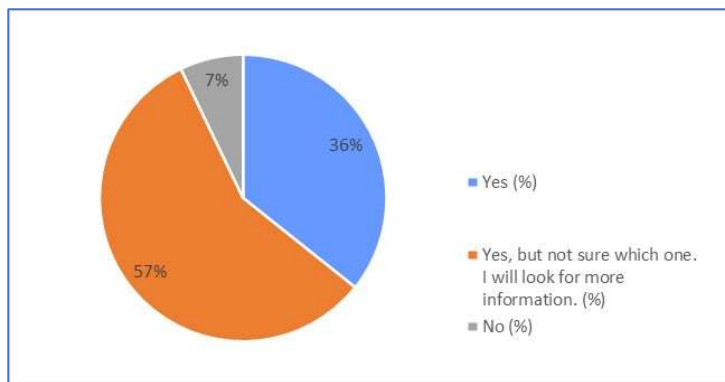


Figure 4.5: The percentage of university students pursue for IT professional certifications

4.6 Challenges in teaching and learning

Teaching is multi-dimensional. Each of the practice-led teacher holds their unique perspective in teaching, with different expectations. PLT-A feels the difficulty in the teaching technique in classes in terms of grasping the pulse of the class and the sense about the class dynamics. PLT-B views teaching as art and there are different teaching skills and factors that can affect the teaching and student learning. PLT-E treats teaching as a role model to the students by sharing the experiences and the role of teachers is an observer and facilitator, who needs to earn respect from the students as why should they sit there for three hours and listen to you! Both PLT-C and PLT-D focus mainly on the responsibilities as a teacher, such as teaching is the basic duty of all staff who need to meet certain level in the teaching standard; teaching is quantifiable in terms of the number of hours you taught, the number of students you had in classes, and the grade in teaching evaluation, all of these are numbers. Teachers PLT-A and PLT-B are relatively highly sensitive to the past and ongoing changes in the IT industry, and the new industry trend. They both are trying to inform the industry changes to the students and conduct the most up-to-date knowledge and tools in

the teaching, taking the view as “the industry IT trend is [made of] what we teach. What we teach is [made of] what the trend is”. In addition, some practice-led teachers are actively supporting the graduates’ career development in terms of role modelling (e.g., to model the profile of the head of IT), job analysis for graduates, how to prepare a good resume, and professional certification and development.

Some practice-led teachers indicate the challenges in teaching and learning. The impact of mass education makes teachers PLT-D and PLT-F concerning about the current tertiary education, especially in the quality of the students whose quality are relatively dropping when compared to the early days of elites-centric system. The student learning attitudes are very diversified while the number of capable students is relatively less than those in the old days whose admission requirements were very demanding as imposed by universities. Most of the top-grade students, they are very concerned about their academic result for the sake of working for very high-profile organisation after graduation. Teacher PLT-C has ever encountered the situation about one student who asked him why he could not get grade A+ after so much effort spent in the course; and it is the expectation gap between teacher and top-grade students because those students may try to equate the study effort spent to the academic result they expected to achieve. But for teacher PLT-C, the grade A+ can only be awarded to those students who can exceed all the assessment requirements in the course.

Learning gap is basically due to the factors of nature of knowledge, students’ capability in understanding, and the maturity level in students’ mindset. As what teacher PLT-D said, “Students are students”; when she teaches the students, she understands that “it is impossible” for her to expect them to learn everything on what she told them. Whilst teacher PLT-C having the same view, he does not expect the students to understand everything when they graduated from the IT degree programme. Three of the practice-led teachers share their thoughts about the issues about student mindsets. For teacher PLT-B, he admits that the students are “still young”, who may not be able to get “the big picture” about the industry landscape that he taught in class as the big picture incorporates many elements, including the industry changes in the past thirty years and they are probably not ready to absorb it at that level; however, it is hoped that after a few years, the students can appreciate what were learned in the university. Rather, teachers PLT-E and PLT-C want to proactively educate the student mindsets for better understanding about the industry; the former takes it seriously in educating the students to see the linkage between technology and business, “bear that in mind you talk in the language of the business” at work, which is deemed to be essential for them to become a better IT professional after graduation whereas for teacher PLT-C, he has launched the apprenticeship programme in his own company, preparing to educate the mindset of the staff on what is the meaning of quality project and delivering it to the clients.

Teaching gap is derived from the pace of change in technological advancement. Teacher PLT-F is very aware of the situation in academia, and it is impossible to “daily” update the course curriculum and content to catch up the changes in IT industry. But for teacher PLT-C, he would review the course materials after each academic year and do the updates if he finds that the existing course materials cannot meet his teaching expectation on the latest in the industry; and he told me that in the past few years, he kept asking himself from student perspective, “how much they could understand and how much they could not understand”. That is why, the course is needed to be adjusted every year to suit for the student learning, too. It can be explained that teacher PLT-A decides to use the real industry data sets for the students to do the up-to-date’s lab practices in the university.

4.7 Conclusion

Overall, the six practice-led teachers bring their own personal resources and industry experience into the teaching practices, tailoring the course design with applied and practical learning. They are enthusiastic in teaching the IT students and feel the obligation to prosper the IT field with qualified but professional IT graduates. Building on their professional profile, they are confident in enhancing the graduates’ competitiveness in job market with professional knowledge and skills, aware of the link between IT and business, having the industry sense and learning for survival. For authentic practices, they bring in the real industry data sets for up-to-date application learning in lab sessions, trying to create the practising environment as ideal live and very close to the industry environment for the students to do scenario-settings practices or practical practices. But the final examination in practical lab uncovers the challenge of having one-sixth of the students who repeated the same mistakes made in the labs. Pedagogically, some industry elements are added in the curriculum and their professional experience is largely embedded in the industry case studies and the case scenarios; that are conducted through their first-hand experience sharing and explanations, by analogy if needed, and even some work codes of practices are included. Dealing with the practical integration between theories and applications, it is the reliance on research-based group assignments to cover the current technology and practices with applications. Two group presentations in PLT-E managed to show their self-efficacy in exceeding the teacher’s expectations by extending the research scope to discover something new but relevant to the project, and by deep-diving into the exact coding in causing the data breach. The findings in class observations showed the disciplinary inquiry are learning-driven approach, helping the students to do self-reflections on what they have done in the project, whilst the questions were focusing on the students’ first-level understanding, deeper understanding and solving the problems identified in their own projects. But for those technical terms and concepts related to their presented projects, most students encountered problems in giving the answers and only one student group could give the satisfactory answer. One final year project was proved to be outstanding, but the project idea was initiated by the final year student. Outside the classroom, there are experiential learning activities arranged for the students’ learning; it is, however, discovered

that the impact of university ranking can affect the experiential learning activities in two aspects; one is that the more higher rank of university the students are coming from, the more senior executives can be shown up to meet up with the students during the company visits, or as industry speakers; and the other is the university-wide hierarchy of the mentorship programme to support the student learning to becoming elites, which in turn is aiming for achieving higher university ranking.

IT discipline is an applied and highly practical discipline, but students find difficulties to learn the advanced knowledge and skills as the pre-condition for actual understanding require some prior industry experience. In the survey findings, most students appreciated the industry learning, 100% preference on the relevant case studies and practices, expecting that class exercises and study materials were close to the industry while guest lectures were seen as the learning support. When comes to the helpfulness in graduate jobs, they ranked high in summer internship and work placement; though no student said experience sharing not useful, it is the most uncertain item indicated by the students. For practical teaching, 94% agreed to have the problem-solving skills sharpened, 70% and above could apply the learning to new situations and feel confident to investigate new ideas, but the most difficult was tackling unfamiliar problems. Facing the gaps in teaching and learning, some teachers need to update the course materials after each academic year as the industry is very dynamic, affected by the fast pace in technology changes.

CHAPTER 5 DISCUSSIONS OF DATA

5.0 Introduction

In this chapter, the purpose is to interpret the data in the findings from the academic point of view with respect to the current academic theories, models, and concepts. In this study, the main themes are to examine some IT practitioners who are now the academic teachers to teach the IT degree students in acquiring IT knowledge and skills and the professional practices, from which, in what ways, they can support the graduates' employability. Firstly, the relationship between practice-led teaching profile and the notions of capital will be discussed as capital concepts can help to elaborate their personal strengths and resources, and their expectations that they are bringing to the teaching profession. Practice-led teaching involves in the curriculum design and teaching pedagogy. In the findings, their curriculum design is largely related to the approach of experiential learning and thus, experiential learning and networking will be discussed accordingly. IT discipline is applied and practical, the notions of work-integrated learning and authentic learning will be used for discussing those applied and practical practices conducted by the teachers. The topics of first principle's teaching approach and vocational training approach will be explored in according to the concept of knowledge structures. Through the discussions in the above areas, the relationship between practice-led teaching and graduate employability will be derived through the USEM model of employability and the forms of graduate capital, preparing the students to transit from the university to the labour market.

5.1 Relationship between practice-led teachers' profile and the notions of capital

The practice-led teachers possess the human capital (Coleman, 1988), by attaining the educational degree (Benhabib and Spiegel, 1994) from IT or engineering, and accumulating more human capital through 18 to 35 years of industry working experience (Mathur, 1999), and they are currently the members of the IT professional bodies, gaining social recognition and reputation (Bourdieu, 1986), connecting to the IT communities of practice whose basis is formed for trust, cooperation, and collective action (Nahapiet and Ghoshal, 1998). They are also elected as the council members of the professional bodies, engaging the social and individually held capital (Huggins et. al., 2012); and the retired teacher PLT-E is still the current committee member of some professional and public bodies. All these professional and public bodies are regarded as 'restricted' knowledge networks (Nahapiet and Ghoshal, 1998). Some teachers possess very strong network capital (Huggins, 2010) and their previous network contacts can be maintained even after leaving the companies and now become their personal knowledge network in teaching. Previously, they worked for the

international or global companies having strong inter-organisational networks or knowledge networks (Nahapiet and Ghoshal, 1998) expected to create economic benefits (Hite and Hesterly, 2001), thus promoting access and exchange of knowledge in the firm's innovation process. Teacher PLT-B can arrange more than 20 companies as company visits in the course while some of the company representatives as local contacts are known at the time when he worked in the US, indicating that his previous company have global knowledge networks (Gertler and Levitte, 2005) to rely on the non-localised networks (Garnsey and Heffernan, 2005) to strengthen the knowledge base (Wolfe and Gertler, 2004). Teacher PLT-A won the local and regional awards while PLT-D won the university's teaching award, meaning that both possess good social standing in terms of symbolic capital (Lindberg, 2013) or cultural capital (Tomlinson, 2017).

The human capital, further expanded through the 'accumulated' (Mathur, 1999; Tymon and Stumpf, 2003) capitals in social, network, symbolic and cultural forms, have become the personal resources possessed by each of the practice-led teachers who can form their unique professional identity as identity capital (Tomlinson, 2017). As they have joined the teaching profession in the social context of university environment, they can articulate their value propositions in the teaching because they are dedicated to teaching, having social obligations (Bourdieu, 1986; Coleman, 1988) to support the IT field by educating more qualified IT graduates, as well as have the confidence and expectations on their own contributions to the students' learning, the university, and the industry; all of these are largely influenced by their social assets (Coleman, 1988) which in turn influencing their human capital. In addition, all the practice-led teachers in this study are experienced IT practitioners, who possess the practical relevance (Srinivasan et al., 1999; Riihijärvi and Iivari, 2008) of field working experience to know the factors of critical success and the causes of failures in their jobs; and thus, each of the teachers has their own successful lived experience of the real world on a single continuum (Dewey, 1938) in the field of IT discipline, starting from the university education. For now, in the university, they are supporting the young people, their students preparing to create their forms of graduate capital and their own single continuum starting from the IT degree programmes.

5.2 Industry knowledge as foundational knowledge of contextual social knowledge

In terms of IT disciplinary industry knowledge, as a form of human capital (Tymon and Stumpf, 2003; Tomlinson, 2017), it is designed by the practice-led teachers as the foundational knowledge, which can be later transformed through the experiential activity and recreated as the contextual social knowledge for the students. The analysis of technology evolution in the past 30 years in IT industry and the recent 5 years of industry players is not a history lesson, but rather is used for illustrating those factors driving for

technology change and the actual changes made in the past, and the current state of IT industry in terms of the prominent technologies and the active industry players in the market. Underneath, there are two reasons. First, there is roadmap or blueprint for technological advancement and the foundation knowledge on IT industry can prepare the students to understand the upcoming industry changes like Web 3.0 and Industry 4.0 as part of the S-curve of technology (Szabo and Szabo, 1988), that can help to explain why knowledge is seen to be easily obsolete by both employers (Humburg et. al., 2013) and educators (Lee et. al., 1995; Noll and Wilkins, 2002). Second, the analysis of the industry players of the recent 5 years in the market is not a business and marketing lesson, but rather offering the full picture of IT industry from the macro view, which is lived by different industry sectors in providing the hardware, software, and services and that can be matched to the IT infrastructure framework and why each technology or consultancy firm have a role to play in the industry. During the company visits as the experiential activities, the students can have the sense of the industry through interviewing and speaking to the company representative directly to transform into their social knowledge. That is why the teacher is well-thought to require all the student groups to deliver the presentation in the whole class because the full picture of the most up-to-date IT field can be created for the student learning. As the foundational knowledge is on industry-level, the analysis can possibly help the students to better understand the other courses in the degree programme. In the USEM model, it is part of the domain-specific knowledge (U) to be acquired by the students and if they can have higher level of abstraction through self-reflection, it can support their learning in other courses in the degree programme.

