THE MANUFACTURING INDUSTRIES NEEDS ANALYSIS FOR MANUFACTURING TECHNOLOGY CERTIFICATE GRADUATES

Analisis Keperluan Industri Pembuatan Bagi Graduan Sijil Teknologi Pembuatan

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Abstract

Manufacturing industries need potential worker that suit them quickly. The cause of the need is, its technology is fast changing, thus worker must be able to cope with the changes. Therefore, need analysis based on the issue with the aim to answer three research questions are required. A case study using need analysis in this paper is subject to Manufacturing Technology Certificate program at the Kepala Batas Community College, particularly the graduates as the potential workers for the industry. The research questions cover the observation of program content, graduate suitability at work, job clarity, further study suitability, and industry perceives on the studied program and graduate. The questions answered the comparative of the studied program syllabus and structure used in previous and current time. Survey and Questionnaire method is applied to answer the question. Later, the program training suitability and present situational are analyzed. Two analysis approaches used in this paper is Frequency Distribution and Hypothesis Tests. As the result, both analyses proven that current use of program syllabus and structure are better than the previous one with statistically significant.

Keywords: Need analysis, hypotheses test, manufacturing technology

INTRODUCTION

Manufacturing is a field involves product design, raw material use, employment, and the use of various production method and techniques. The method and techniques are changing with time; thus, the industries must keep these up to date in production line. Besides, to get to know the interaction of production workers with the machine and their workplace, it is important to have an efficient production line (Kalpakjian & Schmid, 2014). Therefore, graduates in manufacturing technology fields which aligned with the industry needs is important for the potential employers. The graduates as the potential employee equipped with proper knowledge and skills will fasten them to be the efficient technical worker in production line. The properness of the knowledge and skills are needed to be validated by the industries in the mode of recurrently from time-to-time. Therefore, a study that acquires the manufacturing industry needs of the graduates or potential

technical workers is necessary to be done in this mode. The kind of the study also known as Need Analysis (NA).

NA based study is a matured approach and many studies that have been conducted can be found as early as the 1980s (Long, 2005a). It uses various techniques in gathering information to identify the needs, proving the necessity, and listing priority points (Prat, 1980) if it is necessary. In addition, NA includes a study to collect information about the perceives needs of the knowledge, skills and behavior (Lee and Nelson, 2006). The means of NA uses in this paper is to collect data, proving the necessity, and gather perceives of knowledge and skills needs from the industries.

Manufacturing Technology Certificate (SMN) at Kepala Batas Community College (KKKB) graduates are the good example for the aforementioned study to be conducted. Based on the previous study, this is the follow up to gather information and established its necessity in the current industrial needs for the graduates. Most SMN graduates work at manufacturing industries and the rest includes further their study and self-working. While in the college, they studied multi-discipline courses in manufacturing technology fields, in both theoretical and practical components at 30% and 70% ratio accordingly. The courses include Industrial Hand-Working, Engineering Drawing (Manual and Computer Aided); Conventional and CNC Machining; Pneumatic, Hydraulic, and Electro-Mechanical; and Quality Control within three semesters. In the fourth semester, student undergoes Industrial Training in selected Manufacturing Industries. SMN student studies for three semesters in the college and a semester of industrial training. At the moment, we have two industry advisors, a commitment of industrial need advisory and student-industry relation. The advisors are JWR Technology (M) Sdn Bhd and Advance Micro Surface Furnishing Sdn Bhd.

