A Pilot on BIM Skills of Architecture Graduates from Polytechnic

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ABSTRACT

Graduates' employability has become a significant problem, especially among educational institutions, industry, and even the government. This research aims to assess the work skills acquired by architecture graduates in BIM technical and nontechnical skills as job preparation to work in the construction industry. A survey on 30 architecture graduates conducted an online survey on architecture graduates from Polytechnic Malaysia to gather information. There are two types of skills outlined in the study; technical and nontechnical skills. Data evaluated using SPSS and descriptive statistics and correlations to answer research questions. The results show that most architecture graduates are completed with technical and nontechnical skills and show that skills are positively significant to employability. These results are useful to enhance the ability of architecture graduates from the Malaysian polytechnic to consider job skills that need to be equipped by graduates according to the industry's needs. Finally, studies show that industries and institutions should work together to develop career skills needed by new graduates.

Keywords: Employability skills, technical skills, nontechnical skills, architecture graduates, graduate's employability.

INTRODUCTION

Building Information Modeling (BIM) was first introduced in Malaysia in 2009 by the Director of Public Works Department (PWD) in 2007. Since 2009, most BIM implementation was mainly driven by the private sector. The first government project in BIM was announced in 2010. However, the implementation of BIM requires a reliable of tools, skills, expertise, knowledge, and high cost in enabling an efficient of mentoring and coordinating the project progress among players in the construction [1]. Construction Industry Development Board (CIDB) currently comes out with the Construction Information Transformation Plan 2016-2020 (CITP) to ensure the growth of the construction industry in Malaysia. According to technology development in the digital construction industry, the program highlights implementing a particular set of projects to use BIM level 2 by Q4 of 2020 [2]. This program has led to an increase in the demanded professional expertise in BIM knowledge and skills.

In the construction industry, human capital played an important role in ensuring the sustainability and growth of the country. The industry needs a skilled workforce to meet the demand of industry to support the country's development. However, [3] found out that the BIM construction industry lacks BIM skills and experienced workers. The crucial of BIM implementation are the high cost of the technology and the high demand for a skilled workforce [4]. According to [5], to ensure the drive of BIM implementation in the construction industry, providing education and training at the tertiary level helps graduates enter the industry with reliable skills knowledge in BIM. Providing early education and training to students in preparation for future demands can help implement BIM in the Malaysian construction industry.

Polytechnic graduates are graduates who are known as semi-skilled workers after graduating from polytechnics. Therefore, the excellence of graduates in academics, knowledge, and skills is the main agenda prioritized by an institution. To ensure the excellence of graduates requires cooperation from various parties, including students, lecturers, industry, and institutions. There is a global competition among fresh graduates to get jobs, and graduates need to equip themselves with various skills needed by the industry. Generally, academic achievement influences graduates to work. However, additional skills are also something that graduates need to focus on to ensure different from others [6]. Most employers emphasize selecting employees who already have the necessary skills without training and mentoring by supervisors and colleagues. Therefore, architecture requires employees to have specific skills to work; this study was conducted to identify the extent to which the skills acquired by graduates have a relationship in influencing the employability of graduates upon graduation.

Objectives

Overall, this study aims to identify the BIM technical and nontechnical skills acquired among architecture graduates for employability in the construction industry involving BIM. Specifically, this study aims to:

I. To identify the level of skills among architecture graduates from polytechnic
II. To study the relationship between skills (technical skills and nontechnical skills) and employability of architecture graduates from polytechnic
III. To determine the difference between employability among architecture graduates according to gender

Research Scope

This study only focuses on graduates' perceptions of the importance of the skills needed to get a job in the construction industry after graduation from the perspective of:

I. Politeknik Sultan Abdul Halim Mu'adzam Shah Diploma in Architecture graduates
II. Knowledge and skills graduates
III. Employability in the construction industry

Research Limitation

This study is a pilot study focusing on graduates from one polytechnic of only 30 respondents. These graduates are selected because they have worked after graduation. This study was implemented to meet the study's objectives to determine the graduates' skills in ensuring employment upon graduation.