5.3 Experiential curricular activities, network capital, and networking

5.3.1 Experiential learning, relational assets, and network capital

Experiential learning, the resources viewed as part of identity capital (Tomlinson, 2017), is embedded in the course structure as the co-curricular course, through the activities of guest lectures, industry talks or company visits. Social knowledge (Kolb and Kolb, 1984, 2013) is constructed through the transformation of experiential learning and recreated in the personal knowledge of the learners, that means, students can acquire the social knowledge through the guest speakers and the company representatives, and it is socially contextual bounded. As these activities are part of the course, not standalone, the students should be able to do the self-reflections on those industry sharing, together with those taught by the teacher to build up their social cognition (Vygotsky, 1978) in the context. The practice-led teachers possess their personal and social networks, responsible for the co-curricular course to invite some industry contacts, can be personal or department, to be speakers in guest lectures and industry seminar talks, or the company representative as the external mentor for the students. Particularly for teacher PLT-B, he makes call to them one-by-one to talk

about the expectations on their support for the student learning; from the students' perspective, the company contact is a stranger, but they have to set up the meeting as required in the group project. Therefore, the tasks are designed for the students to acquire the communications skills with the external people, social knowledge and to practise self-theories; according to the USEM model, the self-efficacy (E) is malleable in nature, requiring positive intervention (Dweck, 1999; Knight and Yorke, 2002) that is made by the teacher's phone calls in advance to the company representatives but behind the scene; in addition, each student group is further supported by one more professor in the department, who is the internal mentor helping the student group' preparation like interviewing questions and it can also be seen as positive intervention. The practice on self-efficacy can enhance the students' psychological capital (Tomlinson, 2017) as one form of graduate capitals; each student group has 4 to 5 students visiting the company and thus the social knowledge can be co-constructed between group members as a new form of contextual knowledge (Kolb and Kolb, 2013) about the IT company whereas the information collected during the company visit is required to be consolidated, analysed and produced in a written group report before delivering the group presentation in class.

From the perspective of structural-relational embeddedness (Granovetter, 1992) in network capital, when the practice-led teachers arrange the company visits, site visits or guest speakers for the students, they do the invitations on behalf of the department or the university, creating the network ties (Scott, 1991) between the university and the company as relational social assets (Nahapiet and Ghoshal, 1998) for the university; that is why, the speaker will be honoured with a trophy with university logo and company logo after the activities, including those company representatives to be sent after the visits by the student groups. As of network capital, there are calculative ties (Huggins et al., 2012) in the calculative (Williamson, 1993) network where not just the universities need the support from the industry but also the technology firms show interest to meet up with the university students because it is the good chances for them to talk to the current students studying IT, trying to find some potential graduates for their companies. One teacher mentioned that the higher rank the university, the more senior, like country head or CEO, would prefer to be the speakers or representatives to join the events and speak to the university students, and so do the universities preferring to invite the multinational or global IT and consultancy firms; in other words, both higher rank universities and larger corporations are interested to create strong ties (Granovetter, 1973) through the experiential learning activities for the students. Those previous organisational contacts being turned to the personal contacts possessed by the practice-led teachers, when they invite the contacts to support for the student learning, once agreed by them, the teachers can articulate the personal network resources to become the relational assets or network capital for the university.

5.3.2 Networking, social space, and network space

Embedded in the activities of company visits, guest speakers and industry seminar talks, are the value of social capital and network capital while the networking activities are conducted in the shared space (Kolb and Kolb, 2013) that can create the relational bonds (Tomlinson, 2017) for the graduates, promoting the learning in respect to care, trust, and commitment. When the industry speakers come to the university to deliver speeches and sharing (industry, company-related and personal), the university becomes the network space to promote the interactions based on the 'logic of professional expectations' while the lecture theatres and classrooms are the social space based on the 'logic of sociability and social expectations' (Huggins, 2010) where the speaker, the students and the university staff can be socialising with each other to make new contacts and personal touch. The same concept can be applied to the mentorship activities organised by the department if they are the company speakers, whereas the alumni speakers are more inclined towards the latter mainly for socialising purposes to interact and support the junior classmates through sharing of feelings, thoughts, and experiences in persons, including the interview tips and aptitude tests as required by many large firms during the recruitment process. According to Luthans et al. (1998), networking is individual and goal-directed behaviour, aiming for seeking the information benefits in "access, timing, and referrals" (Nahapiet and Ghoshal, 1998, 252) when the 'know-whom' is valued almost as much as the 'know how'. If the company visits are led by teacher or university staff, the company sites are the network space where the university staff and students as a group are visiting the company. For teacher PLT-B's course, the student groups set up the appointment and conduct the visit like individual group visit, interviewing the company representative for information seeking and thus the company office is more like the social space. When the student group's visit is more like personal visit as a form of social capital, the role of the company representatives becomes the senior mentor, showing more caring to the students, though they can also show interest to know more about the current university students and possibly the potential staff in the future. In this sense, the calculative ties (Huggins et al., 2012) can be present in the social space in targeted networking activities. Therefore, the concepts of social capital and network capital in the relationship between the university and the industry are dynamic and can be co-existed in the participants and in the place-bound environments. The above may be characterised by the nature of the entities and the compositions of participants while both parties cannot be coming from the same kind of entity or the same type of person's role.

5.4 Classroom practices and authenticity

5.4.1 Applied practical practices and knowledge structures

The centrality of IT discipline is applied and practical and the practice-led teachers leverage their industry experience to tailor-make the course teaching materials and to do experience sharing on the applied practices which are surely practical, for instance, using the concrete examples in their previous jobs, such as the trade-offs in different decision-making, the deployment of one technology (e.g., AI) in different industry sectors while the concrete examples can also be the actual technological applications in compliance with the regulatory guidelines (e.g., GDPR) set by the industry's statutory bodies. When the practice-led teachers use the concrete examples or practices to the students, they are sharing their first-hand experiences and those are lived experiences, including what can be done and what cannot be done in the workplaces. In terms of educational authenticity, the teachers focus on the relevance and meaningfulness for the students in the learning process. Based on the concept of knowledge structures (Kinchin et al, 2008) for expertise development, the practice-led teachers dialogically explain how to apply expert knowledge through the visible chains of practice that involving the networks of understanding for the students. Expert knowledge is defined as an integrated framework of understanding, and thus, the teachers can still hold the expert knowledge structures though they lose the expertise (know-how) for not practising anymore (Dreyfus and Dreyfus 1986; Kinchin et al., 2008). For the sharing of work code of practice, like the collection of user requirements in project implementation, that involves the deeper understanding about the consequences of not doing properly whose criticality can determine the success or failure of the IT project. It shows that the teachers' sharing of applied practices is the authentic experience that they had gone through their own process of judgement formation and meaning-making (Splitter, 2009) and they are now trying to convey the actual meanings and impart the knowledge to the students through the verbal expressions and communications; but teacher PLT-B said that he is not sure whether his explanation is useful for the students.

Tacit knowledge is the 'black box of intuition' (Kinchin et al., 2008) but tacit knowledge and intuition are critical features of professional expertise (Dreyfus and Dreyfus, 1986; Eraut, 1994). The practice-led teachers, as IT practitioners or experts, they can exercise the "intuitive grasp of situations based on a deep tacit understanding" (Kinchin et al., 2008, 316) and hence, their students possibly may not be able to sense the meanings if they perceive their explanation like 'conceptual submarine' (Perkins, 2006). However, Hoffman and Lintern (2006) interpret this phenomenon as the experts are simply lacking 'tools and vocabulary' in explanation. For teacher PLT-E, his teaching pedagogy in all the lectures is applied practices; that means, he is modelling the applied practices in real world every time when he delivered the lecture to the students and thus, he was excited to see some students exceeding his expectations in the group projects whose format is research-based in

the actual practices applied in the field. There was student group discovered the mobile logon made available from a bank and it can be located only through the mobile app access; whereas another student group showed interest to find out the exact coding that could cause the data breach of a national bank. These two student groups are demonstrating their strong self-initiation to deliver the excellent group projects, not limiting themselves to the project scope written on the assignment; and they could be rewarded by the applauding in class after the presentation as well as could obtain higher grade in the project marking. It is quite certain that some students of teacher PLT-E have gone through the process of self-reflection on what were taught in the classes. In the USEM model, it is observed that applied practices derived from the teachers' authentic experience, can influence the students' understanding (U), self-efficacy (E), and metacognition (M) through instruction, supported by the students' own reflection, judgement, and meaning-making.

5.4.2 Lab practices, closer to the industry, and work-integrated learning (WIL)

The practice-led teachers are all IT practitioners, recognising the contextual barriers (Tomlinson, 2017) between the lab practices in university and the industry practices and thus, they do not treat lab practices as industry practices for the students, but rather focusing the resources and efforts in creating the learning environment in the lab as ideal live, and following the latest technology development. All are designed as very close to the industry, achieving the close integration between university learning and professional practice and applications (Smith, 2012) for the students to do practical practices and enhance the competency, including those practising what are performing at the customer site not regarded as industry practices. Therefore, the practice-led teachers do not consider the authentic work practices for the student learning. In terms of the curriculum design, they are trying to have the practical aspect in form of the supervised practices as work-integrated learning (WIL), used for integrating theory learned in lectures with workplace practices (Patrick et al., 2008) and learning disciplinary knowledge and skills in a real-world context. The purpose of the practice settings is relevant to their degree of study and their future occupational futures, preparing the work-ready of the graduates (Orrell, 2004) as well as increasing their productivity gains in their jobs (Yorke, 2006).

Based on what teachers PLT-A and PLT-B expected in the lab practices, the students are required to develop the application according to their own design model, and the latter, his students learn to understand the original technicality in scenario settings, but without the industry's complexity; based on the above, it is not regarded as the instructional learning because the students are free to decide how to do, when doing, they are doing their own tasks; while in the latter, the students are observing the communication protocols between different network nodes and they can plug and unplug between different types of devices to find out more in the labs. Hence, they are constructing their own learning, knowing and meaning in the labs, and that do not require the validation from the real world (Splitter,

2009) while the students' learning can be authentic; that is why teacher PLT-B reiterates repeatedly that he facilitates his teaching as first principle, not expecting the students' learning confined to the industry's output as a completed product, learning a product will easily make the students miss something in their learning; as what teacher PLT-A said, provided that the students can develop an application functionable, they have caught the understanding. The viewpoints from both teachers are consistent with that of Splitter (2009, 139), who treats the learning for knowing and meaning-making, that "does not depend upon any kind of fixed correspondence with the "real world" out there" because there "exists something unknown to people or even cannot figure in any account of knowledge in the world".

5.4.3 First principle's teaching, knowledge structures and educational authenticity

The centrality for teaching first principle, as advocated by teacher PLT-B, is to focus on the foundational knowledge and the logic of thinking in student learning; even for learning programming language skills, he requests for covering the topics on the differences between different programming languages, the trade-offs when using one language over the other, in terms of easier to program, faster to program, more efficient in running the applications and so forth. In terms of knowledge structures, first principle's teaching is starting from the networks of understanding for the student learning. An expertise is described as an individual's ability to navigate between underlying networks of understanding and chains of contextual practice (Kinchin et al., 2008, 319-322), but the problem for the person, who is capable of moving "from linear [text] structure to a hierarchical [psychological] structure and back again", is the fundamental educational problem as identified by Novak and Symington (1982). That is why the teacher insists on teaching the foundational knowledge, rejecting the vocational training in university as the learning is 'linear in structure' (de Cossart and Fish, 2005) and the learning can easily "miss the target by miles". In addition, the teacher also disagrees product training in university education because of "isolated chains of practice", which may hinder the students' ability to make informed choices in future due to the possible issue of 'broken stories' (Stronach et al., 2002) experienced by the graduates.

First principle for teaching and learning can be regarded as the educational authenticity for knowledge construction as proposed by Splitter (2009, 140-141), who emphasises that the students have to be truly thinker whose learning is no need to go via the real world; and when they internalise the skills and dispositions they learned, they can examine, test, deliberate over, and really think hard in the learning process while they can, at least, accept what they learned as "the (tentative) outcome of their own inquiry" as scientific knowledge in its own right. First principle's teaching approach is to make the learning in original form without complexities, whose learning can become self-sustained objects without

dependence on other learning, enabling the notion of encapsulation (Tall et al., 2000). Even for programming languages, IT students should learn more than one programming languages for a proper IT system allowing different channels or other systems to access through the system interface, denoting the importance of programming language independence (Miller et. al., 2010). Each of the languages has its own logic of programming and thus, learning one of them is just knowing one type of logic only. Therefore, the competent programmers are capable of multiple languages and know the trade-offs when choosing the one to be used for developing the application; that is why, teacher PLT-E said that those IT graduates learn one more of the languages, in addition to those learned by other students, can stand out from the crowd in front of the employers.

5.4.4 Vocational training approach and the implication in cognitive authenticity

Teacher PLT-C plans for vocational training in the course by comparing the university to football training school, it is assumed that his students chosen the elective course can indicate their interest in the subject area and training them to learn the course to get a job is the logical motive. In the lab sessions, it is learned that the students were unable to follow through the lab assignments because they did not know how to select if more than one choice in the step or task before moving on the next; that is regarded as associative learning (Bower and Hilgard, 1981). In some cases, some students did not listen to the class instructions to initiate the system properly, requiring for re-doing the preparation so that the system environment for practices could be ready in the lab. During the practical lab examination, one-sixth of the students repeated the same mistakes of the lab sessions, implying that the students could not internalise what have been learned in the labs and not have the self-reflections on what had been done wrongly in the previous lab sessions. Cummings and Maxwell (1999) criticise that in many educational practices, the teachers cannot internalise the underlying beliefs and thus, the assessments are not truly authentic.