Previous NA study in higher education institutions for a program or a course mainly involved internal stakeholders (Herlina, Tarjiah, & Wirasati, 2021; Ji, 2021; Solehan, Harahap, & Diani, 2021; Lestari, 2021; Otilia & Brancusi, 2015). However, only few studies involved external stakeholders (Semahat & Özcan, 2021; Li & Fu, 2021). In addition, the study of NA is developing the learning process design and observation are dominant subject (Syakur, Zainuddin, Hasan, 2020; Apriyanti et al., 2020; Suswandari et al., 2020; Mubai et al., 2020; Parnawati & Ulinuha, 2019; Diana & Mansur, 2018; Madkur, 2018; Hartanto & Fordiana, 2018; Aeni et al., 2018) and limited study is done to the graduate observation (Semahat & Özcan, 2021; Saragih, 2014). Though, the study to the graduate observation is too general and no in-depth question used in the study. In the area of study, most of the NA papers focus on language fields mainly English Language. Literature review noted that current papers are published in particular fields such as in medical (McDonald et al., 2020; Harrison Dening et al., 2019; Odumuyiwa et al., 2019; Perrotta, 2019; Ning et al., 2019; Mc Carthy et al., 2019), psychology and humanitarian (Mayorgo-Sierra et al., 2020; Breman, Giacumo, & Griffith-Boyes, 2019), computing (Agyei, 2019; Nusawat, Pengnate, & Saikatikorn, 2018). This reveals that it is essential for an NA study that focus on a non-language field that observe the graduates by external stakeholders. Based on literature review, there is no paper attempt that is similar to this study – this justifies the conduct of this study.

NA for SMN at KKKB is conducted recurrently from time-to-time as directed by the Department of Polytechnic and Community College Studies (JPPKK). Besides, the study is required due to the new syllabus used by the mid of 2017. After several years using the syllabus and resulted in three batches of graduates, thus the outcome of the syllabus needs to be investigated. Furthermore, since current manufacturing technologies are rapidly changing, the graduate knowledge and skills need to be verified by the industries.

All of these factors, suggest that a manufacturing industry need analysis need to conduct study for the programs and graduates used of the new syllabus. From nine selected questions for the industries, these questions are dimensioned into three research questions as follows: (1) Is the program content suitable for the industrial need? (2) Is the graduate job position clear and suitable for further study? (3) Is industries perspective concerning the graduates and program offered positive?

MATERIAL AND METHODS

Based on literature study, type, focus study, and method must be assured in order to conduct NA study. Betti & Mahdi (2021) noted that the Training Suitable Analysis is one of the seven NA types, and this type is selected due to this study attempt on gathering the suitability of the SMN program and graduates to industry information. Besides, Present Situational Analysis (Otilia, 2015) is chosen as the focus of this study since in this study conducted the comparison of what had already been known from previous study on previous syllabus and on the new syllabus. In addition, this study applied Survey and Questionnaire method, which is one of the 18 NA methods suggested by Long (2005b).

Table 1. The 30 Industries Answered Questionnaire Form

The List of Industries	The List of Industries
Prestige Dynamics Industries Sdn Bhd	AM Machining Tech Sdn Bhd
Nissei Technology (M) Sdn Bhd	Micron Memory (M) Sdn Bhd
JWR Technology (M) Sdn Bhd	Jabil Circuit Sdn Bhd
SAM Engineering & Equip. (M) Berhad	Dell Technologies Malaysia
TRIO Papers Mills Sdn Bhd	Fatty Chemical (M) Sdn Bhd
Jinko Solar Technology Sdn Bhd	Iwan Industry Factory Sdn Bhd
Fu Hao Manufacturing (M) Sdn Bhd	Jabil Circuit Sdn Bhd
CNC Manufacturing Sdn Bhd	Plexeco Tech Sdn Bhd
Altramax Technologies Sdn Bhd	Excel South Asia Sdn Bhd
AZE Tool Supply & Engineering Sdn Bhd	Mforce Part Sdn Bhd
Western Digital Media (M) Sdn Bhd	Ecofame Sdn Bhd
Polytool Technologies Sdn Bhd	Florthern Sdn Bhd
Next Wave Engineering Sdn Bhd	Future Engineering Sdn Bhd
Paradigma Engineering Sdn Bhd	KCK Machinery Sdn Bhd
Kb Metal Machining Sdn Bhd	Mattle (M) Sdn Bhd