LITERATURE REVIEW

Most architecture graduates from polytechnic are equipped with the appropriate technical and nontechnical and well-known semi-skilled workers. Both of the skills are important to ensure the employability of fresh graduates [7]. Graduates' employability becomes the key issue in higher education to ensure they can get the job and maintain the job upon graduation from TVET higher education. There are various types of research conducted among the researchers to help enhance the employability of graduates. According to [8], this graduate employability program has grown in importance platform to develop quality workers for a productive labour market.

BIM skills, nontechnical skills, and knowledge are essential to ensure individuals use them for smoothness in daily work. Graduates equipped with BIM knowledge might enhance individual

skills and competency when working. Most employers demand employee with BIM knowledge compare employees knows how to use BIM software [9]. The BIM knowledge enables to help an individual to increase their BIM skills. Currently, BIM education has become necessary in higher education. The training and knowledge in the tertiary help ensure students have a deep knowledge and skills to succeed in the BIM construction industry [10]. Early education also increases students' awareness and readiness in BIM for future employment. Hence, graduates must possess the appropriate skills for the job [11,12].

However, according to [13], employees who possess nontechnical skills are more likely to be successful and appreciate their jobs than those that only develop technical skills. Employers also define technical skills development; however, nontechnical skills are difficult to build quickly. Nontechnical skills are necessary for developing good technical skills. The study supported by an empirical finding from [14] has found out that most employers in the construction industry demand employees with excellent nontechnical skills. Nontechnical skills were the highest-ranked demands in the BIM construction industry [15]. Apart from technical skills, graduates must be excellent in nontechnical skills for employment. Graduates must have technical and employability skills to increase the chances of getting a job in the construction industry [16–18].

METHODOLOGY

This study applied a quantitative approach method. The research aims to identify the relationship between BIM skills (technical and nontechnical skills) among architecture graduates from polytechnic. The quantitative data obtained from the questionnaire survey. The data analysis used descriptive statistical analysis to find out the architecture graduate's skills for employment. In addition, t-tests were also used to identify differences in the skills possessed between male and female graduates.

Participant

The study population is Diploma in Architecture graduates from Politeknik Sultan Abdul Halim Mu'adzam Shah. For this pilot study, 30 respondents were selected used the purposive sampling method as the study sample to represent other graduates. Ten (10) to thirty (30) participants is enough for a pilot study [19], [20]. A small group was selected as a research pilot study to ensure the reliability of the questionnaire items.

Instrument of Study

The research instrument used in the study is a questionnaire survey. The questionnaires were generated electronically using *Google Form* and e-mail to the graduates. The questionnaire used is divided into two sections: Section A and Section B. Section A consists of the respondent's demographic profiles. At the same time, Section B consists of items related to BIM skills and employability. Part A contains items such as:

I. Gender
II. Race
III. Employment status
IV. CGPA
V. Training

Section B of the questionnaire contained 56 question items on the skills graduates acquired after graduation. The distribution of this questionnaire according to the aspects of the study is shown in Table 1.

Table 1 Distribution of Questionnaire Items According to The Study Constructs

No	Construct	Items	Total
1	Technical Skills	Modelling Skills, Virtual Modelling Skills, Design Skills, Construction Drawing Skills, Computer Application Skills	25
2	Nontechnical Skills	Communication Skills, Willing to Learn, Problem-solving Skills, Teamwork Skills, Creative Skills	25
3	Employability	Employability	6

The data obtained from the questionnaire were analyses using IBM SPSS statistic 25.0. The graduate skill level is measured using the mean score interpretation below (Table 2). 5 Likert scales were used to answer the questions (Table 3).

Table 2 Means Score Interpretation

Mean Score Range	Interpretation
1.00 – 2.33	Low
2.34 – 3.66	Medium
3.67 – 5.00	High

Table 3 Likert Scale Table

Interpretation	Scale
Very Disagree	1
Disagree	2
Neutral	3
Agree	4
Very Agree	5

Data Analysis

The study used SPSS (Statistical Packages for Social Science) version 25.0 to analyses the whole data. Table 4 displays the relationship interpretation and coefficient value *(r)* according to the *Rule of Thumbs [*21].