In this study, it is clearly that teacher PLT-C wanted to prepare the authentic learning environment in lab sessions or called workplace-situated learning'' (Smith, 2012), and the authentic assessment (Gielen et al., 2003; Gulikers et al., 2004) as practical lab examination. The teacher is the course subject's domain expert, both PhD academic qualification and industry background, it can be viewed as the issue of "pre-authentication" (Petraglia, 1998) without taking proper consideration of the student learning, possibly also due to the skills possessed by him has become part of him, largely automatic and non-reflective (Kinchin et al, 2008). Besides, the students expressed the negative comments on heavy workloads and very demanding in the course evaluation. Both can be signalling some inappropriate expectations set for the students in the course and the vocational training approach in the course is not matching with the learning for some students. To be fair, during the class observation, the students were enjoying the course as their group project presentations

reflected their efforts in doing research and technical development and they were trying hard to answer the teacher's tough questions during Q&A session. The focus of this study is on teaching pedagogy and let us look at what the lab assignments are; when a real project case previously successfully completed is now disaggregated into steps or tasks to become lab exercises, the students are required to follow the logical steps to complete the tasks as the actual tasks at customer site. According to the teacher, the students are required to pick a choice in some of the steps, and that is interpreted as integrative learning (Smith, 2012), but some do not know how to decide because of insufficient knowledge. When one step cannot be done properly, the student cannot move on to continue the lab exercise unless that step is achieved. Based on these two scenarios, those steps and tasks are interrelated and sequential, and each step or task requires for technically cognitive action or called cognitive authenticity (Herrington & Herrington, 2006), not simply a step. Therefore, the students attending the course are presumably possessed some prior related knowledge, and it is also mentioned by the teacher who does describe the pre-requisite in the course requirements.

5.4.5 The role of absorptive capacity in learning IT domain knowledge and skills

For IT domain knowledge and skills, it is pivotal for the learners to possess some related prior knowledge as absorptive capacity (Cohen and Levinthal, 1990), as it can support the knowledge and knowing capability in the learning of professional practices (Nahapiet and Ghoshal, 1998); and in this study, it refers to the students in acquiring applied practices and practical practices in IT discipline. In these practices, the role of related prior knowledge can be served as the pre-condition of innovative capability for the students, but they also need to possess the ability to evaluate and utilise outside knowledge (Cohen and Levinthal, 1990); that is, the students need to rely on some of their prior knowledge acquired or the teacher's teaching to have some self-reflections before they can do the practices. Based on the system concept, IT discipline is applied and practical and thus most of the IT knowledge and skills are for problem solving, in the process of creation and acquisition, receiving the inputs and delivering the outputs after the system processing. Under this notion, the possible issues, or risks of pouring insert knowledge on the students or subverting their constructive learning process (Splitter, 2009) caused by the practice-led teachers are highly unlikely; on the contrary, the knowledge and skills imparting by the teachers as prior related knowledge can accelerate the student understanding, strengthen their decision making, and enhance their self-reflection in learning the subject matters when practising the practices. When these practices are practised on realistic problems in the lectures or in the labs, the students are free to make mistakes or having a chance to re-do or correct the errors, as what teacher PLT-F said, some kinds of learning are required to be done wrongly for several times before the graduates can get to it finally.

In the work-integrated learning, like elective consulting project course mentioned by teacher D, the course's pre-requisite requirement is the prior participation in the summer internship, as the light-weighted consulting project practice that the students can have the chance to perform the feasibility study and submit some recommendations to the company. All these student learning opportunities, both in university and those beyond, are very valuable in the student learning process as what Smith and Worsfold (2015, 38) observed, it "may help the individual to develop self-efficacy or confidence both as a student (where pertinent learning occurs) and as a practitioner (where useful outcomes or products are generated for the client)"; which is the self-efficacy and self-theories (E) in the USEM model. But in the workplace, many mistakes are totally unacceptable, like the scenario of missing a zero digit as emphasised by teacher PLT-D, for example, 1,000 versus 10,000 in a financial statement, it can probably be a disaster. When the students can develop the more malleable self-efficacies in the university environment, they can discover their own strengths and weaknesses so as to build up their strong sense of self-awareness supporting their employability in the longer run.

5.5 Authentic pedagogy, student project presentations and learning-driven

5.5.1 Classroom community of disciplinary inquiry on intellectual disciplinary works

The class observations are designed for understanding practice-led teaching in promoting classroom community of disciplinary inquiry (Splitter, 2009). As the observations were conducted at the time of the students' group project presentation, the Q&A sessions were the interactive dialogues between the students and the teacher and is learning-driven based on the project work done by the students who are proactively answering the teacher's questions to gain higher marks; therefore, it is staging the most authentic moments during the process of teaching and learning, and it should be regarded as situated class observations. As the group project presentations were arranged in the last lesson of the course, all the students possess some knowledge of the subject matter and thus, the disciplinary inquiry is deemed to be reflective for the students. Disciplinary inquiry in constructivist curriculum is the authentic pedagogy to require the students to master and apply the disciplinary tools and to have structured collaborative inquiry with the peers (Newmann et al., 1991, 1996); whereas Splitter (2009) demands for the learning environment to promote the students to be truly thinkers and reflective inquirers; through the authentic engagement in the learning process, the discipline-based knowledge construction and interactive inquiry would be meaningful and fulfilling to the students.

For the class observations on the group project presentations, all were delivered by the student groups as a way of articulating the intellectual disciplinary works completed by them as group work or individual basis, used for demonstrating their understanding in the course subject in the form of their 'authentic' work, constructed between university learning and the perceived application in the field. The range of student projects delivered, including the latest development of technology-oriented applications, enhanced security risk assessment applications and tools, framework-based project management plan for application development project in a chosen company, and technology-enabled business application projects. The design of all the group assignments and projects is open-ended, the topics given by the teachers are just a few words, like bitcoin technology, e-wallet, a project management plan, best practices on internet banking and so on; and the students are free to decide the breadth and the depth in the project, and free to choose the field or a company that they are interested in. In other words, those students presenting the project are more knowledgeable than that of the teacher about the projects; and both parties are communicating dialogically to inquiry about the application of the disciplinary subject area within the project work chosen by the students; and therefore, the students observed in the study are all engaged learners (Splitter, 2009) as one teacher said, his teacher role as good listener and facilitator.

5.5.2 Authentic learning environment, learner-driven, and reflective thinkers

For teacher PLT-B, he intended to let all the students have better understanding on one technology through the student assignments, and thus to set for having two of the students, while all students are free to choose the topic they like, to work on two different topics but on the same technology. To achieve this, he created the learning environment in the class where, after the two individual presentations delivered by the two students, he told the class to discuss about the two projects together; through the very basic question, what is the difference between (.....) one student gave his answer, but the other student said, "I don't agree with you". The learning environment during the class presentation is learning-driven (Brown and Long, 2006) in a shared space (Kolb and Kolb, 2008, 2013), open and trust as the teacher's questions are not used for judging the student presentations; but the learning environment is intellectually competitive as the students need to negotiate their meaning and understanding, and to persuade the teacher, the other competing student, and the fellow classmates to accept their answer. In addition, there were two other student presentations attracted the dialogic conversations between the student presenter and the fellow classmates because the students were trying to apply the technology in the real-life situations that have successfully aroused the interest of the students and triggered their higher level of thinking and self-reflection at that authentic moments, by asking, do we really need the third tunnel as we have two road tunnels already? When can I have the investment if? When there are so many students engaged and reflective in the class, it is the educational authentic learning in teacher PLT-B's class, which is meaningful and fulfilling to the learners, without the need to going via the "real world" (Splitter, 2009).

5.5.3 Probing questions, student reflections, and weaknesses in technical concepts

In terms of student understanding in the subject matter of the course, according to the approach of authentic intellectual work, Newmann (1991) and Saye et al. (2018, 866) expect that teaching can be effective if the teachers can support cognitive autonomy to encourage the students to generate the solutions that can meaningfully applied to solve the problems outside the classroom, and “pose challenging questions and press students to justify their answers with evidence’. Whilst for Splitter (2009, 142), he reminds that “inquiry-based teaching is not context-free” and it is the job of the teachers to provide the appropriate contexts for the classes. As mentioned earlier, all the student projects were required to show the application elements to demonstrate their understanding in learning. Based on the questions asked by the teachers, most of them were probing questions and some were framed in scenario-setting to require the students to give elaborations, explanations, and comparisons; and the further tough questions are demanding for their deeper thinking and understanding on deployment, feasibility, and effectiveness of the solutions proposed in their own projects. During the interactive looping of questions and answers, the students can go through their own reflective process; and this process is deemed to be effective because they learned the subject in the course and the project work was delivered by themselves, though their answers based on their reflective outcome may or may not be effective as it requires for the additional level for verification but this part is not the focus in this study. For those group projects, the teachers are looking for the understanding of the students and they assess them based on their reasonings and justifications during the disciplinary inquiry process. However, it is found that the students are rather weak in applying the technical concepts taught in classes in their projects, and it happened in the classes of teachers PLT-B, PLT-C and particularly for PLT-D. Both teachers PLT-B and PLT-C mentioned the exact technical term and asked the students to give the answers, even for PLT-B trying to recall the student’s memory on which part of the course that he taught about it, but the students of both classes could not make it.

5.5.4 Learning the subtle contextual difference in words and different perspectives on project management

All the group presentations in the class of teacher PLT-D were project management projects, and it is critical for the students to understand the exact meaning of the knowledge areas stated in the project management framework, which is part of the requirements in pursuing the professional certification. In reality, all IT students would involve part of IT projects in their job as described by PLT-D and PLT-E, while the latter said that all companies need to have good project managers. Reviewing the disciplinary inquiry in project management project presentations, teacher PLT-D identified the weaknesses in the group presentations

and picked up the knowledge areas for questioning, including time management, quality management, scope management and cost management. In this study, it is worthy to discuss time and quality in more detail in this section. For project time management, the teacher picked up the criticality of 'date', indicating is a project milestone in the project task schedule, as well as implying the trade-off between time and quality. For project quality management, the teacher tried to articulate the subtle difference in the meanings between 'security versus reliability', 'reliability versus app bugs' and 'problem versus risk'. To certain extent, the pair of words looks similar and sometimes can be used inter-changeably. But when applying it in the context of IT project planning and implementation, each of these words is unique in its meaning and the subtle difference must be known by all IT practitioners. That is the reason why these knowledge areas are formed as the body of knowledge in project management framework. There was one simple statement made by teacher PLT-D when she replied to her students, *"If the function is not working, it's not a function"*. It is a very powerful statement to demonstrate that university education does need to put effort educating the students on the basics before any practical learning for the students, and those basics are merely on knowledge itself.

Based on the findings in the student surveys, many students enjoyed the project management course, had good learning, and appreciated the teacher a lot; while showing great interest to do IT projects after graduation, they are aspiring to be a project manager in the future. In the work of Reich and Nelson (2003, 42), they realise the insights of CIOs who treasure "project management standards, a common set of practices upon which they manage projects", and one of the CIOs said that his company does not hire a project manager with project management certification; whilst having it, "that doesn't make them excellent either, but at least it tells me that they understand the concepts that we're going to be challenging them on". Project management certification is not regarded as the type of certification as described by Bailey and Stefaniak (2001, 98) which is "a niche with a specific technology" nor "highly specific skills". Hence, it is seen as the CIOs' management decision to "use people with company-specific knowledge to run their projects and give their people a reason to stay" (Reich and Nelson, 2003, 42). Referring to the student surveys, there were 46% of students having a clear timeline to pursue project management certification while another 36% of students did not know when they will go for it; implying that it is not an easy decision.

5.6 Knowledge retention and transferability

5.6.1 Intellectual capital and encapsulation

Knowledge is the most powerful engine of production (Marshall, 1965) whereas intellectual capital is regarded as a pivotal resource, driving for economic development and growth

(Stewart, 1997; Florida and Cohen, 1999); and once applied, intellectual capital refers to the “knowledge and knowing capability” of professional practices, which are “socially and contextually embedded” (Nahapiet and Ghoshal, 1998, 245, 246) in this study. Knowledge is considered as object (Polanyi, 2009; Newmann et al., 1996; Nahapiet and Ghoshal, 1998) and “knowing as action or enactment, actively shaping of experience performed in the pursuit of knowledge” (Polanyi, 2009; Nahapiet and Ghoshal, 1998, 245; Splitter, 2009). The conceptual encapsulation explains how the learners can transform the learning, such as an action, task or operation into self-sustained objects or entities during the learning process. Piaget's notions of abstraction help to justify how the learning pieces are constructed into the platonic objects through higher level reflective abstraction, that is, an action or operation can be converted to thematized objects of thought or assimilation through abstraction. Dubinsky et al. (1988) claim that the transformation process does not destroy the physical object and recognise the concept of permanent objects to agree that an individual is capability of taking control of repeatable action.