Table 2. The List of Questions

GC	D	CQ	Specific Question	Clustered Question
I	Suitability of program content and industry needs	A	Has the offered program completed the basic theoretical and practical of the manufacturing technology field? (Fully Complete/Partially Complete)	(1) Is the program content suitable for the industrial need? Based on CQ of A, B, C, and D.
		B	Do the offered program suitable for current industry needs? (Yes/No)	
		C	Does the study duration suitable for the offered program? (Yes/No)	
		D	Do the industrial training duration is suitable for SMN program? (Yes/No)	
II	Career Opportunity	E	Do SMN program graduates suit any of the following field in the industries? (i. Machining, ii. Product Design, iii. Quality Control, iv. Automation, v. All (general))	(2) Is the graduate job position clear and is suitable for further study? Based on CQ of E, F, and J.
		F	Do SMN program graduates suit any of the following position in the industries? (i. Draughtsman, ii. File Technician, iii. Production Technician, iv. Machinist, v. Product Designer, Automation Technician; vi. Quality Control Technician)	
		J	Do SMN program graduates suitable to further their studies? (Yes/No)	
III	Industry Perspective	L	Based on your opinion, do the SMN program resulted in the graduates needed by the manufacturing technology industries? (Yes/No)	(3) Is industries perspective concerning the graduates and program offered is positive? Based on CQ of L and M.
		M	Personally, are you encouraging any of your staff or friend to enrolled in SMN program in Kepala Batas Community College? (Yes/No)	

Note: D – Dimension; GC – Group of Classification; CQ – Code of Question

The selected questionnaire is designed by JPPKK for colleges that offer SMN and similar program band, i.e., Community College at Kepala Batas, Kuantan, Taiping, Besut, and Miri. Aligned with this, the used of the existing research questionnaire is much preferred by researchers and only few used self-developed questionnaire (Herlinawati, Tarjiah, & Wirasti, 2021; Lestari & Petrus, 2021; Saragih, 2014).

This research began by a questionnaire containing specific questions, is converted into an electronic system using Google Form, in order to circulate it through e-mail, telegram, and WhatsApp. Though, about 55 forms circulated to the industries, only 30 answered questionnaires are returned (Table 1) that answered the specific questions as in Table 2. Out of all the 30 answers, nine are industries that employed SMN graduates and the rest 21 are industries that offered industrial training to SMN students. In designing research questions, the specific research questions are class into clustered question, shown in Table 2.

Pictorial of the general result will be presented in graph of frequency distribution. The graph is useful for clarifying complex patterns and difficult to spell-out in tables. For this purpose, histogram graphs are used throughout this paper.

HYPOTHESIS TESTS

Normally, a hypothesis test is conducted in either one of the tests, because of the sample size condition. T-test is for a smaller sample size study, i.e., 30 or lower, and Z-test is for a higher sample size. The prime difference is the test is lower at the mean and higher in the tail of Z-distribution (Rumsey, 2011). Besides, each t-test sample size has difference t-distribution – the low sample size has much different mean and tail value compared to the Z-distribution. However, the two tests have similar target – to find the p-value in deciding Null Hypothesis (H_0) or Alternative Hypothesis (H_a) rejection statistically.

However, both tests conducted in this study. This is due to several reasons. Firstly, since the sample size (n) of this study is falling right at the border of t-test condition, thus the distribution between t-distribution and Z-distribution are closely similar. The second point, fortunately, though the z-test condition set that for the n is 30 or lower; but the Z-test can be tested at any n number to find the p-value. Finally, the third point, mathematically, t-test cannot be tested on each research question. By t-test, it results is based on general point of view for a sample. However, Z-test enables each research question to be tested. Thus, by both tests, general view and view on each research question for either H_0 or H_a is proven rejected.

