



# INTERNATIONAL JOURNAL OF ACADEMIC RESEARCH IN BUSINESS & SOCIAL SCIENCES



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Nurin Asyikin Ahmad, Mohamad Sattar Rasul, Norasmah Othman, Natasha Dora Muridan

To Link this Article: <http://dx.doi.org/10.6007/IJARBSS/v11-i3/8594>

DOI:10.6007/IJARBSS/v11-i3/8594

**Received:** 06 January 2021, **Revised:** 10 February 2021, **Accepted:** 22 February 2021

**Published Online:** 25 March 2021

**In-Text Citation:** (Ahmad et al., 2021)

**To Cite this Article:** Ahmad, N. A., Rasul, M. S., Othman, N., & Muridan, N. D. (2021). Identifying Problem Based Learning (PBL) Indicators of Entrepreneurial Learning for Technical Entrepreneur. *International Journal of Academic Research in Business and Social Sciences*, 11(3), 1117–1131.

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**Vol. 11, No. 3, 2021, Pg. 1117 - 1131**

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[www.hrmars.com](http://www.hrmars.com)

ISSN: 2222-6990

## Identifying Problem Based Learning (PBL) Indicators of Entrepreneurial Learning for Technical Entrepreneur

Nurin Asyikin Ahmad, Mohamad Sattar Rasul, Norasmah  
Othman, Natasha Dora Muridan

Faculty of Education, the National University of Malaysia, MALAYSIA

Email: [nurinasyikin87@gmail.com](mailto:nurinasyikin87@gmail.com), [drsattar@ukm.edu.my](mailto:drsattar@ukm.edu.my), [lin@ukm.edu.my](mailto:lin@ukm.edu.my),  
[natashadora@gmail.com](mailto:natashadora@gmail.com)

### Abstract

Entrepreneurial learning is now being enhanced from conventional learning to active student-centered learning. Problem Based Learning (PBL) might be the right tool that meets all of these criteria and is capable of enhancing entrepreneurial specific skills in line with current needs. The objective of this study is to identify the PBL indicator in entrepreneurial learning in order to produce technical entrepreneurs. A Modified Delphi Technique was used to identify the indicator of PBL. The Modified Delphi Technique process were two rounds of surveys to obtain the Range of Quartile (ROQ) for a decided level of consensus among experts by using a questionnaire instrument set. Experts involved are among 12 entrepreneurial lecturers from a higher institution. The PBL construct to be measured are the ability to apply information, teamwork skills, problem solving skills, decision making efficiency, knowledgeable entrepreneurs, stimulate critical thinking and communication skills. The findings showed that the experts agreed on a high level of consensus for all items under PBL indicators. Implementation of PBL as an active learning strategy in entrepreneurial learning has a suitable and significant effect on students to improve entrepreneurial skills. Therefore, it is important for educators to introduce PBL as it plays an important role in producing competitive and capable technical entrepreneurs in facing future challenges.

**Keywords:** Problem Based Learning (PBL), Technical Entrepreneur, Entrepreneurial Learning, Technical and Vocational Education (TVET), Modified Delphi Technique

### Introduction

Global economic challenges, technological changes, and the dominance of knowledge workers have a major impact on the learning process. Considering the challenges of this revolution, graduates need to be more proactive in equipping themselves with specialized skills and soft skills such as problem-solving skills, social skills and the ability to innovate, be creative and have high personal values in order to meet the demands of today and addressing increasing challenges (Masek, 2015; Dewiyani, 2018). The main reason for this is because entrepreneurship in this era of globalization will surely be more challenging as technology

becomes more sophisticated, competitions become more intense and labor demands will become more complex. (Yusof, 2010). In addition, work processes and business methods are also moving in tandem with the rapid advances in technology, bringing the human processes and technology to a greater degree.

Indeed, conventional learning methods are not appropriate to be used in order to answer the increasingly diverse challenges today (Dewiyani, 2018; Kim, 2019). In line with this, various educational transformations have been implemented including the technical and vocational education (TVET). It is now apparent that the teaching and learning system is more focused on proactive and innovative learning in which learning is more student-centered (Arasti et al., 2012; Li-Hsien, 2014). Therefore, Problem Based Learning (PBL) might be the right tool that meets all of these criteria (Masek et al., 2016). This method or approach can provide graduates with the specialized skills that the industries need today (Masek, 2015). In fact, this learning innovation is in line with the principles in entrepreneurship education that is to prepare and encourage students to discover, create and exploit opportunities (Westhead & Solesvik, 2016). In addition, it also contributes to the formation of technical entrepreneurs in which elements of entrepreneurship such as knowledge, skills and capabilities are very important and must be available to every individual who ventures into entrepreneurship (Amiruddin et al., 2017). With this, the PBL approach is one of the most innovative approaches in developing students' skills and abilities in solving real problems and working on them in the future (Masek, 2015).