For Tall et al. (2000), it can give insights to teaching and learning because the learning pieces can be protected during transformation and the learners can manage to control and repeat the action; by common sense, it denotes the notion of re-useability. If it is possible for the students to transform and protect the learning pieces and have it to become self-contained encapsulated objects in the state of portability, as high-level abstraction objects in the students' mind, that can imply the learning in university to be transferable to the workplace environment. However, the most critical stage within encapsulation concept is to make sure that reification (Sfard, 1994) is performed in the learner's brain before he or she can learn all the above in the learning process. Reification represents the transition from an operational to a structural mode of thinking in learning, and Sfard (1994) introduces the considerations of meaning and understanding which can be used to explain how reification is taken place. Once the operation of reification process is understood, teachers can have better ideas in supporting the student learning; and reification is influenced by two schools of thought, objectivist approach versus constructivist approach. The former treats meaning as the relationship between symbols and the real world without the interference of human mind, while the latter considers meaning to be conferred through the understanding of the learner. IT theories and concepts are defined as different sets of well-designed frameworks, well-defined protocols, industry standards; that deemed to form the bodies of knowledge in IT discipline. In IT degree courses, every IT concept and term denotes a set of well-defined rules and meaning that IT students need to learn about the rules, industry standards and technical interpretations before they can apply the theories to come up the technical solutions in solving the problems. In this sense, objectivist approach in reification should be adopted by IT students when learning the IT theories and concepts whereas constructivist approach in reification should be taken place when designing the technical solutions to solve the IT problems. If the above can depict the learning approaches and patterns in IT knowledge and skills, what are the implications to the teachers? We need to explore what are the teaching methods and tools deployed by the practice-led teachers in IT degree courses.

5.6.2 Case-based learning scenarios and forward reasoning

In the study, practice-led teachers come up different teaching methods and tools to inform their professional experience in the teaching, which are comprised of scenario-based, case-based, concrete examples, and analogy, which can be used in combination by the teachers during the courses of teaching. During the lectures, when industry-based case study, such as aviation project, is used to illustrate how artificial intelligence works in real world, different scenarios can be constructed to frame different possible situations for the sake of stimulating the students to consider different alternative solutions. The overall understanding about the technology and the industry is not confined to any single scenario, which reflects the situations in the real world because many possible scenarios can be happen. The value of the practice-led teachers is not accounted for listing out all the possible scenarios to the students and it is not realistic, too. Leveraging their professional experience in the field, with direct involvement in the previous or even the current IT projects, they can make use the different scenarios to illustrate the relevance and appropriateness under what the conditions are. This rationale is supported by their working experience in the field, and it is asserted that each of them had gone through the reflection process in assessing the different situations in the IT field and possessing the relevant experience in tackling different challenges. Their relevant experience is probably including the live cases of successes and failures because they possess the industry experience ranged from 18 to 35 years in the field. As they hold the concrete examples in mind, they are ready to share the living experience with the students and explain to the students on what, how and why. The uniqueness is that they can flexibly pick any concrete examples to respond to students' questions without the need for any pre-determined answers while the practice courses taught by them do not have textbooks, but they develop the course materials by themselves. Scenario-based explanation can be viewed as an agile teaching tool, which can quickly clarify what is stuck in the middle if some students cannot understand what's taught in classes; however, it is rather contextual in nature and thus, for effective teaching and learning, the teachers should use more than one scenario to illustrate the point to the students that can trigger their self-reflection for better understanding. When those case studies and examples are used for explaining the current problems and applying what have learnt, it is regarded as forward reasoning learning experiences for the students (Bevins et al., 2012).

5.6.3 Scenario-based learning in lab practices, backward reasoning for real data sets

Practical lab sessions deploy scenario-based setting for student learning but in different approaches. Their scenario settings are ranged from technology-oriented without industry complexities, real data sets from the industry and embedded work practices. Embedded

work practices have been discussed in detail in the earlier part that this section will discuss the first two types of practices. The scenario settings purely on technology-based can facilitate the understanding of the students on the composition of IT network and how different machines and devices are communicating with each other in lab environment, which can serve for reinforcing the students' theoretical learning in lectures. When the learning rests on the originality of the theoretical stand, it becomes a self-contained entity, portable and re-usable, as described as an ideal live of the real environment, very close to the industry but not the same. Learning how to design and develop an application to tackle certain actual problems is not easy; while using real data sets are used as teaching tools, it is very valuable for student learning because the complexities embedded in the data set are real and existed that the students can have the chances to touch the complexities and learn how to solve the real-life problems; and it is regarded as backward reasoning problem-based learning which is more difficult (Bevins et al., 2012). Strictly speaking, the real-life complexities can never be intimidated; it is highly appreciated that practice-led teachers can bring the real data as the learning tool; for the fact that the real data set can help to train up the malleability of the students, once the students can solve it and come up with the solution, they show their understanding and are confident to tackle the similar problems in the future when they encounter it. Hence, it is very effective to enhance the self-theories of the students, the self-efficacy (E) of the USEM model and the psychological capital as a form of graduate capital.

5.7 Teaching and learning in IT discipline

5.7.1 Students' proficiency is more than skills

The topic of student proficiency seems to be referred to skill-oriented requirements, but in this study, first principle's teaching approach focuses on student's learning on foundational knowledge which is not contradictory with what teacher PLT-E advocating for students' proficiency at work as he refers it to let the students understand the dual role of IT in technology-enabled sector, and the application role of IT is posited for supporting business growth. Except for the primary IT sector of vendors, the role of IT staff in the technology-enabled sector needs to support the business and operations teams by implementing the IT systems, like customer relationship management system, banking system and supplier portal, which are serving for enabling the business growth. Hence, IT departments and the staff nowadays are no longer the cost centre in most of the companies, and this observation is consistent to the research work of Reich and Nelson (2003). Before implementing any IT systems, IT staff are required to coordinate with the business users and collect the user requirements and it is implied that knowing some business knowledge is part of the IT jobs. Proficiency, in this sense, can be regarded as having the smooth work process when dealing with business users, collecting the relevant user requirements, turning the user requirements into technical specifications of the new IT systems and so do the upcoming

user acceptance tests before the formal system launch. During the group project presentations, the teacher raised question to one student group about change control under project quality management in their presentation, PLT-D's statement to the group was clear and direct, *"we can't unconditionally allow the customer to make changes"*. Why the agreed project scope can be changed, it is largely requested by the business users who pay for developing the IT system. When the project scope needs to be changed, the system requirements need to make the correspondent changes. Why the system requirements need to be revised, the common reason is about the user requirement specifications which do not reflect what are their requirements. Here comes the big question: why there is the discrepancy? That is the reason it is part of the best practices shared by the teacher, who tells the students to have the habits to write down the user requirements every time they met and then to ask the users to confirm what have written down, even in point form if not enough time. She elaborates that it is not because of worrying the users to change the requirements afterwards but needs to confirm the understanding of the users to be accurate, as project team member responsible for this project task.

5.7.2 Challenges in teaching and learning

Based on the feedbacks from the practice-led teachers, their challenges in teaching and learning are mainly due to the nature of knowledge, students' mindsets and learning attitudes and fast pace in industry changes. The advanced level of IT knowledge and skills are rather difficult for the students to learn because the learning is either requiring for some prior working experience or the acquisition of those knowledge demanding for the students to have high-level of abstraction for understanding. Not all the students join the summer internship or one-year placement programme, those students' learning are very much relying on the teachers. For those students possess some working experience, their mindsets may not be mature to understand those advanced IT knowledge like corporate governance and leadership skills. One teacher tries to use analogy as a way of explanation to enable the students' understanding in a principle or idea while the analogous things, she picked are those the students are familiar with.

According to Cohen and Levinthal (1990, 130), they argue that this approach can improve the learning capabilities of the learners in the "development of the capacity to assimilate existing knowledge"; as learning capabilities and problem-solving skills have similar mode of development, teachers may consider teaching the students through 'analogy-to-example' and if the students can understand how these examples worked, that can determine their success in developing new solutions (Pirolli and Anderson, 1985). The possession of some related prior knowledge as the absorptive capacity (Cohen and Levinthal, 1990), can increase the students' creativity by associating and linking to those they had never considered before; the Harlow's (1959) concept of learning sets suggest that the behavioural phenomenon of "insight" typically refers to the "rapid solution of a problem"

(Ellis, 1965, 35). However, there are two conditions to be met, the examples relevant to the prior knowledge acquired need to be processed more deeply in the associations (Lindsay and Norman, 1977) and the capability in solving problems can be accumulated by practising more trials on related problems (Cohen and Levinthal, 1990). Accordingly, the practice-led teachers should help to create the strong associations between the concrete examples or scenarios that they are using in the classes and labs, either by dialogic communications or by doing some simple exercises, and those examples and scenarios should be varied in multiple contexts (Bjork et al., 1989), such as teacher PLT-A illustrating the use of AI applications in aviation industry and railway industry, to promote understanding and higher level of abstraction. In addition, the teachers can consider using myths, stories, and metaphors to articulate the rich sets of meanings (Clark, 1972). It is understood that metaphors can cut across different contexts by combining the imaginative and literal observations with cognitions (Bateson, 1972) while storytelling is very powerful narrative tool in the exchange process of practice and tacit experience between technicians, that can lead to improved practices in solving the problems (Orr, 1990).

Improving the students' mindset in learning is the most difficult for all kinds of teaching, but this aspect is much required in those applied and practical subjects like IT whose existence is for solving the problems in the real world and improving the lives of people. In this study, half of the teachers express concerns about not less students who are very result-oriented, and learning is secondary to getting high grades in the transcript; that is, their learning is focused on those areas more likely to be examined and they select the elective courses based on how easy they can get good marks and high grades. These are the students having fixed beliefs who are less persistence in taking on challenging or risky tasks and trying to avoid any failure (Dweck, 1999). It is the common understanding that working in the global companies like investment banks and the 'big four', the four global accounting firms, are the ideal jobs of many IT students. It is good for those students who have self-motivated to plan for their graduate job, but it may be relatively short-sighted or criticised as 'a blinkered view of higher education' (Kinchin et al., 2008) if taking the exam-oriented approach in the university learning. Having an outstanding degree transcript should be able to let them get a job from those privileges' firm, but the path of graduate employability is not as easy as it will be. However, self-efficacy is malleable through positive interventions, and it is valuable for the teachers to motivate the students to learn something challenging, and to create the learning environment to accommodate making mistakes and allow corrections and in this aspect, teacher PLT-C is doing well to support the student learning in the lab practices. Due to the inter-dependence between IT industry and teaching, when the IT industry is kept innovating and advancing, the practice-led teaching is required to have correspondence. As teacher PLT-A and PLT-C are conducting the teaching related to the latest technology development and the respective IT security, both are properly addressed it by having the up-to-date materials for lab practices as well as reviewing and updating the course materials after every academic year.

5.8 Conclusion

All the practice-led teachers in this study possess the similar type of academic discipline in technicality and the industry experience in IT field background, having the IT domain-specific knowledge and skills. They possess strong human capital in IT discipline and good social standing in the professional communities of practice (Lave and Wenger, 1991), influenced by the accumulated social capital with relational assets, which is not a separate dimension (Peeters et. al. (2019) but allocated across all categories of employability dimension, retained, and enhanced throughout their journey in the IT field and the university teaching. The teachers leverage their personal assets, derived from the network connections accumulated in their previous employment, converting them to becoming the university's network capital in the forms of the experiential learning events attended by the university students who experience and acquire the relationship and connection with the industry speaker or company spokesperson. All the experiential learning activities are embedded with the 'desired' calculative ties (Williamson, 1993; Huggins et al., 2012) with economic or noneconomic considerations because all parties are rational actors (Coleman, 1988). Hence, the success of the practice-led teachers, leveraging their social assets and network assets, can support the students to get closer to the labour market by 'bonding ties' (Tomlinson, 2017) with the company representatives and industry speakers as the potential employers in the future. In addition, the practice-led teachers can extend the teaching team to support the students by having the external mentors like company representatives or the external teaching assistants in lab and the work practice mentors like the work supervisors during industry placements, internships and elective consulting project courses; whereas the practice-led teachers are the master of the applied practices and practical practices in the university teaching, self-developing the course teaching materials embedded with industry knowledge. In the practice labs, they aim for developing the learning environment to be ideal live, having real data sets, and closer to the university, and that is good enough for the students to understand the application of theory into practice because the students can have the chances to make mistakes and correct them as well as to have self-reflections in the learning process whose learning are regarded as the self-efficacy (E) and metacognition (M) as the curriculum design in the USEM model of employability while the metacognition in the model is said to interact and promote the other two variables of understanding (U) and skills (S) in the model, while self-efficacies can influence graduates' employability directly. As the lab practices are very close to the industry for professional practices but not resembling work practices, they are conducting the teaching for IT knowledge and skills as the work-integrated type of learning approach but not the exact WIL theory as proposed by Smith (2012) and Smith and Worsfold (2015).