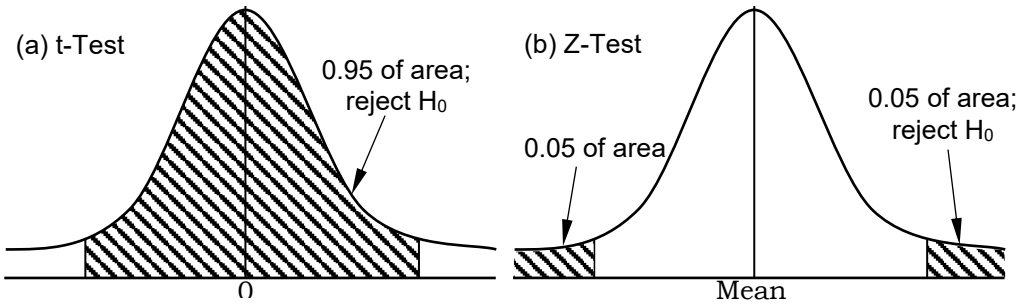

Figure 1. The Rejection Area for H_0

Generally, a true claim that representing most of the sample is valued by 95% or 0.95 (Rumsey, 2011). Thus, the border line that defined rejection is 5% or 0.05. In making decision, the condition to reject the H_0 in t-test is different than in the Z-test. The t-test shown in Figure 1(a), shows that for t-test p-value must be less than 5% to reject H_0. Though by t-test the exact p-value is unobtainable, the p-value is estimated between two values listed in Statistical Table for t-Distribution. On contrary, for Z-test p-value must be more than 5% to reject H_0. This p-value determined by calculation. In order to calculate result of p-value for Z-test, questionnaire survey study of previous and current must be obtained to represent the previous proportion (p_0) and current proportion (p). Then the proportion values used to calculate p-value with disregard n for previous study. For this paper, previous study conducted in November 2016 and current study conducted in early August 2021. As aforementioned, the graduates for current study used syllabus began in 2017 and for the previous study used syllabus began in early 2013.

RESULT AND DISCUSSION

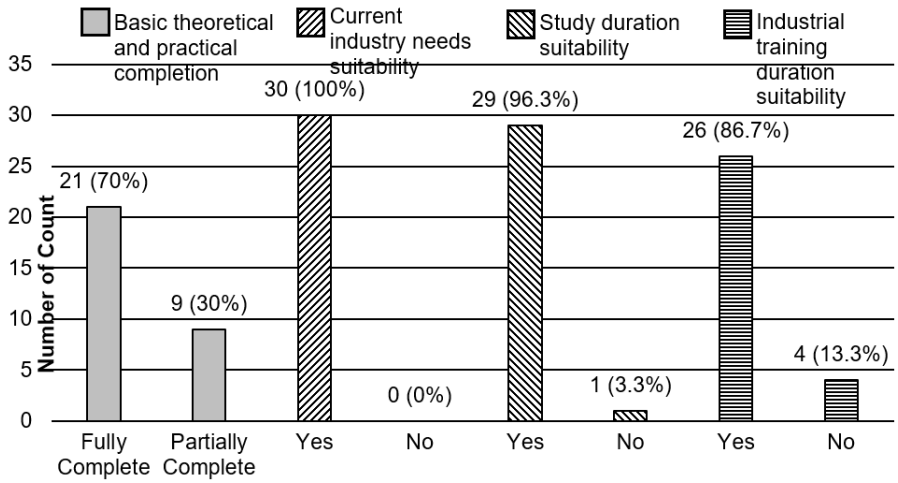

Figure 2. Result for the Code of Question of A, B. C, and D.

