ACQUIRING 21ST CENTURY SKILLS THROUGH PROJECT BASED LEARNING: EXPLORING SCIENCE STUDENTS' PERCEPTIONS OF THEIR EXPERIENCES AT TWO MALAYSIAN PUBLIC UNIVERSITIES

BY

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ABSTRACT

The researcher has explored the impact of project-based learning (PjBL) on the acquisition of 21st century skills by the science students of two selected Malaysian higher educational institutions. The researcher has investigated the types of skills students have acquired during the project implementation, and endeavored to understands what aspects of PjBL have impacted the acquisition of skills and the challenges for acquiring 21st century skills. To conduct the research the researcher has obtained qualitative case study methods. In total eight in-depth semi-structured interviews had been conducted from purposefully selected participants from two purposefully selected public universities of Malaysia. The research also analyzed one combined video that consists of presentation videos prepared by eight different groups participated in the project. Next, the interviewing segment is central to generating data to be used for in-depth analyses of the PjBL process. Lastly, the results from interview and video data analysis had been used to identify challenges faced by students during the skill-acquisition process. The result indicates that students have partially succeeded in acquiring a subset of overall skills in the array of 21st century skills. All the skill acquisition poses challenges associated with them. Students lack creativity skills and unfavorable pedagogical environment is one of the reasons responsible for their lack of creativity. Students believe that dependency on traditional assessment system hampers their skill acquisition specially creativity skill. Moreover, according to students' perspective, the more autonomy they receive in choosing the project topic gets them more opportunity to be creative. Surprisingly, the students did not prefer total autonomy in their project work. In their perspective, time to time increased monitoring from the teacher would increase their skill acquisition in general. The students were given non-complex, simple problem which hampered their opportunity to exercise problem solving and critical thinking skills. Because of lack of appropriate diverse environment, students' social and cross-cultural skill acquisition was impacted. It is hoped that a better understanding of the determinants of these challenges will lead to formulating solutions to the hindrances in PjBL practice in Malaysia. This research has implication for the policy makers and educational practitioners alike. Policy makers will be able to improve policy principles based on the findings of the research. By exploring the experiences of the students, the researchers will understand the skill acquisition process better which consequently will help future researchers to develop more rigorous and comprehensive assessment model.

خلاصة البحث

تناولت الباحثة بالدراسة مدى تأثير أسلوب التعلم القائم على المشروعات، على اكتساب طلاب مؤسسات التعليم العالي الماليزية مهارات القرن الحادي والعشرين. وفي سبيل استكشاف ذلك التأثير، قامت الباحثة بالتحقيق في كيفية تأثير تنفيذ عملية التعلم القائمة على المشروعات، على اكتساب الطلاب للمهارات، وسعت كذلك إلى استقصاء جوانب التعلم القائم على المشروعات، التي أثرت على عملية اكتسابهم للمهارات، كما تطرقت إلى التحديات التي تواجه عملية اكتساب مهارات القرن الحادي والعشرين. وبتحليل الباحثة للدراسات السابقة، وجدت أن ثمة نقصًا في وجود أدلة قوية على تأثير عملية التعلم القائم على المشروعات، في عملية اكتساب مهارات القرن الحادي والعشرين، طبقًا للأدبيات الحالية (كوندلف 2017، وتشنغ ولام وتشان 2008، وهرناند راموس ودي لاباز 2009، وكالدي وفليباتو وغوفارس 2011، وميودوزر وبتزر 2007). وتظل عملية اكتساب تلك المهارات بمثابة ظاهرة غير مكتشفة بعد، في هيكل الدراسات الحالية، حيث يركز معظم الباحثين، من خلال توظيف وسائل بحث كمية، يركزون على الحصول على حقائق أقرب إلى التنميق عن عملية اكتساب تلك المهارات. وبناءً على ذلك، لا تزال التفسيرات الرصينة للعملية الأساسية غير مفهومة. نتيجة لهذا، يبرز العديد من النتائج المتناقضة فيما يتعلق بعملية اكتساب المهارات في عملية التعلم القائمة على المشروعات، مما أدى إلى نشوء نوع من الارتباك وسوء الفهم بين كل من التربويين والطلاب والمسؤولين. ونظرًا للأسباب المذكورة أعلاه، أخذت الباحثة على عاتقها مهمة الاستعلام عن تلك الأجزاء التي لم تقم الأدبيات الحالية باكتشافها. وجدير بالذكر هنا، أن معظم الدراسات الحالية قد استقت بياناتها من كل من التقارير الشخصية للطلاب، وكتيبات الانعكاس، دون استخدام أدوات قياس موضوعية لعملية التعلم (فوغلر وآخرون 2018). يعد هذا البحث بمثابة لبنة في بناء الأدبيات الحالية ذات الصلة، حيث تحاول الباحثة من خلاله الانخراط في تحليل موضوعي لعملية اكتساب المهارات تلك، وذلك من خلال تبني أحد فروع مناهج البحث النوعي، وهو دراسة الحالة، باستخدام نموذج تقييم قائم على إطار تعلم القرن الحادي