The students' learning experience can be deemed as authentic experiences on its own right of the students because they are engaged in the practices and self-reflective while are further supported and strengthened by the experience sharing and explanation by the practice-led teachers as first-hand experience. In addition, the disciplinary inquiry during

the Q&A sessions after the student presentations is observed to be learner-driven by the project works prepared by the students as the authentic engagement and experience for the students, the fellow classmates, and the teacher because the students are engaged learners and reflective thinkers, including the competitive conversation between different presenters and the questions raised by the fellow classmates who related the presentations' subject matter to the reality. The practice-led teachers were using the mostly probing questions, but some were very tough questions asking for deeper understanding on the subject matter being presented by the student groups. However, it is found that their students are weak for learning IT concepts. Though there were only a few questions in total from all teachers to ask for relating the projects to the technical concepts taught in the courses, all those students were silent, and no student was able to give the answers. Correspondingly, in project management course, all the questions raised after each student group presentation were those seeking for the students' understanding on the contextual meaning of the key words in the knowledge areas of the project management framework. Though there is very subtle difference in those words, it is critical enough for the teacher to spend each of the Q&A sessions in 10 minutes with every student group and all those words or knowledge areas were picked up from what they presented in their group project. Hence, the disciplinary inquiry conducted by the practice-led teachers are truly domain-specific knowledge, making the students are truly reflective thinkers. As these Q&A sessions are trusted and committed, the teachers can support the students in tackling challenging questions with positive interventions. Based on this analysis, the student learning during disciplinary inquiry is regarded as self-efficacy (E) and metacognition (M) in the USEM model of employability, promoting the variables of understanding (U) and skills (S) in the student learning. In terms of the notion of transferability, the practice-led teachers use the concrete examples, case-based learning and scenario-based learning that can strengthen the understanding of the students, together with their first-hand experience in explanations and considering the trade-off in different decisions. Therefore, they can support the students to become reflective thinkers, for high-level abstraction and reflection are the essences of the university graduates to transfer the knowledge and skills from the university education to the workplace as the longer term of employability by being productive and knowledgeable in the subject matter.

CHAPTER 6 CONCLUSION

Within a globalised world, the interconnectedness between economic level and political level would impose changes on the business and labour markets (Slaughter and Leslie, 1997) while the correspondence in higher education policies is seen as an organising principle (Stevenson and Tooms, 2010) between economic agenda and government policies, aiming for producing more knowledge workers (Tymon and Stumpf, 2003) who are more educated, capable of increasing the productivity gains (Farrell, 2003; Yorke, 2006), and can make contributions to the economic growth. In the new economy, the productivity gains are economic considerations, following the policy-oriented framework to create the relationship between new technology and productivity (Godin, 2004), leveraging new technologies as an internal engine to facilitate the structural economic change, and thus, economic globalisation can drive for superior economic structure (Pohjola, 2002; Olssen et. al., 2004) in a global competitive knowledge-focused society (Hagen, 2002). Through the work of Benhabib and Spiegel (1994), it is confirmed that the growth of total factor productivity is a function of human capital and human capital is treated as the “significant input in the production of knowledge ideas”, whilst “human beings with knowledge produce more knowledge” (Mathur, 1999, 205). Influencing the development of human capital (Coleman, 1988), social capital is consisted of the assets and the network (Bourdieu, 1986; Burt, 1992) in web of social relationships, also having important influence on the development of intellectual capital (Nahapiet and Ghoshal, 1998). Therefore, the concept of capital distinction can show the social relationships between human, social, network and intellectual capital; and it can help to explain why social capital is unable to be identified as separate dimensions but loaded on all dimensions of employability. In this study, the practice-led teachers possess the forms of human, social, network, symbolic, and embodied capital, accumulated by their academic attainments of technology discipline, industry experiences and professional practices in IT or technology-enabled sector and the university teaching experience in IT disciplines on a single continuum of lived experiences, and now helping the IT degree students to create their work-related identity (Tomlinson, 2017) and pre-professional identity (Jackson, 2016) as their own forms of graduate capital on the single continuum starting from the university degree.

In the 21st century, the economic globalisation drives for the globalisation of trade in goods and services (McBurnie and Zигuras, 2001), including higher education as an industry under the framework of the General Agreement on Trade in Service (GATS) (Knight, 2002) and meanwhile, the massification of higher education is becoming a worldview phenomenon of rapid increase of student enrolments in higher education as well as the emergence of academic mobility (Altbach et. al., 2009) with increasingly more international students, creating the possible impact of imbalance global workforce in supply and demand. Universities are generally regarded as the largest knowledge-based institutions (Moscardini et. al., 2022) and knowledge factories (Aronowitz, 2000) or academic factories (Jacoby, 2001) that the policymakers initiate the “government policy drivers” (Neary et. al., 2012, 53)

to influence the supply of graduates and the occupational skills through government funding allocation. The massified system of higher education, locally, creates the problem of overcrowded graduate labour market (Anderson and Tomlinson, 2021), leading to the increasing pressures of credential inflation (Tomlinson, 2008) and the declining status of credentials. When a degree or certificate is not a complete entry ticket to get a job, the graduates are required to strengthen their individual human capital to distinguish from the other job seekers in the recruitment process. For the employers, they are worried about the issues of knowledge easily obsolete (Humburg et. al., 2013) and considered to have competency and inter-personal skills as the preferred selection criteria, though are criticised as creating the social magic (Ashley et. al., 2016), it is suggested that it is better for the graduates to develop more behavioural competences (Tomlinson, 2008) to strengthen their personality package (Tomlinson, 2017).

Having these global and local pressures in place, IT industry, made up of the primary and secondary IT sectors, is facing their own sets of opportunities and challenges. Because of the fast pace of technological advancement, e-business is interpreted as the new business model (Higgin, 1999), requiring the company to transform into “digitally networked enterprise”, heralding the new economy (Hackbarth and Kettinger, 2000, 78). According to the published report from The United Nations, it was estimated that “the global value of e-commerce sales (B2B and B2C) reached almost \$26.7 trillion in 2019. This corresponded to about 30% of GDP and represented an increase of 4% from 2018 (\$25.6 trillion)” (UNCTAD, 2020, 4). However, e-businesses bring up the new dimension of risks in data fraud or theft and cyber-attacks, whereas security becomes not just a technical issue, but also a strategic and potentially legal one (Birman, 2000) because cyber risks have been regarded as the global risks (Bilan et. al., 2019), the massive incident of data fraud or theft, predominantly driven by economic motive. Based on the global risks report published by World Economic Forum (WEF, 2019, 8), ‘data fraud or theft’ and ‘cyber-attacks’ were listed in the top 5 global risks in two consecutive years in 2018 and 2019, implying that the standard practice in revealing the cost-and-benefit analysis (Reich and Nelson, 2003) as required in any kind of business models is being challenged to add the new dimension of risks into the analysis. Bessen (2019, 615) identifies that “new productivity-improving technologies will likely bring a disruptive reallocation” and the impacts of process automation are estimated to be 8 to 14 per cent across occupations (UNCTAD, 2021, xviii). However, it is pointed out that “the distinction between occupations and tasks is critical since even occupations at high risk of automation can perform tasks that are hard to automate” (UNCTAD, 2021, 40); and “by 2035, the global 5G value chain is expected to support 22 million jobs” (UNCTAD, 2021, 19). Hence, for the IT jobs, there are expected changes in the existing IT job requirements, and the creations of new job roles like cyber-security, and new job groups like CTO.

As practice-led teachers, possessing the contextually rich industry experience in IT discipline as applied and practical, they are enthusiastic and passionate to support the IT degree students acquiring the IT disciplinary knowledge and skills, and the professional practices,

from which to strengthen their behavioural competences (Tomlinson, 2008) as embodied capital (Tomlinson, 2017), enhance their career adaptability (Savickas and Porfeli, 2012) as psychological capital, and create the 'bridging ties' (Putnam, 1999) with the industry. Based on the research findings, their teaching and direct support for the students' academic and practical learning, experiential learning and their graduate jobs is multi-levels, distinctively focusing on the course design, practice-led pedagogical approach, extra-curricular programmes, IT professional development, and having the face-to-face dialogues and job analysis with the IT graduates about their job offers.

Facing the contextual barriers (Tomlinson, 2017) between university education and workplace practices, they do not expect to teach the students on industry practices, preferring 'not resembling the lab practices' with that of the industry. Pedagogically, they design the lab environment very close to the industry settings, application-oriented practices with industry data sets, practical understanding on theoretical application with the industry complexities extracted, having the client-oriented IT practical practices. In the academic environment, they allow the students to try by errors and correct the mistakes, thus encouraging the malleability in their self-efficacies; while the lab practices are the correspondence to their lectures, it can promote the students to do self-reflections while practising. In terms of educational authenticity, they leverage their industry experience to articulate the students' understanding on the subject matters through their dialogic explanations as first-hand experiences and through the concrete examples in case-based or scenario-based learning.

Based on the feedbacks from the student surveys, in terms of usefulness in the study, 100% of the students thought real-life case studies and examples were useful and 96% thought experience sharing of industry practices were useful. When it comes to the helpfulness for graduate jobs, these two course items ranked the 4th (71%) and the 7th (57%) respectively. Looking at the detail, there were 43% of the students not knowing whether experience sharing was useful though no students thought it was not useful. It can reflect that the students know that teacher's industry experience is valuable but not knowing how to relate it to themselves. As the teaching contents and materials are highly contextual-based with industry perspectives, and statutory guidelines and principles, all these can be seen as applied practices and practical practices in the classroom inquiry; through the dialogic conversations and the use of analogy in some difficult topics, the practice-led teachers impart the disciplinary knowledge on them by activating their reflective thinking and followed by the group assignments and projects. For the deeper understanding of IT domain knowledge, they conduct the teaching through classroom-based disciplinary inquiry on the student project presentations in the last lesson of the course, but it is learning-driven teaching and led by the students who did the group work and present it, the role of the teachers is a good listener and facilitator to raise the disciplinary questions in probing while encouraging for more elaboration and explanation. It is found that the students were highly engaged as reflective thinkers and proactively taken up some tough questions. Through the

above practice-led teaching, they are fundamentally having the IT students to achieve the higher-level of thinking and reflections in the university environment allowing for making mistakes in increasing their malleability to take up challenges; they can effectively teach the IT students on disciplinary knowledge and skills through the interaction with the self-theories and metacognition experienced in the classes to get the USEM model of employability (Knight and Yorke, 2002) operating in the IT curriculum.

Furthermore, the experiential learning activities are embedded either as the co-curricular activities like guest lectures and company visits or in the networking events like alumni speakers of mentorship programme to share the job interview tips. For work practices, the IT degree students can acquire the working experience during industry placement, internships, and elective consulting project course. More subtly, they offer more learning support to the students by extending the teaching arm to have the external mentors, like company representatives and work supervisors, and the alumni speakers as senior mentors for informal learning and job support. However, they do encounter some challenges in teaching and learning. Due to the nature of tacit knowledge as 'black box of intuition' (Kinchin et al., 2008), and the skill model of proficiency (Dreyfus and Dreyfus, 1986) that the acquisition of advanced IT knowledge requiring analytical skills in decision making and the intuitive understanding of the particular situation, the practice-led teachers understand the fundamental educational problem of moving linear structure to hierarchical structure (Novak and Symington, 1982) and thus, let IT students memorise the learning and hope they can do the job mapping in the future if their job will cover that area. It is acknowledged that some university students are not mature and let them grow up to later recall their learning in the university.

In this study, the greatest challenge is practising the practical lab assignments close to the workplace-situated learning (Smith, 2012) and the same mistakes were made repeatedly in the practical lab examination which is regarded as the authentic assessment (Gielen et al., 2003; Gulikers et al., 2004). The teacher is the course subject's domain expert and thus, may be caused by the 'pre-authentication issue' (Petraglia, 1998), particularly problematic in the associative learning which requires the students following the logical steps and making choices in those technical steps and tasks as integrative learning (Smith, 2012) in doing the practical practices in the lab. This example can show the problems of using real-life project as authentic workplace learning for the students because the actual project is implemented intellectually and cognitively, which cannot be simply disaggregated into the sequence of steps or tasks for the students to do practices as learning tasks because each of these is dependent on the others and needs to be done with reasoning, implying that it is not a simple task or step and thus cannot be purely instructional. For cognitive action, the students need to possess some related prior knowledge (Cohen and Levinthal, 1990) as the pre-requisite for knowing capability (Nahapiet and Ghoshal, 1998). For those students without the prior knowledge but want to attend this course, it is suggested that they can sit next to those classmates who have the prior knowledge in the lab and self-learning after

school to catch up the course. There are two suggestions to handle the prior knowledge, firstly, the teacher should prepare a more concrete list of IT knowledge areas for the course and inform the students on the first lesson of the course so that they prepare in advance for lab practices; and secondly, based on the knowledge structure for expertise development (Kinchin et al., 2008) that 'expert knowledge is interpreted as networks of understanding', it is better for the teacher to come up the blueprint of the real project, mapping with the sets of lab assignments or at least a clear pre-briefing of the whole set of exercises, which can help to encourage the self-reflections of the students to the higher-level. If considering to apply backward reasoning in teaching the professional practices or the similar kind of industry practices, the question is whether completing the whole set of lab assignments can re-build the original project case delivered in the customer site; what is meant that can achieve what that original project can be achieved in meeting the needs of the client. It can be explained on why there is the debate between educational authenticity (Splitter, 2009) and authentic intellectual work (Newmann et al., 1996, 2001); though both schools of thought agree that for good teaching pedagogy, it is the "capacity" to let students "make meaning and form judgements based on good reasons" (Newmann et. al., 2001; Splitter, 2009, 147).