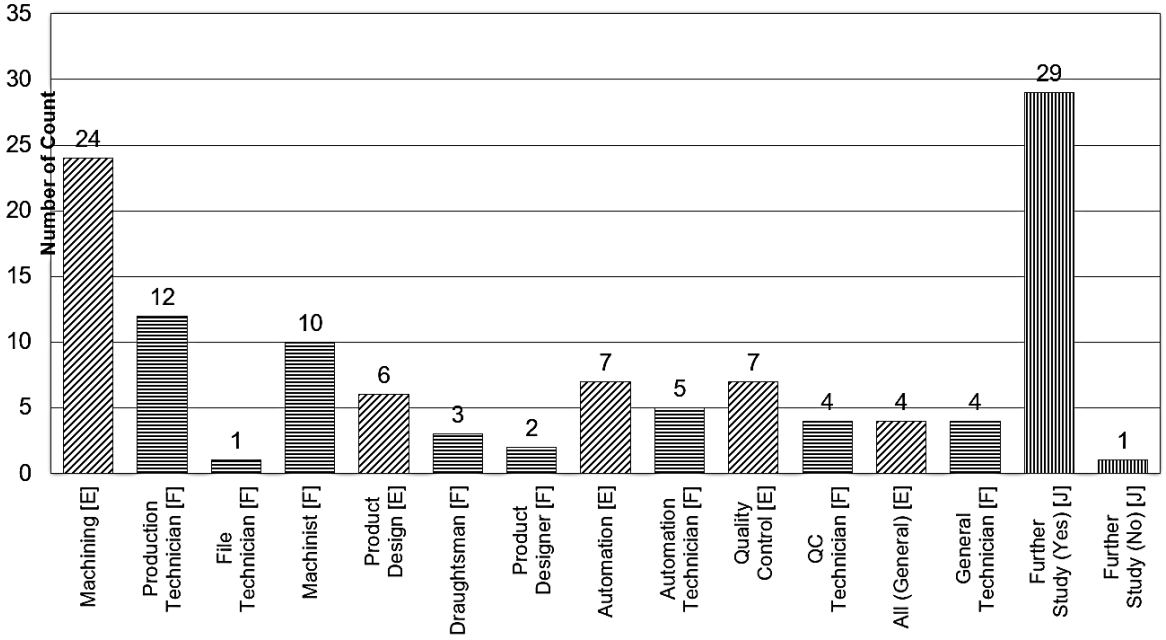

Figure 3. Result for Code of Question of E, F, and J.

Manufacturing technology is a diverse field, thus SMN program structure is designed for the basic and up to date for industry needs. In order to keep the structure up to date, industry representatives and academicians from qualification agency has been requested to verify the course syllabuses and structure of SMN. The result with 70% agree that SMN covers the industry needs and 30% is partially covering the needs, shown in figure 3. This 30% score shows that there is more room for improvement for SMN program. However, further detail of the information is needed to clarify what is the incomplete areas for industry needs. In addition, all of the industries agreed that SMN is suitable for current industry needs. Furthermore, 96.3% agreed that study duration is suitable, and 86.7% agreed that industrial training duration is suitable. These positive characters agreed by industries shown in figure 2.

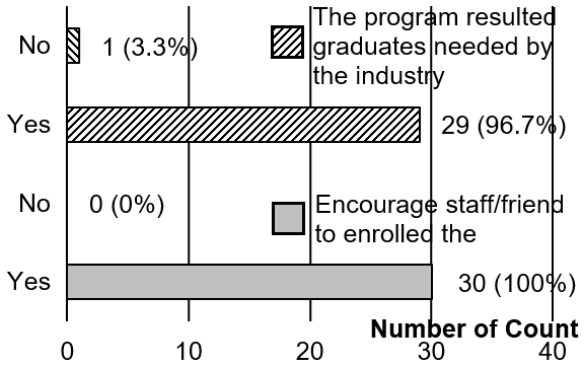

Figure 4. Result for Code of Question of L and M.

Table 3. Estimating p-Value for t-test

Description	General
The alternative context	$H_a > H_0$
Sample Number (n)	30
Degree of freedom	$30 - 1 = 29 = t_{29}$
Referred from Statistical Table: t-Distribution (Rumsey, 2011).	For the Selected Significance Level of 95%, thus the test statistic is 2.5. Based on this t-value of 2.5 the value for t_{29} falls between 2.479 (98th percentile = 98%) and 2.756 (99th percentile = 99%). Based on this figure, the p-value falls between the following points: 100% - 98% = 2% = 0.02 100% - 99% = 1% = 0.01 Because both 2% and 1% are less than 5%, hence H_o is rejected.

Table 4. Research Question Findings – Previous and Current Study

Symbol	Research Question	Previous	Current
X	The sample proportion (p) for the program content and industrial need suitability, by averaging all Group of Classification 1 – Question A, B, C, and D.	83.92%	88.25%
Y	The sample proportion (p) for the graduate job scope clarity and further study suitability. Cover selected question in Group of Classification 2 – Question E, F, and J.	86.91%	92.44%
Z	The sample proportion (p) for the employee positive perspective toward graduate and program offered, by averaging all Group of Classification 3 – Question L and M.	93.32%	98.35%