Table 4 *Rule of Thumbs* for Interpreting Correlation Coefficient Value

Correlation Value *(r)*	Interpretation
0.90 - 1.00	Very strong positive (negative) relationship
0.70 – 0.90	Strong positive (negative) relationship
0.50 – 0.70	Moderate positive (negative) relationship
0.30 – 0.50	Weak positive (negative) relationship
0.00 – 0.30	Very weak positive (negative) relationship

Analysis of the data begins with reliability to determine the reliability of the instruments used in the questionnaire. The reliability analysis is the basis to assess the data reliability. Cronbach Alpha was used in the study to determine the average correlation of the items. There are eleven element items in the questionnaire items. Descriptive analysis was used to determine the percentage and frequencies for respondent demographics in Section A of the questionnaire. In

comparison, Section B used descriptive statistics to analyses the mean, standard deviation, and correlation among variables.

Table 5 Reliability Analysis

Constructs	Cronbach Alpha (<0.06)
Technical Skills	
Modelling Skills	0.970
Virtual Modelling Skills	0.883
Design Skills	0.949
Construction Drawing Skills	0.915
Computer Application Skills	0.877
Nontechnical Skills	
Communication Skills	0.963
Willing to Learn	0.971
Problem-solving Skills	0.983
Teamwork Skills	0.994
Creative Skills	0.980
Employability	**0.820**

Table 5 displays the result of reliability analyses. The tables show the Cronbach's Alpha of modelling skills (0.970), virtual modelling skills (0.883), design skills (0.949), construction drawing skills (0.915), computer technical skills (0.877) for the technical skills dimensions. At the same time, the Cronbach's Alpha for the nontechnical skills dimension is communication skills (0.963), willingness to learn (0.971), problem-solving skills (0.983), teamwork skills (0.994), and creative skills (0.980) (Table 2). The study used the Cronbach Alpha value to measure the reliability of the research instrument [22]. The Alpha value is reliable (0.50-0.70) and highly reliable (more than 0.70). The analysis finding demonstrates that the questionnaire set is reliable and relevant to the research study.

RESULTS AND DISCUSSION

Demographic Respondent's Profiles

In this study, a total of thirty (30) respondents had given the response to the questionnaire survey. All the respondent background is graduates from Diploma in Architecture from Polytechnic. The total number and percentage of respondents according to gender, race, CGPA, training, and employment status of graduates from polytechnic display in Table 6.

Table 6 Respondent Demographics Profiles

Measure	Gender	Frequency	Percent (%)
Gender	Male	14	46.7
	Female	16	53.3
Race	Malay	28	93.3
	Indian	2	6.7
Employment Status	Full-time Job	20	66.7

	Contract Worker	10	33.3
CGPA	2.50 – 2.99	16	53.3
	3.00 – 3.49	13	43.3
	3.50 – 4.00	1	3.3
	Total	30	100
Training	Yes	17	56.7
	No	13	43.3

Thirty (30) respondents are architecture graduates involved in the study, with 14 (46.7%) males and 16 (53.3%) females. While most of the respondents are Malay (n=28, 93.3%) and Indian (n=2, 6.7%). A large number of students from the polytechnic is the background of the Malays. In terms of employment status, 20 (66.7%) of the respondents are full-time working, and the other 10 (33.3%) are part-time workers. For the CGPA, only one (n=1, 3.3%) score 3.50-4.00, other 13 (43.3%) score 3.00-3.49 and 16 (53.3%) of them are score 2.50-2.99. 17 (56.7%) of the respondents have been going for the BIM software training, and 13 (43.3%) respondents were never involved in the training.

Level of Architecture Graduates Skills

Table 7 Technical Skills and Nontechnical Skills Interpretation

Items	Means	SD	Interpretation
Technical Skills	3.29	0.64	Medium
Nontechnical Skills	3.72	0.73	High
Employability	3.70	0.62	High

Table 7 provides another descriptive analysis. The finding aligns with the empirical finding from [23] that most of the graduates have a technical problem that does not match or meet the employer's requirement. However, [24] highlights those employers are mostly satisfied with the polytechnic graduates' skills. The results contradict the empirical finding from [7], who found out that nontechnical graduates are moderate. Hence, both technical skills and nontechnical skills necessary for fresh graduates. The finding from [14], [25] highlighted those graduates need to master technical skills and nontechnical skills to enter the workforce.