The controversial view between academic teaching and vocational training in higher education has been a long debate, but this study is not aiming for giving an answer from the university level. This study, however, can provide an insight for these two teaching approaches to become an organising principle on the course-level or programme-level. Pedagogically, the purpose of education or teaching and learning is following the essence of knowledge (Anderson 1984) while for IT discipline as applied and practice, the concept of knowledge structures for expertise development is resonated. When IT expertise is seen as an individual's ability to navigate between underlying networks of understanding and chains of contextual practice in applying the IT theories into practices, the complementary nature of linear and networked knowledge structures and their contextual significance need to be recognised and meanwhile, avoiding the issues of isolated chains of practice (Kinchin et al., 2008). The core values of first principle's teaching approach are to understand the originality of the technical theory as it stands technically, before applying it into practices. Vocational practices are generally regarded as the effective way in training the students to get to the IT tasks for completion efficiently. In this study, the practical practices in the labs and practical exam are reviewed, demanding the students to possess more than skills for cognitive actions. That is why vocational training may not be appropriate if no other learning support is made available for the students, especially for those without related prior knowledge. Therefore, the choice between academic teaching and vocational training approach on IT knowledge and skills is more viable if it is taken into consideration with the nature of the knowledge and skills to be acquired on course level. In teaching IT course, both approaches can be adopted by the teacher who deems to be appropriate or even mixing them in teaching one concept or skill. Based on this study on those taught by the practice-led teachers, it is necessary for the students to possess some related prior

knowledge as absorptive capacity (Cohen and Levinthal, 1990) when acquiring the IT disciplinary knowledge and skills in the courses.

Based on the above two discussion themes, though they are contextually related to IT disciplinary knowledge and skills, these themes can be applied in any discipline which is applied and practical in nature, according to the concept of knowledge structures for expertise development. As I raised the question earlier, if using real-life IT project as the authentic work practices for workplace learning, whether completing the whole set of practical lab assignments can re-build the original project case delivered in the customer site, I would suggest that this subject can be considered as a new research area that can be further explored in understanding the gaps between practical practices or professional practices and industry practices. The potential contributions can be relevant to bridging the teaching gaps in future practices from practitioner's perspective while the academic contribution can be related to the further study on the academic concepts of authenticity and resemblance as well as the knowledge structures for expertise development.

As a research degree student, I have lots of reflections in this study and all the self-reflections are life-enhancing. At first, I have countless experiences of back and forth to do verification and justification between academic view and practitioner view because I need to find the linkages and associations between the two sides, while allowing for consensus and contrasting. It is the similarity between forward reasoning and backward reasoning that I have discussed these approaches under the topic of case-based and scenario-based learning. It is challenging but very meaningful process and highly relevant to me. Secondly, it is the learning for the subtle difference in the meaning of some words as synonym. There are many English words that can be used inter-changeable, and it is very common in writing articles to have more varieties. But for disciplinary knowledge, the meaning of some words is contextually meant as those identified as the findings in this study. For me, it is learned that there is subtle difference in the meaning between 'basically' and 'fundamentally' in this piece of writing. It is so amazing to me! Castells (2000) describes information technology workers as 'self-programmable' workers, and for me, I am 'self-programmable' research degree student too.

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List of Appendices

Appendix 3.1: Participant Information Sheet

Postgraduate Research Study: How does professional experience (or the professional experience of practice-led instructors & professors) inform the educational experience of university students on IT programmes in Hong Kong?

Researcher: Ann Lai-Ping, CHAN

Information Sheet For Semi-Structured Participants

You or willing members of staff from your department are being invited to be involved in this research study. Before you decide whether you want to take part, it is important for you to understand why the research is being conducted and what your participation will involve.

Please take time to read the following information carefully and discuss it with other members of staff from your department if you wish. Please contact me if anything is unclear or if you would like more information. Take time to decide whether or not you wish to take part.

Thank you for reading this.

Aims: The aims of the project are to gather information about the value propositions of professional and industry experience in university education, how do these industry experience through practice-led instructors and professors inform the educational experience of students on IT programmes, what are the current teaching practices while the aspects of their students' learning outcomes, and potentially their graduates employability and professional development, will also be explored and discussed.

Requirements: The interview will be carried out on the campus in between May and July. The interview will be based around a semi-structured interview pattern and will take approximately 60 minutes. The interview is intended as an opportunity for you to express your views on the value of teaching professional experience in IT programmes as well as your own sharing.

The interview will be recorded, and later transcribed into text form. Recordings of interviews will be deleted upon transcription.

Anonymity/Participation: As part of the presentation of results, your own words may be used in text form. This will be anonymised, so that you cannot be identified from what you said. All of the research data will be stored in a secure place in a separate, password-protected file from any data supplied.

Please note that:

- You can decide to stop the interview at any point
- You need not answer questions that you do not wish to
- Your name will be removed from the information and anonymised. It should not be possible to identify anyone from my reports on this study.

It is up to you to decide whether to take part or not. If you decide to take part you are still free to withdraw during the interview or any time up until. If you withdraw from the study all data will be withdrawn and destroyed.

If you do decide to take part, you will be given this information sheet to keep and be asked to sign a consent form.

Once the thesis arising from this research has been completed, a brief summary of the findings will be made available by the researcher upon application. It is also possible that the results will be presented at academic conferences and journals. The data will be kept securely for five years from the date of Doctor of Education degree awarded, before being destroyed.

If this study has harmed you in any way you can contact the University of Nottingham using the details below for further advice and information:

Supervisor's Name: Professor Sarah Speight (Sarah.Speight@nottingham.ac.uk)

Supervisor's Name: Professor Howard Stevenson (Howard.Stevenson@nottingham.ac.uk)

Contact for further information

Research Ethics Coordinator, School of Education

University of Nottingham

Email: educationresearchethics@nottingham.ac.uk

Appendix 3.2: Participant Consent Form

CONSENT FORM FOR SEMI-STRUCTURED INTERVIEW PARTICIPANTS

Project Title-Postgraduate Research Study: How does professional experience (or the professional experience of practice-led instructors & professors) inform the educational experience of university students on IT programmes in Hong Kong?

Researcher - Ann Lai-Ping, CHAN

Supervisors - Sarah Speight, Howard Stevenson

- I have read the Participant Information Sheet and the nature and purpose of the research project has been explained to me. I understand and agree to take part.
- I understand the purpose of the research project and my involvement in it.
- I understand that I may withdraw from the research project at any stage and that this will not affect my status now or in the future.
- I understand that while information gained during the study may be published, I will not be identified, and my personal results will remain confidential.
- I understand that I will be audiotaped during the interview.
- I understand that electronic data only will be stored in a password protected computer that only the researcher has access to.
- I understand that I may contact the researcher or supervisor if I require further information about the research, and that I may contact the Research Ethics Coordinator of the School of Education, University of Nottingham, if I wish to make a complaint relating to my involvement in the research.

Signed (research participant)

Print name Date

Contact details:

Researcher: Ann Lai-Ping, CHAN

University of Nottingham

Email: lai.chan@nottingham.ac.uk

Supervisor's Name: Professor Sarah Speight (Sarah.Speight@nottingham.ac.uk)

Supervisor's Name: Professor Howard Stevenson (Howard.Stevenson@nottingham.ac.uk)

The contact details of the Research Ethics Coordinator should participants wish to make a complaint on ethical grounds are: educationresearchethics@nottingham.ac.uk

Appendix 3.3: Semi-structured research interview's question set

1. Would you please briefly share with me your professional experience?
2. What are the factors to motivate you to take up the teaching profession after years of service in the IT industry?
3. How do you view the value of "industry learning as part of the university education" for students on IT Programmes?
4. Based on your experience in the industry and now in the academic field, how do you see the relationship between "student learning in university" and "graduates' employment and professional development after graduation"?
5. Can you tell me how you draw on your professional experience in your teaching to inform the educational experience on students? Please give me some examples.
6. In what ways do you monitor the learning progress of your students in acquiring the professional skills and understanding in your course(s)?
7. Based on your observations and understanding, do you think your students who are able to learn and understand fully in what you taught to them? Please share with me your experience.
8. How do you perceive your students in understanding the importance of acquiring professional skills and knowledge when studying IT programmes? Please elaborate.
9. Do you encounter any challenges during the process in drawing on your professional knowledge and industry practice to inform the educational experience on students? Please give me some examples.
10. What do you consider to be the minimum set of industry skills and experience that IT graduates should learn in university? Please share with me your thought.
11. What do you consider to be the most difficult set of industry skills and experience for IT graduates to learn in university? Please elaborate.
12. From your perspective, in achieving the practical transfer from professional experience to educational experience on students, what do you think are the success factors contributed from the areas, such as university, department, programme, teacher, student and so on?

Appendix 3.4: Student survey's question set

IT Course Design

(Scale 1 to 5, where 1 = Strongly Disagree and 5 = Strongly Agree)

- 1 The aims and objectives of the course were made very clear.
- 2 The course content covered both technical skills and industry knowledge in IT field.
- 3 Please rate the following course items in according to the level of usefulness to you?

(Scale 1 to 5, where 1 = Not Useful and 5 = Very Useful)

- _____ Understanding of the course subject in the field of study
- _____ Technical aspects like programming skills, lab exercises & etc.
- _____ Experience sharing of industry practices and real-life examples
- _____ Class exercises, assignments & projects
- _____ Others, such as company visits & etc.

- 4a Course assignments & projects were effective to help me practising what I learned in the course.

4b *The areas that you had practised were:*

Ans: _____

- 5a Course assessments were consistently used for assessing my understanding in the course.

5b *The course assessments that I had taken in the course were:*

Ans: _____

- 6 I usually had a clear idea of where I was going and what was expected of me in the course.

Student Learning Experience

(Scale 1 to 5, where 1 = Strongly Disagree and 5 = Strongly Agree)

- 7 Course materials were comprised of theories and applications in IT industry.
- 8 The study materials covered relevant case studies and industry practices in IT field.
- 9a It was made clear what resources were available to help me learn.
- 9b *The relevant resources available to help my learning were:*

Ans: _____

- 10 I learned to express ideas confidently with teacher and classmates.

- 11 The teaching staff was very experienced in making the course more practical and interesting.

- 12 How useful to you is, if teaching staff possess the experience from working in IT or related industries?

Ans: _____

- 13a The teaching staff made a real effort to understand difficulties I might be having with my work.

- 13b If any, what had the teaching staff done to understand your difficulties in the course? Please give examples.

Ans: _____

- 14 The teaching staff always encouraged me to understand the subjects from different angles.

Student Learning Outcomes

(Scale 1 to 5, where 1 = Strongly Disagree and 5 = Strongly Agree)

- 15 The course helped me to develop IT technical skills.
16 The course sharpened my problem-solving skills to handle IT tasks in the future.
17 The course prepared me to work as a good team member in IT projects in the future.
18 As a result of the course I feel confident about tackling unfamiliar problems in my job.
19 The course provided me with a broad overview of IT field of knowledge.
20 I learned to apply principles from the course to new situations.
21 The course developed my confidence to investigate new ideas.
22a I consider what I learned valuable for my future.
22b Please elaborate how this course is valuable to your future:
Ans: _____
23 The course has stimulated my interest in the study of IT field.
24 The course developed my ability to do self-reflection on what I learned.
25 The course has inspired me to pursue job in IT field after graduation.
- 26 ***Overall, I was satisfied with the quality of this course.***

Open-ended Questions:

- Q.1 What do you think to be the most difficult topic(s) that you learned in this course?
Please give example(s).

- Q.2 What do you think to be the most practical skills that you developed in this course?
Please give example(s).

IT Degree Programme Level:

- Q.1 Please rate each of the following course items/activities in according to the "level of usefulness" in your study IT degree programme?

(Scale 1 to 5, where 1 = Not Useful and 5 = Very Useful)

- _____ Understanding of the subject knowledge in the field of study
_____ Theoretical frameworks and methodologies
_____ Technical aspects like programming skills, database design, network architecture & etc.
_____ Real-life case studies and examples
_____ Experience sharing of industry practices by professors/instructors
_____ Practical lab exercises
_____ Class exercises and assignments
_____ Group projects and presentations
_____ Guest lectures
_____ Industry seminar talks
_____ Company visits
_____ Field trips
_____ Mentorship
_____ Summer internship
_____ Work placement

Your Graduate Jobs:

- Q.1 Do you think each of the following course items/activities will be helpful to your jobs after graduation?
(3 options: *Yes; Maybe; No*)
- ☐ Understanding of the subject knowledge in the field of study
 - ☐ Theoretical frameworks and methodologies
 - ☐ Technical aspects like programming skills, database design, network architecture & etc.
 - ☐ Real-life case studies and examples
 - ☐ Experience sharing of industry practices by professors/instructors
 - ☐ Practical lab exercises
 - ☐ Class exercises and assignments
 - ☐ Group projects and presentations
 - ☐ Guest lectures
 - ☐ Industry seminar talks
 - ☐ Company visits
 - ☐ Field trips
 - ☐ Mentorship
 - ☐ Summer internship
 - ☐ Work placement

Professional Development

- Q.1 Do you know whether there is any IT professional certification related to this course subject?
- a. Yes
 - b. No
 - c. I have no idea.
- Q.2 If there is/are available IT professional certification(s) related to this course subject, will you consider to go for the certification?
- a. Yes
 - b. No
 - c. Not sure
- Q.3 If the IT professional certification would require for taking the public examination, when will you plan to sit for the exam?
- a. Yes, I will plan to do it before completing the degree programme.
 - b. Yes, I will plan to do it after graduation.
 - c. Yes but not sure which one. I will look for more information first.
 - d. No. It will not be relevant to me.
 - e. No. I am not interested in.
- Q.4 Please provide the list of IT professional certification(s) that you will be interested to pursue for:

List of Tables

Table 2.1: Most identified knowledge deficiencies

Knowledge deficiency	Occurrences
Written communications	10
Oral communications	10
Project management	9
Software tools	9
Testing	9
Teamwork	7
Problem solving & critical thinking	7
Programming	7
Requirements	7
Personal skills	6
Ethics	5
Leadership	5
Design	5
Databases	5
Development & Improvement Processes	5