In career opportunities set of questions, they are clearly classified into graduates' job clarity of field and position; graduate job vacancy and salary rate; and further study suitability. The classification of graduate job clarity of the field and position shown in figure 3. For questions E and F, industries may suggest more than one field and position in the circulated electronic questionnaire. Thus, the total score might be more than 30 counts. Based on figure 3, the industries are clearly knowing of field and position that is appropriate for SMN graduates. In addition, the graduates are suitable to further study for

advancing their knowledge, shown in the similar figure. Generally, the null hypothesis (H_0) of the program, graduates, and perspective based on previous syllabus better than by the use of new syllabus. Alternatively, for the Alternative Hypothesis (H_a), compared to previous syllabus, the use of new syllabus is better in term of: (1) the program content suitable for industrial need; (2) the graduate job position is very clear for the industries and supported for the graduates to further study; and (3) the industries have a positive perspective towards the program and the graduates.

Industry perspective set of questions shown in figure 4. The figure shows 96.7% of the industries agreed that SMN graduates are needed by the industries. Moreover, this study found that 100% of the industries are positive toward SMN program.

According to the alternative context of $H_a < H_0$, degree of freedom of 29, and selected significance level of 95% (refer table 3); a t-test is conducted. By t-test, the p-value determined from the referred Statistical Table (Rumsey, 2011) is below 0.05 (refer Table 3), or p-value falls between 0.01 and 0.02. Hence H_0 can be rejected, and H_a is accepted statistically.

In addition to t-test, Z-test is conducted based on research questions X, Y, and Z in Table 4. Result for Z-test in previous study is 83.92%, 86.91%, and 93.32% accordingly. The better result is obtained for all X, Y, and Z research questions in the current study. Based on this value, Z-test is conducted and the Z-test calculation is shown in table 5.

Table 5. p-Value for Z-test Calculation

Description	X	Y	Z
The alternative context	$H_a > H_0$	$H_a > H_0$	$H_a > H_0$
Sample Number (n)	30	30	30
sample proportion (p)	0.8825	0.9244	0.9835
previous proportion (p_0)	0.8392	0.8691	0.9332
Standard of Error $\sqrt{\left(\frac{p_0(1-p_0)}{n}\right)}$	0.0671	0.0616	0.0456
$\frac{p-p_0}{\sqrt{\left(\frac{p_0(1-p_0)}{n}\right)}}$	0.6456	0.8977	1.1034
Referred from Statistical Table: Standard Scores and Corresponding Percentile from the Standard Normal Distribution (P) (Rumsey, 2011).	72.58% = 0.7258	78.81% = 0.7881	86.43% = 0.8643
p-value $\frac{100\% - P}{100\%}$	1.000 - 0.7258 = 0.2742	1.000 - 0.7881 = 0.2119	1.000 - 0.8643 = 0.1357

The condition is, if p-value is less than 0.05, thus it shows that the H_0 is reasonably true. Based on p-value obtained from the calculation (refer Table 4), all are above 0.05, i.e. $\text{p-value}_x = 0.2742$, $\text{p-value}_y = 0.2119$, and $\text{p-value}_z = 0.1357$. Thus, H_0 can be rejected, and H_a is accepted.

CONCLUSION AND RECOMMENDATIONS

The conclusion is centered to answer the above-mentioned research question in three dimensions. Each dimension is measured by frequency distribution and hypothesis tests. In the first dimension, the conclusion is the industries were given positive agree study content and duration, thus the content need to be revised from time-to-time to meet this industry growing need in the future. As for the second dimension, the finding concluded that the industries are well known of SMN graduates to place the graduates at a suitable field and position. In addition, the industry backing that SMN graduates should further their study. Conclusion on the third dimension is, industries have a positive perspective toward SMN graduate and program. The conducted t-test and Z-test are representing the comparative of SMN graduate and program using either previous and current SMN syllabus and structure. Finding on these hypothesis tests is current syllabus and structure is better than the previous one.

Since the study was limited to one-way interaction, in the future, the questionnaire circulation should be conducted with follow-up feedback to further detail of the information given and so the action to be taken later up to the specific industry needs. Currently, JPPKK is ongoing to use the latest version of syllabus for SMN. Thus, NA is proposed to be conducted once there are three batches of graduates using this latest syllabus. Under the process used of the new syllabus, which began in the mid of the year 2021, hence there is no batch of graduates that has fully used the new syllabus.

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