Relationship between Technical Skills and Employability of Architecture Graduates

Table 8 Pearson Correlation Between Technical Skills and Employability

Items	Technical Skills	Employability
Correlation Coefficient	1.000	0.508**
Sig. (2-tailed)		0.004
N	30	30

***Correlation is significant at the level 0.01 (2-tailed)*

The findings of the correlation analysis in Table 8 indicate that there is a significant relationship between technical skills and employability ($r=0.508$, $p=0.004$; $p<0.05$) according to the *Rule of Thumbs* table. There is a significant moderate positive relationship between the technical skills of graduates and employability. The result of the relationship analysis indicates that the level of technical skills affects graduates' employability but moderately. Graduates must increase their specific technical skills to meet the labour market requirements [26].

Relationship between Nontechnical Skills and Employability of Architecture Graduates

Table 9 Pearson Correlation Between Nontechnical Skills and Employability

Items	Nontechnical Skills	Employability
Correlation Coefficient	1.000	0.594**
Sig. (2-tailed)		0.001
N	30	30

*** Correlation is significant at the level 0.01 (2-tailed)*

Table 9 displays the findings of the correlation analysis between nontechnical skills and employability. The results show there is a significant relationship between nontechnical skills and employability ($r=0.594$, $p=0.001$; $p<0.05$) according to the *Rule of Thumbs* table. There is a significant moderate positive relationship between the nontechnical skills of graduates and employability. The result of the relationship analysis indicates that the level of nontechnical skills also affects graduates' employability but moderately. The results align with [27], highlighting those employees with specific nontechnical skills have a more advantageous position among employers.

Architecture Graduates Employability According to Gender

Table 10 Pearson Correlation Between Nontechnical Skills and Employability

Element	Gender	N	Mean	SD	df	t	Means Differences	Independent T-Test t	
								Significant Value	F
Employability	**Male**	14	3.67	0.46	28	-.273	-0.0625	0.787	3.86
	Female	16	3.73	0.74					

Table 10 displays the result of the independent t-test employability of graduates by gender. After the statistical analysis of the independent t-test, *Levene's test* showed no significant ($p> 0.05$). The results showed the variance between male and female students was similar. This result had met the assumption of *homogeneity of variance* of male and female students in employability. After the independent t-test was performed, it was found that it was not significant, $t(28) = -0.273$, $p = 0.787$; $p> 0.05$ with Mean Differences (0.06250). Therefore, null hypotheses are accepted. Thus, there is no difference in the employability among polytechnic architecture graduates based on gender.

CONCLUSION

Overall, this study has achieved the objective of the study to identify the level of skills acquired by graduates. This study shows a significant difference between graduate skills (technical and nontechnical skills) and employability. These results are consistent with the findings conducted by [25], which shows a relationship between graduates' skills and employability graduates. The skills are essential for graduates in the technical field. The independent t-test analysis findings show that there is no difference in employability between males and females of architecture graduates. In conclusion, skills acquired in the institution have affected the employability of graduates after graduation.

However, this study is a pilot study involving 30 respondents from the Sultan Abdul Halim Mu'adzam Shah Polytechnic. This study is not representative of all polytechnic graduates offering architecture programs in Malaysian Polytechnic. A further study needs to be done to see to what extent the skills acquired among architecture graduates affected the employability of graduates as a whole.

Thus, in strengthening the skills of graduates, initiatives from lecturers and institutions in ensuring that polytechnic graduates, especially architecture, are highly skilled and meet the demands of employers in the construction industry. Collaboration between institutions and industry will help determine required skills and provide early education of skills and knowledge in BIM to produce semi-skilled workers to meet the employers' demands in the construction industry [28]. In addition, it is also important for students to play a role in diversifying skills and knowledge so that employers can expect graduates to be skilled in BIM technical and nontechnical skills upon graduation.

The author would like to thank *Hadiah Latihan Persekutuan* (HLP), Ministry of Higher Education, for the full support in carrying out this research.

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