والعشرين.وإجمالًا، تم إجراء ثماني مقابلات متعمقة شبه منظمة، مع عينة قصدية من المشاركين الذين ينتمون إلى جامعتين عامتين ماليزيتين تم اختيارهما قصديًّا كذلك. قامت الباحثة أولًا بتحليل مقطع فيديو واحد مدمج، يحتوي على ثماني مقاطع فيديو معدة من قِبل ثماني مجموعات مختلفة. تلاه مرحلة المقابلات التي شكلت أداة أساسية للحصول على البيانات التي تم استخدامها في عملية تحليل متعمقة لعملية التعلم القائم على المشروعات. وأخيرًا، تم استخدام نتائج هاتين العمليتين من أجل الوقوف على التحديات التي يواجهها الطلاب أثناء عملية اكتساب المهارات. ومن المرجو أن يؤدي الفهم الأفضل لمحددات تلك التحديات، إلى صياغة حلول لمعوقات ممارسة عملية التعلم القائم على المشاريع، في ماليزيا، والتي بدورها ستؤدي إلى بناء مجتمع طلابي يتمتع بمهارات عالية. وتأمل الباحثة أن يكون لهذه الدراسة آثار على صانعي السياسات والتربويين على حد سواء. حيث سيتمكن صانعو السياسات من تحسين مبادئ السياسة بناءً على نتائج هذه الدراسة. ومن خلال استكشاف تجارب الطلاب، سيستوعب الباحثون عملية اكتساب المهارات بشكل أفضل، مما سيساعدهم في المستقبل على تطوير نموذج تقييم أكثر دقة وشمولية. وهناك اعتقاد شائع بأنه ما لم يتم اعتماد ذلك من خلال سياسات تقييم صارمة، فإن تعليم هذه المهارات قد لا يتم التعامل معه كأولوية من قِبل المعلمين والطلاب على حد سواء (أنانيادو وكلارو 2009، وكوندلف 2017).

APPROVAL PAGE

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DECLARATION

I hereby declare that this thesis is the result of my own investigations, except where otherwise stated. I also declare that it has not been previously or concurrently submitted as a whole for any other degrees at IIUM or other institutions.