Table 2.1: Most identified knowledge deficiencies (extracted from Radermacher, A. and Walia, G., 2013, p.527, Gap between industry expectation and the abilities of graduates)

Table 3.1: The profile of the 6 practice-led teachers

<u>Name</u>	<u>Gender</u>	<u>PhD (Y/N)</u>	<u>Nature of taught degree course(s)</u>	<u>Job nature</u>	<u>Industry experience</u>
Practice-led Teacher A	M	Y	Technical	Applications	IT and academic sector
Practice-led Teacher B	M	Y	Technical, professional practices	Infrastructure	IT and technology sector
Practice-led Teacher C	M	Y	Technical consultancy	Cybersecurity	IT field
Practice-led Teacher D	F	N	IT Consultancy	Consultancy	IT field
Practice-led Teacher E	M	N	IT professional practices	Head of IT	Banking and finance sector
Practice-led Teacher F	M	N	Not applicable	Technology business	IT sector

Table 3.1: The profile of the 6 practice-led teachers

Table 4.1: Professional profile of the 6 practice-led teachers

	Practice-led Teacher A	Practice-led Teacher B	Practice-led Teacher C	Practice-led Teacher D	Practice-led Teacher E	Practice-led Teacher F
Gender	Male	Male	Male	Female	Male	Male
PhD qualification	Yes	Yes	Yes	No	No	No
Academic researcher	Yes (current)	Yes (current)	Yes (current)	No	No	No
Academic teaching	Yes	Yes	Yes	Yes	Yes	Industry liaison
Industry experience						
IT vendors	Yes (previous)	Yes (previous)	Yes (previous)	Yes (previous)	No	No
IT service provider	No	No	Yes (current)	No	No	Yes (previous)
IT trainer	No	No	Yes (current)	Yes (previous)	No	No
Commercial organisations	Yes (current)	Yes (previous)	No	No	Yes (retired)	Yes (current)
Job nature	Technical	Technical lab researcher	Technical	Technical	Regional CIO	Business head
Work focus area	IT applications	IT infrastructure	IT security services	IT project delivery	IT management	IT business
Professional membership						
Industry representative in public bodies	No	No	No	No	Yes	Unknown
Advisory board member in public bodies	No	No	No	No	Yes	Unknown
Committee member in professional bodies	Yes	Yes	Yes	Yes	Yes	Unknown
Professional membership	Yes	Yes	Yes	Yes	Yes	Unknown
The courses taught by them, for example:						
	Programming	Engineering Practices	Cybersecurity Practices	Project Management	Professional IT Practices	n/a
	Artificial Intelligence			Risk Management	Management Practices	

Table 4.1: Professional profile of the 6 practice-led teachers

Table 4.2: Personal qualities, creating competitive edge towards employability

	<u>PLT-A</u>	<u>PLT- D</u>	<u>PLT- C</u>
Part 1: Learning in the university			
Student learning activities		Observations through 1. Co-curricular course ^(c) 2. Experiential programme activities ^(d)	
Part 2: Personal qualities of the students			
Personality		• “More curious in knowing” • “More sociable”	“Have the curiosity in learning new things”
Level of maturity	Self-understanding ^(a)	More mature	More mature
Advanced planning	Career objective in mind • Plan to advance themselves and get promoted		
Motivation	“Love to acquire professional skills, because it’s their career”		Good motivation to learn ^(e)
Behaviour		“Definitely taking more initiative”	“Take self-initiation to find out the answers”
Attitude			“Who can grow faster, with professional development after graduation, are those with good attitudes”
Part 3: Preparation for work			
Advantages:	“Highly attractive in terms of employability”		
Part 4: Aspiration for career development			
Self-aspiration	Technically strong for career progression ^(b)	• “To be IT project manager in the future” ^(c) • “To admire at him [alumni speaker] and want to be ‘him’ in the future” ^(d)	Planning for professional development

Table 4.2: Personal qualities, creating competitive edge towards employability

- (a) “For lots of students coming to the university, they are more practical, they understand that they will be working in the industry. They are highly motivated already in terms of IT skills.” (PLT-A)
- (b) “You really need to be strong technically in order to progress in your career.” (PLT-A)
- (c) “For instance, we offer a course on project management. Many students said that they show interest to do project management for IT projects, to be IT project manager in the future.” (PLT-D)
- (d) “Some students are more mature. How can I observe them? After they attended these activities, they have already got some ideas about the industry. To take the sharing of one alumni speaker as an example, he has worked in the industry for 5 years and now is IT project manager. When the students heard about his sharing, they started to admire at him and want to be “him” in the future.” (PLT-D)
- (e) “Be active outside classrooms, such as to write some programming, to do some computer settings, to do business or even to do repairs on IT equipment. All these can help to show the motivations of the students.” (PLT-C)

Table 4.3: The most difficult set of IT industry skills and knowledge

	PLT-A	PLT-B	PLT-C	PLT-D	PLT-E	PLT-F
IT projects						
• Process and methodology	Y					
• Organisational issues				Y		
Soft skills						
• Teamwork	Y	Y				
• Professional report writing			Y			
• Negotiation skills					Y	
o Pricing negotiation						Y
o Contract negotiation						Y
• Presentation skills					Y	
IT knowledge						
• High-end knowledge			Y	Y		
IT skills						
• Advanced IT hard skills				Y		

Table 4.3 The most difficult set of IT industry skills and knowledge

Table 4.4: Summary of IT academic courses and programme activities involved by the practice-led teachers

IT Courses	Professional practices (Classroom)	Experiential learning	Work practices (Outside the classroom)
Required			
Software application	Industry learning		
Engineering practices	Industry learning	Company visits	
IT professional practices	Industry learning		
Co-curricular course		Guest speakers	
Final year project		Industry or experts	
Industry placement		Industry learning	Work practices
<i>Summer workshops</i>	<i>Skills training</i>		
Elective			
Cybersecurity practices	Industry learning		
Consulting project course		Industry learning	Work practices
Summer internship		Industry learning	Work practices
Work-study programme		Industry learning	Work practices
Extra-curriculum activities			
Industry seminar		Guest speakers	
Mentorship		Guest speakers	
Site visits		Company visits	

Table 4.4: Summary of IT academic courses and programme activities involved by the practice-led teachers

Table 4.5: Engineering Practices, course development in co-curricular design

Course: Engineering Practices Level: Undergraduate level, the required course			
	Course design	The role of Teacher B	Student groups (4-5 students per group)
1	Industry background Aims: ❖ To give students some understanding of the IT industry. ❖ To serve as the background information for the students before they visit the companies.	Introduce the landscape of the IT industry: • How the industry evolved over time in the last 30 years • To do analysis on different major players per the whitepapers published on their company website	
2	Company visits Aims: ❖ To create some opportunities for students to learn what is like - to work in the industry and the different types of industry. Types of companies chosen: • Start-ups, or • Multinationals, or • Research labs	More than 20 company visits pre-arranged <u>External</u> • Identify someone from each of the companies while the person's background can allow the students to learn something from • The person serves as the external mentor to the group Selection criteria: ○ Knowledgeable, who are practising in the industry ○ Willingness to explain / to have dialogues with students ○ Willingness to help students understand the followings: - <i>what is that company's role in the industry?</i> - <i>what are their competitors?</i> - <i>what are the different jobs in that of the company?</i> - <i>how do they try to succeed?</i> • Contact each of them personally to make sure they understand the goal • Invite them to participate	Each student group needs to visit one company only <u>Three-stage action items</u> Before the visit: • Contact the named person provided by teacher B • Set up the company visit • Prepare some questions for the interview, such as - <i>Company role in the industry</i> - <i>Their position in the company</i> During the preparation, each student group needs to meet up the assigned internal mentor (another professor) for advice. During the visit: • Visit the named person • Interview the contact person • Seek for some career advice

		• Thank you them for spending the time with the students • Give them a souvenir <u>Internal</u> • Invite more than 20 professors in the department • Each group to have a professor as an internal mentor <u>The role of the internal mentor</u> • meets up the student group • goes through the group's preparation for the visit and the interview: - <i>how to talk to the external people,</i> - <i>how to prepare yourself</i> - <i>how to behave,</i> - <i>how to get the most out of the visit.</i>	
3	Sharing session in class Aims: ❖ All student groups need to share what they have learnt in the visit. ❖ Each student can get, even a glimpse of different kinds of companies in IT. ❖ Each student can see how these companies operate in the industry.	Teacher B sets out the following guidelines: <u>Format</u> Group presentations 10-15 mins each <u>Presentation rule</u> • It is a shared group presentation • Each student gets a chance to say something <u>Management</u> • Make sure each group to have a responsible person, a leader, like the coordinator • Define the role of the coordinator • Assign privilege to the coordinator who can report any free rider in the group • Deduct some points for that student who failed to participate	After the visit: Each student group needs: • to submit a group report • to conduct the group presentation in class <u>Arrangement</u> • Each student in the group says something about some different aspects of the visit • Each group has a leader to do coordination <u>The role of coordinator</u> • to coordinate the group's presentation preparation • to get everybody together • to give feedback to the teacher if there is any teammate who do not participate

Table 4.5: Engineering Practices, course development in co-curricular design

Table 4.6: Professional IT Practices, a new course in lecture-and-tutorial design

	Course: Professional IT Practices Level: Undergraduate level, required course	
	Course design	• It is a co-teaching course. • Both practice-led teacher E and the other professor are sharing the teaching effort equally. • Practice-led teacher E is responsible for 6 lecture topics and 6 case studies. • Every 2 weeks for one topic, with one hour in week 1 and two hours in week 2. ○ Week 1: Lecture ○ Week 2: Tutorial and Lecture
1	Lectures	Aims: ❖ Give lectures ❖ High-level introduction of the project case assignments • Teacher E segments the lecture content into 6 lecture topics and develops the lecture notes based on his own professional experience. • Lecture topics are related to effective IT management, IT security and banking, data privacy and protection, big data analysis, future of banking in cyberworld. • All the lecture topics are related to the IT practices in the banking industry, with the respective real-life examples. • Week 1: one-hour lecture and high-level introduction about the assignment and the related research scope • Week 2: one-hour lecture after the first hour for tutorial session
2	Research-based group assignments	Aims: ❖ To require the students to do industry research around the case study assignment which covers the areas in technology and business. ❖ To present the research result to show the understanding. • All the group assignments are designed in case study format. • Each assignment requires 2-3 student groups to make presentation in the class.
3	Tutorial sessions	Aims: ❖ Group presentations ❖ Assess the research effort and the understanding of the students ❖ Create the feedback loops for the presentation groups and the rest of the class

		• There are 2-3 group presentations in the 2nd week for each assignment. • Each group presentation takes 30 minutes, and all groupmates need to share some part of the presentation. • Q&A sessions are used for giving feedbacks by the teacher and the fellow students.
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Table 4.6: Professional IT Practices, a new course in lecture-and-tutorial design

Table 4.7: Cybersecurity Practices, course development in lecture-and-lab design

	Course: Cybersecurity Practices Level: Undergraduate level, an elective course	
	Course design	• It is a hands-on course, with training in lab sessions. • Class duration is 4 hours, in the computer lab.
1	Lectures	• The course content for the lecture sessions is consolidated whereas the scope of lab sessions is enlarged. • The outline of the lecture materials is referencing to some relevant books while the contents are developed by himself.
2	Lab sessions	The lab sessions are designed and guided by a case. The case project is written by Teacher C and his team. ❖ It is designed on the rationale about the foreseen work that their future job will get involved, with reference to the requirements in local job market. <u>Overall scope</u> It is the kind of basic systems setting or work processes that they need to perform it before they can start to work on the system tasks. • The must-know settings include how to set up the servers, how to do server configurations, how to set virtual machines and so on. <u>Approach</u> The instructions for lab sessions is kept as the minimal as possible because we want to let them try doing more. <u>Lab assignments</u> • The instructions are given before each class. • The lab session in week 1 is to set up the servers, week 2 to set up the VM by installing the DNS, web server, FTP server, and so do the remaining weeks. *One of the lab assignments is to do “Hacking into a system”. From setting servers to hack in the machine, from hacked in to how to fix the problem, inside the hacked machine, what needed to be

		done, like how to set up the firewall, how to activate the intrusion & detection mechanism & so on. <i>Pre-requisites:</i> - <i>Students need to be learnt about what is operating systems, what is programming, how to write a web programming, how to set the different types of servers, to know something about network; with all these, they can then consider taking the course.</i>
3	Home assignments	• Compared with the lab assignments, students have less guided instructions and need to think more when doing the individual assignments.
4	Group project	• Students need to pick an advanced topic. • They then form a group to work on that topic. • At the end of the course, each group needs to do a group presentation: ○ In the presentation, other than the basics, they need to cover the topic related to the latest development in the market.

Table 4.7: Cybersecurity Practices, course development in lecture-and-lab design

Table 4.8: Industry seminar on FinTech

	Theme: FinTech Remark: Non-credit bearing	
1	Opening	• Teacher PLT-F was responsible to deliver the opening speech.
2	Global perspective	• The 1st speaker is an executive representative from a global bank, introducing FinTech from the global perspective, in breadth and depth.
3	The impact of new technologies on financial sector and its regulatory requirements	• The 2nd speaker, possessing author experience in technical whitepaper, discusses the relation between FinTech and the local government authority for regulation. As he is knowledgeable in new technology development, his role can share the different angles on how the latest technological development can affect the financial industry.
4	Current IT practices	• The 3rd speaker, the current IT practitioner possessing the experience as application developer, he can conduct the sharing related to the mobile banking anytime and anywhere.
5	Q&A session	• Teacher F was leading the Q&A session.