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CHAPTER ONE

INTRODUCTION

1.1 INTRODUCTION

Human society is ever progressing. Education, an integral pillar of this progress, too has been evolving. Traditionally, the education system functioned as the primary agent of this change. At other times, education itself is forced to change according to nascent landscapes. The changes that have occurred in the past two decades have surpassed the flow of change of any other times since the emergence of human civilization. Various scholars attribute it to over-arching and radical changes brought forth by the information revolution, the proliferation of technology, and disruptive innovation such as artificial intelligence. Education practices have been explicitly and implicitly implicated by this. Moreover, amid growing challenges, many experts of pedagogy have come to acknowledge that the assumptions upon which existing education infrastructure was built are quickly approaching irrelevance and obsolescence (De-Graaff & Cowdroy, 1997; Fernandes et al., 2012; Medel-Anonuevo, 2001). What's more, the emergence of a new generation of technology-savvy learners—often called the Digital Native or New Millennium Learners—demands a recalibration of the legacy approach in education to equip present-day learners with skills and abilities relevant to the pursuit of knowledge and employability in the backdrop of current realities and challenges (Binkley, 2012; Dede, 2011; Voogt & Roblin, 2012). Furthermore, at a broader scale, the needs of individuals and society have changed in response to dynamics of environment (Voogt & Roblin, 2012; Ananiadou & Claro, 2009; Sahin, 2009; Benade, 2017; Dede, 2011). A burning example of this is the wave of change observable in the job market, which was predicted long back by Castagna and Reich, (1992). While Reich's worries were more generalized, Rifkin (1995) was more specific in predicting the threat of machines replacing jobs that require recursive activities. To tackle this, Rifkin prescribed producing "mind workers" and "service workers" instead. Realizing the gravity of the problem, Rifkin's consternation was echoed later by pedagogic experts from different sub-disciplines (Voogt & Roblin 2012; Voogt, Erstad, Dede, & Mishra, 2013).

The discipline of education has, throughout history, adapted several times to cater to new demands of knowledge and society (Trilling & Fadel, 2009). For example, with the appearance of constructivist philosophy, lecture and textbook-based teaching methods have been transformed into alternative pedagogical methods such as project-based learning (PjBL), problem-based learning (PBL), and inquiry-based learning (IBL/EBL). Project-based pedagogical methods are different from its cousins mainly because of two features- firstly, the whole method continues based on one driving question, and secondly, it requires the students to produce a tangible outcome (Chu, Reynolds, Tavares, Notari, & Lee, 2017). In this approach students are seated at the core of the pedagogical system to ensure student participation in the planning, designing and implementation phase of the projects as a means to motivate and engage students further (Harmer & Stokes, 2016, Harmer & Stokes, 2014; English & Kitsantas, 2013, Bell, 2010; Lam, Cheng, & Ma, 2009; Grant 2011). At the same time, it allows students to learn by doing and experimenting (Krajcik & Blumenfeld, 2006; Thomas 2000; Blumenfeld, Soloway, Marx, Krajcik, Guzdial, and Palincsar, 1991). Though students play a large role in the planning and implementation of PjBL, research on the experience of the students is scant (Grant 2011; Beckett & Hager, 2005; Beckett 2002). Many developed nations in the world have been experimenting with PjBL for a while with varying degrees of success. Among them, reports from the US, UK, Australia, Hong Kong, China, Singapore, Spain, Israel, Taiwan, and Switzerland are noteworthy (Chu et al., 2017a; Chu et. al., 2017b).

Meanwhile, in Malaysia, even though a few selected institutions have been implementing PjBL, the experience of students involved in PjBL remains largely unexplored (Aiedah & Lee, 2012). Considering the potency and promise of this method of teaching in inculcating competencies required for the 21st century, a lack of academic attention to this field is puzzling. Moreover, given the encouraging findings of existing research elsewhere regarding students' ability to take ownership of their studies, enhanced collaborative efforts, problem-solving, establishing a connection and presentation of their learning as a product, an in-depth examination of various facets of students' experience in PjBL is both theoretically and practically merited (Bell,2010; Ravitz, Hixson, English, & Mergendoller, 2012; Musa, Mufti, Latiff, & Amin, 2011a; Musa, Mufti, Latiff,& Amin, 2012b). Additionally, from the acquisition of 21st century

skills standpoint, the issue of challenges encountered from the students' angle remains undocumented. This matter is especially pertinent for Malaysia, given its national priority of achieving a high-income status soon. This study proposes an exploration of students' experience while participating in Project-based learning, to understand and unravel the transversal and multidimensional 21st century skillset students acquire during their education journey. This study is adapting the explanatory case study method to explain the experiences of the students by extrapolating different possible angles concerning the acquisition of 21st century skill from the experience of the students.

There are three major motivations behind this study. First, from a theoretical (academic) standpoint, this study should contribute to the existing corpus of PjBL and 21st century studies by inductively adding information regarding (i) students perspective of acquisition of 21st Century Skills using PjBL, (ii) the process of skill acquisition while participating in PjBL and (iii) the challenges students face while acquiring these skills through PjBL (Benade, 2017; Gómez-Pablos, Pozo, & Muñoz-Repiso, 2017; Lee, Kim, & Byun, 2017; Musa, Mufti, Latiff, & Amin, 2011a; Musa, Mufti, Latiff, & Amin, 2012b). The insights gained promise to help resolve several conflicts in existing scholarship stemming from contradictory, ambiguous, and unclear findings. The next motivation which led the researcher to this study is the void in the literature related to students' experience and students' voice concerning the series of events they had to go through while participating in PjBL and how it affected their development of 21st century skills (Bell, 2010; Hung, Hwang, & Huang, 2012; Koh, Herring, & Hew, 2010; Lee & Lim, 2012; Musa et al., 2012b; Panasan & Nuangchalerm, 2010). Students are at the centre of both the PjBL method and 21st century learning. 21st century skillset was also developed for the students so that their employability and their chance of surviving in a fast-evolving world are higher. Since PjBL is a student-centred pedagogical method, exploring the experience of the students is a logical way of getting insights into their experience during a PjBL implementation and thus help to address the issues and challenges they face while experiencing project-based learning. This study helps gain insights into how PjBL helps promote the acquisition of 21st century skills. The findings from this study would help practitioners make informed decisions while adopting the PjBL method in teaching as well as modify

their teaching strategy where needed (Benade, 2017). The findings (either PjBL promotes 21st century skillset or not) illustrates the effect of PjBL on the inculcation process of 21st century skills and which helps to point out the areas of weakness and strength, and thus would guide policymakers and implementers to change and modify the pedagogical design following the findings. The final motivation of this study comes from the scarcity of studies on the underlying reasons of the multifaceted challenges students face while experiencing PjBL—a problem that cannot be left unattended, for if we do, the improvement trend of students' experience graph would only remain at its place or decline (Gómez-Pablos, Pozo, et al., 2017; Grant, 2011; Lee et al., 2017).

The niche of this study is to capture the educational journey of the students starting from their educational experience with the PjBL methodology, towards the end when the students present their learning product. This study aspires to focus exclusively on the investigation of students' experience of the Malaysian Higher Educational Institutions (HEI), to unravel the process of 21st century skill formation, acquisition, and challenges that the students encounter while participating in PjBL while maintaining a balance of their content knowledge.

1.2 BACKGROUND OF STUDY

1.2.1 The History of Project-Based Learning

John Dewey and William H. Kilpatrick are considered as the harbingers of PjBL in America around 1897, which was claimed to be a product of the American progressive education movement. Earlier, John Dewey first introduced inquiry-based learning in a school that he owned, the Laboratory School of Chicago, in 1896 (Knoll, 2015). He believed in the philosophy of constructivism which means individuals form their knowledge by doing or experience. Dewey believed that children come to school to perform new activities under the guidance of a teacher, and thus they acquire qualities and skills essential for social and personal life (Thompson, 2011). He believed that the purpose of education is to improve our life in general. William H. Kilpatrick, a student, colleague, and believer in John Dewey's philosophy, believed that "learning is a wholehearted doing." With this belief in his heart, he played a significant role in the

progressive movement of education, where he established the project method for early childhood education. Kilpatrick's socio-cognitive theory of "selfhood" upheld the development of self in the social context, where every child develops their comprehension related to their play and activity in different circumstances with the help of community members (Meyer, 2015). In England, Frobel (1782-1852) and Montessori (1870-1952) introduced activity-oriented learning in early childhood education and kindergarten. The underlying philosophy in establishing this school was "my playing is my learning", where students learn essential material by playing and interacting with their peers (Yelland, 1999). The basis of their argument was that when students play and engage in self-directed activities, they learn the best as they gain ownership and become empowered, with the help of the increasingly high level of motivation (Yelland, 1999). Later, project-based learning started to flourish in parallel with problem-based learning in engineering education in Denmark. During the 1960s, strong students revolt triggered the emergence of project-based learning in social science and other disciplines of knowledge (Graaff & Kolmos, 2007). During the 1970s to the 1980s, more institutions started to implement PjBL in the classroom environment and since the 1990s, the literature on PjBL flourished.