Table 4.8: Industry seminar on FinTech

Table 4.9: Practical Lab Design, teachers PLT-A, PLT-B and PLT-C

	Teacher B	Teacher A	Teacher C
Course nature:	Computer Engineering	IT application system development	Cybersecurity
Inside-the-lab setting	Computer network with IT equipment setup like computers, routers, monitors	Computer lab	Computer lab
Learning objectives:	- Understand the technical knowledge in textbooks - Reinforce what are taught and learnt in classes	- Learn the current IT tools, the current programming languages - Learn the current IT practices - To demonstrate their understanding	- Training-oriented - Understand the needs of IT jobs - Able to perform those job tasks, if previously practised in the lab exercises, in the future
Learning mode:	- Practical - Hands-on	- Practical - Hands-on	- Practical - Hands-on - Do the practices through guided assignments
What do the students do?	- Connect the nodes between routers - See how the information get transmitted from and to the machines electronically - Through the monitor display to see what the different packets are back and forth to make it happen	- System design - Coding	- Different types of server setup - Virtual machines setup - Equipment configurations - Installation of software - Hacking practice - how to fix the problem in the hacked machine - firewall setup - activate the detection mechanism
What are the teachers prepared for the lab sessions?	- Prepare the lab exercises based on the technical knowledge from the textbook - Scenarios setting with the industry's mess situations and complexities extracted out	- Realistic data sets, not toy problem - Industry scenarios like aviation systems, railway systems	- Develop a set of lab exercises in the form of tasks and steps for practices - Scenarios are derived from the case study written by teacher C - Background of case study is based on

			the project cases done for the industry
Does it relate to the industry?	"The lab is the ideal live which is closer to the industry, but it is not the same."	"Follow the technology development very closely" and teach the "up-to-date" skills and knowledge.	The lab assignments are "very close to the industry" as it is "very similar to what we do in the job".
Is it the same as the industry?	"There is a gap between the lab and what is going on in the industry."	Very close to the latest technology and the data sets are "real" data.	What are performed in the customer site are "the same kinds of steps" as those practising in the labs.

Table 4.9: Practical Lab Design, teachers PLT-A, PLT-B and PLT-C

Table 4.10: Examples of students' feedbacks on Course Workload and Assessment

- Project management and its related technical knowledge: These were related to the knowledge areas and the process in project management methodology, such as how to prepare the project management plan, project planning, budgeting, project charter; and the technical skills include work breakdown structure, net present value calculation and the use of Microsoft Project management tool.
- Technical skills: Examples were coding, data management, system analysis, Excel, Java, SPSS, Gantt chart, information Management, mobile application, python project and SEO and web analytics.
- Business knowledge: Examples were real business case analysis, business project management, digital marketing, e-business, performing different risk scenarios and risk management.

Table 4.11(a): Examples of students' feedbacks on Practice-led teaching

- Understanding the IT Industry: They expected the teachers to be "more familiar with the real IT industries" and possess the "updated knowledge and understanding of market requirements". They hope the teachers can help them to "better understand the real cases in IT industry", "know the latest trend in the industry", have "clear picture on the industry and how they work", and understand "IT fields with more real-life examples".
- Real-life experience sharing: They hoped the teachers can "compare differences between mock project management and real-life project management", share "more real-life experiences" or "actual experience" to them, let them "know the practice of the industry", "very useful and important to me if they can share their real-life experience from working in any related industries".
- Career support: They expected the teachers who are "willing to give suggestions and guidance" to them. The teachers can share with them "more about on how to apply the skills on career", "high degree for career reference", and "highly useful because [*the teacher's name is made anonymous*] she shared some of her experiences in work field to make it easier for students to understand the abstract concepts".
- Academic support: They also mentioned the teachers can "provide the big picture and more understanding on the theory", "use related knowledge to answer my questions", "can answer IT specified questions", able to provide "more practical examples", "some concrete examples", "very useful as it can help me to apply the theory into real world".

Table 4.11(b): Examples of students' feedbacks on teaching support

- (1) To encourage them to ask questions in classes: "asking question for ensuring our understanding of the course", "ask if we have any questions".
- (2) To proactively make responses to student enquiries: "actively answer our concern"; "willing to answer my questions"; "we can ask questions and they'll try to explain the answers; if we do not understand, they'll try to explain them in another way"; and "quick respond to my emails".
- (3) To provide detailed explanation: "gave detailed explanation and examples"; and "use examples to illustrate the theory".
- (4) To provide direct support in student learning: "try to explain the code one by one"; "they help us to fix the app building"; and "assist [to] demonstrate how to use the program".
- (5) To arrange individual consultation: there were 4 students specifically mentioned it.
- (6) Feedbacks on submitted assignment: "they marked clearly on our group's internal report and answered our questions patiently".
- (7) Advice on group projects: "discuss with us on which part of our project should be improved"; "find focus for doing group project"; and "I raised some questions about the project, and the tutor tried to elaborate the real environment and clarify their job roles [in the project case] to me".
- (8) Guest lecture: "invite guests who are currently working on IT fields and conduct a lecture to us".

Table 4.12: Examples of students' feedbacks on how the course is valuable to their future job

Future careers (39%):

The relationship between the course and their future job

- "This course is valuable to me when I aim to work in the related field in the future. I can talk about what I have gained in this course."
- "The course focus is exactly the same as the job I am anticipating after graduation."
- "This course is really practical and very similar to what I actually did in an IT company (which I have worked for an internship)."

Benefits for job interview and the future job

- "Learn the skills of using those software and programming language. I can apply the knowledge in my future interview and job."
- "Learning the basic knowledge in this industry and support my future career (e.g. knowledge for interview)"

Career choice

- "The knowledge I gained from this course will be useful if I want to become a project manager or any other related positions."
- "To pursue my career as a business analyst."
- "After having a basic knowledge on project management, I think I can work on this field and become a professional on IT or IS project management."
- "To understand that whether I am suitable to the related career field."
- "It helps broaden the choice of future career, as I can apply for risk management related job duties."
- "I can learn different concept and knowledge in this course which is helpful to my future career."
- "It may change my career path."
- "Valuable for future career"
- "Useful in long term"

IT industry

- "Explore the industry."
- "Understand the potential market of IT industry."
- "I would like to engage in IT industry."
- "I learnt different IT skills that I can choose to work in an IT industry, rather than general business industry."

Project management knowledge and skills (28%):

The list includes how to develop a new business project, the framework, the process and the procedure of project management, learn the entire process of planning, implementing and evaluating an IT project, how to prepare project budgeting and assigning tasks to members, how to handle a project from the start till the closing part, project skills like balancing the time, cost and scope, evaluate the risk I encounter in the future

Practical knowledge and skills (26%):

For examples: business applications, risk management, increasing the knowledge area in both technical and theoretical, SEO, updated technical skills like big data tools, giving some direction for self-learning, “Concepts to be actualised”.

Mindset (7%):

Two of the students just wrote down “very useful” while one student said, “the course can help me not to afraid [of] when I have IT project in the future”.

Table 4.13(a): Examples of practice-led teachers’ teaching tactics to assess the students’ first level of understanding

Teaching tactic one: Seeking for elaboration or explanation

- *“What’s the biggest problem of using cloud based DDOS protection?”*
- *“How many data samples needed to bias a machine learning model?”*
- *“You mentioned that there are some potential attacks on e-wallet, which include reverse engineering. Is there any case you observed or read about the reverse engineering?”*
- *“In your demo, I can see that you have changed something to show the CSRF attack. Can you explain a little bit more what have been modified in order to protect from the CSRF attack?”*
- *“If those are packages offered from [the software], can we customise it by changing some of the items for us to do the testing? Or is it possible for us to modify some of the items for us to do testing? Or we need to do all during the testing?”*

Teaching tactic two: Asking for doing comparison

- *“What is the difference between mobile wallet and [bank] account?”*
- *“What is the difference between SDN and NFV?”*
- *“Yours is supervised learning model or federated learning. How about for unsupervised, the other method of discrete clustering?”*

Table 4.13(b): Examples of practice-led teachers' teaching tactics to assess the students' deeper understanding

- *"How do they coordinate? Is there any spectrum guideline?"*
- *"What is the pre-requisite in order to install it (sandbox) to use?"*
- *"What components, items that need to be installed?"*
- *"I wish to know a bit more about how to perform the pass checkbox capture with"*
- *"The famous example you mentioned is volumetric attack. How effective is the Cloudflare in defending the application layer, the DDOS attack?"*
- *"One of the future directions is to use the hardware wallet, instead of the software wallet apps. Do you think it's feasible to secure the e-wallet more?"*
- *"I mean, by considering application-level attack, is it effective to use cloud-based filtering?"*
- *"What is the feasibility of stoler on IIS and Tomcat perspective? Performing stoler attack on IIS and Tomcat, is it effective or not so effective?"*

Table 4.13(c): Examples of practice-led teachers' questioning techniques using simple question-setting and scenario-setting

Simple question setting:

- *"You list out a number of vulnerabilities related to SDN. How do you solve those vulnerabilities?"*
- *"You mention, poisoning type of attack during the testing phase. What's the detection and mitigation strategy for that?"*
- *"Are there any vulnerabilities in affecting the blockchain implementation?"*
- *"You have mentioned quite a lot, the cons about Solaris. Have you thought any way to improve it?"*

Scenario-type question setting:

- *"You mention, the benefit of smart contract is that nobody can change the figures in the block. If I really find that some of the blocks are incorrect, what will happen?"*
- *"How about the system-level vulnerabilities, like buffer overflow?"*

Table 4.14(a): Examples on project time management

Example 1:

Student: "..... we will create the manual and then submit to AWS available for download."

Teacher: "So, what's the date?"

Student: "Feb 21"

Teacher: "When will the app be available? That is a very important date for customers to download the app." and "How long?"

Student: "5 months"

Teacher: "Elaborate more"

Example 2:

Teacher: "Only items, no dates, when are you going to complete?"

Student: "..... "we have activities and sub-activities" "we only select 5 key activities to present"

Teacher: "When will be the project closing date?"

Student: (Observer: can't hear it clearly)

Teacher: "When will be the completion date of the app development?"

Student: (Observer: no response)

Teacher: "Even for the collection of user requirements, once completed, it is also a very important date."

Example 3:

Teacher: "Why to spend 6 months?"

Student: "I need to spend time to talk to the users and also to add a new opening method in the system."

Teacher: "Can I ask you to shorten it to 5 months?"

Student: "Yes, I can start the coding earlier!"

Teacher: "Will it affect the quality?"

Student: "Should not be." (Another student jumped in: "We are XXX bank!")

Teacher: "If then, why you spend 6 months!"

Table 4.14(b): Examples on project quality management

Example on security versus reliability:

Teacher: "Back to the slide - "Things we will monitor", the bullet point of Reliability, can you elaborate?"

Student: "To protect the account information....."

Teacher: "That is security!"

Student: "Yes"

Teacher: Then, it is security, not reliability. So, it is how you can do the monitoring in quality control."

Example on reliability versus app bugs:

Teacher: "What is the difference between reliability and the number of bugs?"

Student: "The number of bugs will affect the mobile app."

Teacher: "The bugs are expected."

Student: "When we make some queries, it is not function[ing]."

Teacher: "If the function is not working, it's not a function."

Example on problem versus risk:

Teacher: "Under the Risk Register, ... why to stop the website to do the updating. Customers need to do shopping online..... the website cannot be stopped."

Student: "We will do it at midnight, ...different periods will offer different discount, ...as the coupon discount needs to do updates.....this is the problem."

Teacher: "This is a problem. Should not be treated as risk."

Example on change control:

Teacher: project delay due to changing requirements, use crashing and the other method in the project. "Why we need to entertain those changes from customer?"

Student: If the customer asks for changes, "we will explain to the customer the changes, is it necessary?"

Teacher: "We can't unconditionally allow the customer to make changes."

Table 4.14(c): Examples on project scope management

Example 1:

Teacher: "You mentioned about to blast out email to customers, is it within your project scope?"

Student: "We want to do it near the end of the App development process to see whether the customer likes it."

Teacher: "Our job is to develop the app, not to promote the app."

Example 2:

Teacher: "You mentioned about the availability at 99.9%. Availability should be handled in the system maintenance phase. Suppose we will pass the project to the client to do the maintenance. Why we need to do this part?"

Student: "We just want to show it to the client that our system can achieve it."

Teacher: "It's okay. But it is not part of our job."

Table 4.14(d): Examples on project cost management

Teacher: "The project cost is \$180K. How do you make sure the budget not to be exceeded?"

Student: "The cost budget is based on labour cost, which is based on the days of labour. We have reserved 10% as the contingency budget."

Teacher: "If then, there is delay in project?"

Student: "We use SPI. If people do it longer time, PM will keep track the days and to handle."

Table 4.15: The dialogue between the course director and the industry speaker

Course Director: "You started to tell us about yourself – started from tech but in doing selling job, ... and then to become a General Manager; which is very different from us. How do you view the jobs like systems developer, business analysis?"

Speaker: "Good question! Sales and marketing are customer-facing.... In my current company, we have....., 60+ staff are customer-facing including technical, ... We don't have pure admin staff nowadays."

Course Director: "So, tech people need to have people skills!"

Speaker: "It depends on the type of project. Tech people needs to come out to talk about the tech solution for me because they need to build the creditability while I can't do it. So, I also need to upgrade myself..... I regularly spend 4-5 hours to keep up my technical knowledge to the latest technology."