1.2.2 The Context of Malaysia

The discourse on acquiring 21st century skills often brings about the discussion on the relationship between these skills and graduate employability (Collet, Hine, & du Plessis, 2015; Pellegrino & Hilton, 2012; Tahir et al., 2018). Research related to 21st century skill development has shown that lack of skill has been pandemic among the fresh graduates around the world, which affects graduate employability. Malaysia is no different. To understand this issue in the context of Malaysia, we will look at the current condition of employability in the discussion on the graduates in Malaysia and the reasons for their unemployment in the following section.

1.2.2.1 Skill Deficiency and the Issue of Unemployment

Today's society can be called knowledge society, one which implies that ideas, information and knowledge function as commodities. A knowledge society requires a particular understanding of information instead of knowing some information (Voogt, & Roblin, 2012). Globalization, the rapid development of science and technology, and the ever-changing nature of present society have made it necessary that education should not only teach the students content knowledge but also equip them with the skills necessary for the ever-changing global society (Collet et al., 2015; Dede, 2011; Voogt & Roblin, 2012). Moreover, because of the proliferation of data and the rapid development of ICT, the nature of jobs is changing every day. As an effect of automation, repetitive labour-intensive jobs are disappearing. The changing nature of job nature has risen the concern of the people involved in the education process. Jackson and Tomlinson (2020) mentioned that students must be flexible, adaptable, and acquire transferable skills mainly because of the following trends. Firstly, there is a rapid upsurge in non-conventional work and more workers are entering casual, freelancing, and fixed-term employment. Secondly, because of the advent of technology such as robotics, automation, artificial intelligence, cloud storage, and shared economy has engendered intense international competition, data safety concern, and changed the nature of skills and profession. And thirdly, fiscal fragility which can be defined as an economic climate in which the economy is characterized as vulnerable to any economic crisis, stagnant economic growth, joblessness, and productivity challenge. These trends, along with the availability of non-linear and non-hierarchical professions, have made it imperative for graduates to become flexible and equipped with transferable skills (Jackson & Tomlinson, 2020; Vaquero & Cebrian, 2013). Generally in many parts of the world, while the graduate recruiting rate has surged, their work readiness remains a concern (Jackson & Tomlinson, 2020). The discourse on work readiness invokes the discussion on the gap between the employer's expectation and graduate skills. Employability skill gap has become widespread that it continues to be debated in the field of education, and higher educational institutions have a role to play in this context (Collet et al., 2015; Tahir et al., 2018). Higher Educational Institutions can work towards eliminating the skill deficiency of the graduates by developing, nurturing, and evaluating the nonacademic skills of the graduates, and prepare them for the known and

unknown challenges posed by today's knowledge society and beyond (Collet et al., 2015; Jackson & Tomlinson, 2020). Similar to other parts of the world, graduate employability has become a major issue in Malaysia (Musa, et al., 2012a; Sadrina & Mustapha, 2017; Yoong, Don, & Foroutan, 2017).

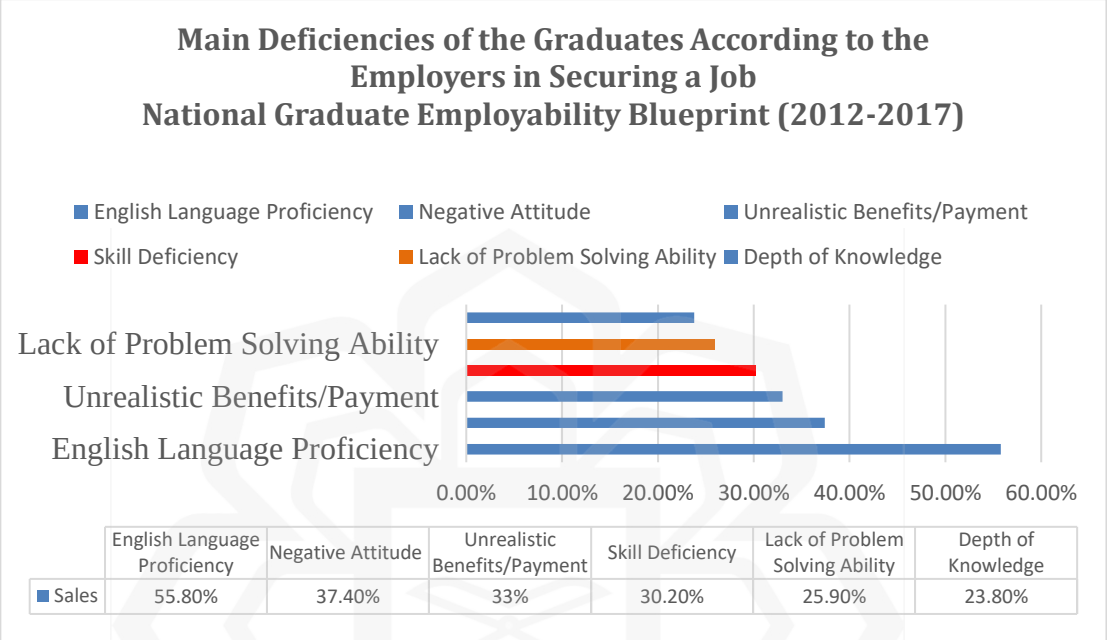

Figure 1.1 Main Deficiencies of the Graduates According to the Employers in Securing a Job National Graduate Employability Blueprint (2012-2017)

As per statistics reported in December 2019, 3.4% of Malaysia's workable population remains unemployed (Statista, 2020). While this figure is for the general population, the figure is far worse for the youth section, which is 11.4% in the year 2019 (Statista, n.d.), a 0.7% raise from Bank Negara's 2016 report which estimated youth unemployment to be at 10.7% (Ibrahim & Mahyuddin, 2017). According to the report provided by the National Graduate Employability Blueprint (2012-2017), an array of problems was identified by employers in hiring the existing products of the educational system, and these problems reflect the reasons behind graduate unemployment (see Figure 1.1).

1.2.2.2 Malaysian Educational Context

Malaysia's commitment to the betterment of educational quality since 1990s is remarkable both on a stand-alone basis as well as when compared with its ASEAN counterparts (Sirat, 2013). For starters, given the diverse and fragmented education system inherited from the tumultuous 1950s, the nation's success in fully integrating a national education system has been praised by academics and neutral observers (Bajunid, 2019). Despite remarkable success in improving access to primary education, ensuring equity, improving gender parity, and achieving the Millennium Development Goals of 2015, various problems continue to persist. Aside from drop-out rate problems, rural-urban division, and concerns over national assessments, the effectiveness and efficiency of Malaysia's educational system have been criticized by several observers (UNESCO, 2013). The issue is now of greater relevance as Vision 2020 becomes obsolete. The country had conceptualized the National Transformation Plan 2050, which will continue Vision 2020 and extend beyond it. Malaysia's long-term educational goals are interwoven with the nation's overarching aspiration of attaining a developed, high-income status, *en route* to establishing a united nation full of psychologically liberated, secure, and educated citizens (Bajunid, 2019; Islam, 2011). This phenomenon is bi-directional in nature. To elaborate, just as ensuring a high quality of education for the citizens yields greater productivity and thereby higher economic output, the pursuit of stimulating fiscal and governance policies demand a higher educated and skilled workforce well-versed in pertinent skills (Fong, et al., 2014; Lee, 1999) This point is iterated in great details by several reports. The World Bank and School of Oriental and African Studies (in an analysis report) pointed towards the standard of education, lack of autonomy, and teacher training and recruitment as its biggest obstacle towards acquiring the high-income status (Sanusi & Ghazali, 2014). Suggestions have been made to improve the quality of the graduates to speed up the process of achieving a high-income country status. Some of the demerits of the endemic approach to education in Malaysia include lack of job readiness, lacklustre proficiency in English, and the dearth of soft skills. Experts suggest that these deficiencies may hold Malaysia back from performing better in the world economy (Sanusi & Ghazali, 2014). As a result, different quarters have voiced concerns regarding the educational approach, with some even calling for a radical shift in the educational infrastructure. Moreover,

from a geopolitical standpoint, Malaysia's strategically important location along the Malacca Straits makes it a hub of globalization. Thus, in this highly competitive globalized and knowledge society, Malaysian students are expected to prepare themselves not just with the skills traditionally thought to be necessary for a successful, career and life, but also with the newly emerged and anticipated future 21st century skills, to enable them to fully contribute to the progression of the society (Islam, 2010).

1.2.2.3 Policy Revision to improve the Eliminate the Required 21st century skill gap

According to The National Graduate Employability Blueprint (NGEB)- 2012-2017, skill deficiency and lack of problem-solving ability are among the major causes of graduate unemployment (Figure 1.1). To solve this problem, NGEB (2012) launched a revised policy. The Ministry of Higher Education published Malaysia Education Blueprint (HE) 2015-2025, which considered the evolving nature of the world, automation, and technological proliferation, and thus proposed actions for transforming the whole education system in a balanced manner, between "moral and ethics" and "knowledge and skills". The blueprint shares the concern of the employers about the lack of employability skills among the graduates. To change the current condition, a major transformation is needed in the schooling system (Malaysia Education Blueprint, HE (2015-2013). In this blueprint, the government has instructed higher learning institutes to prepare the graduates with all the necessary qualities based on the needs of the employers. According to the researchers, although the government has taken several initiatives to improve the skills of the graduates, the attempts have not been entirely successful. Studies show that the issue still prevails. The employers still think that graduates lack important life skills such as decision making, leadership, and critical thinking (Tahir, Samah, Mohammad, Latif, Yusof, Bahru, 2018). Thus, the employability of the graduates continues to be a problem. Studies suggest that the following reasons might be behind the underwhelming result of the attempts in the development of graduates' skills. In NGEB 2012, industries had a lot of power in deciding the direction of Institutions of Higher Learning, while it did not assign any role to institutions and families, making very little reference to the role of government agencies in making the students job ready. Moreover, the blueprint also did not

underscore the role of the graduates themselves (Yoong et al., 2017). The Malaysian Qualification Framework also insisted on the development of personal competence, functional competence, and ethical aptitudes. The skills that have been emphasized in MQF2 are under these abovementioned three competencies are collaborative skills, leadership skills, social responsibility, ICT, technology skills, communication skills and interpersonal skills, mathematical ability, self-direction, moral and societal obligation, and so forth. The MQF2 has emphasized the skills that have many similarities with the P21 framework that this study uses to investigate students (Malaysian Qualifications Framework, 2017).

Table 1.1 Name of Competencies and Focus of Development

Name of Proficiency	**Emphasis**	**Malaysian Qualifications Framework (MQF) Version 2**
Ethical Aptitude	Integrity & Spirituality	Moral and societal obligation, work ethics, practices, professionalism, social responsibilities, individual growth, individual value management, lifelong learning, occupational and educational progress and development
Personal Competence	Leadership, Communication & intellectual skills, social responsibility, ambitious and Resilient, Self-confident	Leadership team skills, autonomy and responsibility
Functional Competence	Language Skill	Exercise, situation, cognition skills, work skills, principal proficiencies
	National Identity	ICT, entrepreneurship, technology skills, communication and interpersonal skills, mathematical ability.
	Disciplinary knowledge and skills, practical knowledge and skills, cultural and civilization knowledge	Knowledge, understanding