### **Problem Statement**

The speed of the world in the industrial revolution 4.0 calls for rapid human action in seizing opportunities that can be explored to boost the country's income and economic development. However, the Global Entrepreneurship Monitor (GEM) 2017/2018 report shows that Malaysia is one among many of the countries that is still lagging behind in terms of entrepreneurial inclination that was only at 17.6 percent compared to other ASEAN countries such as Indonesia (28.1 percent), Vietnam (25%) and Thailand (37.4%) (Global Entrepreneurship Research Association (GERA), 2018).

One of the factors is that the involvement of graduates in entrepreneurship is minimal. Based on the Graduate Tracer Study for Community College 2017, it has shown an increment in students' engagement in its own company that is 560 (6.5%) students in 2016 while in 2017, 676 students (6.6%) are involved. Although there is a growth in students' involvement in the private sector, the increase is only at a low rate of 0.1 percent (KPT, 2017). Despite the various efforts made by the government, the issue of lack of students' involvement is still ongoing. Based on the study done by Yatim and Rahim (2017) on students from the Electrical Installation program at Bukit Beruang Community College, it is shown that Electrical Installation students are less prepared to venture into electrical entrepreneurship after graduation. Data analysis have shown that the level of business knowledge of students in the field of electricity is moderately high at 2.9% and their interest in entrepreneurship is also moderately high which is at 3.39%. This situation is also supported by the study of Madar and Hamid (2014) regarding the Critical Success Factors (CSFS) for entrepreneurship programs at community colleges and found similar problems in which students had entrepreneurial potential but lacked of entrepreneurial knowledge, confidence, and creativity as well as innovative attributes in facing global challenges.

In addition, Loras and Vizcaino (2013) argued that engineering graduates prefer to work in available companies rather than choosing entrepreneurship after graduation.

According to a study in one of the Spanish institutions on civil engineering students, most of the students found it difficult to start a business (64.3%) as well as being unclear on how to do or even start a business (49.7%). Meanwhile, Dewiyani and Kosasih (2017) in their study of Industrial Engineering students who took up the subject of entrepreneurship has shown that the average score of students' learning interest was 51.73%, students' independence was 52.09% and students' creativity was 51.69%. This findings have shown that the average interest in learning, independence and creativity of Industrial Engineering students who are pursuing the subject of entrepreneurship is still low, that is less than (<70%). This problem arises because the approach adopted still favored the conventional method of teacher-centered teaching.

The study conducted by Dewiyani (2018) has shown that as many as 83% of lecturers deliver lectures face-to-face, which is a teacher-centered learning process and this has made students to be passive in their learning process that involves only one-on-one communication that is from the lecturer to the students. This has caused many engineering students to not be exposed to the concepts and principles of entrepreneurship but are focused only on subjects or modules related to their field of study (Swart, 2014). In addition, the differences between the two applied areas (technical and entrepreneurship) will create difficulties for students because technical education is focused solely on the development and creation of technology while entrepreneurship education emphasizes on the product commercialization through the creation of new ventures (Kleine et al., 2019).

This scenario needs to be taken seriously as the entrepreneurial element plays an important role in the development of technical entrepreneurs and it should be incorporated into the teaching and learning process (Mohd Shahrir, 2015; Mustapha et al., 2017). Sipon et al. (2017) in her study of entrepreneurial intentions for Kuala Langat Community College students has shown that the appropriate pedagogical knowledge and concepts are needed in enhancing entrepreneurial intentions and thus creating successful and competitive entrepreneurship. It is clear here that there is a discrepancy in the development of technical entrepreneurs in terms of the capabilities of educators in the process of delivering and exposing entrepreneurship to students. Teachers need to explore the entrepreneurial world before they train their students in entrepreneurship (Otache, 2019). Based on these issues, it will be a critical requirement to obtain clarification on the indicators for Problem Based Learning in producing technical entrepreneurs.

### **Problem Based Learning (PBL) in Entrepreneurship Education**

Based on the challenges of the industrial revolution and progressively demanding workforce, higher education institutions are increasingly being referred to as "nurseries" of entrepreneurship which in essence provide a variety of requirements for developing entrepreneurship among students (Debarliev et al., 2020; Guerrero et al., 2017). Thus, entrepreneurship learning is enhanced from conventional learning to active student-centered learning (Solcan, 2016). Among the student-centered active learning, one of them is Problem Based Learning (PBL) which emphasizes innovative and engaging learning methods (Silva, 2016). PBL is to be considered as active learning because students are encouraged to take the lead in their own professional training and education (Da Silva et al., 2018). In addition, PBL approach is proven to be very effective in educating and propagating learning among students (Mohamad & Graaff, 2013). Research evidence also indicates that active learning approaches such as PBL have been successful in imparting skills that enhance students' employability (Smith et al., 2013).

The Problem Based Learning method (PBL) is an educational method that can encourage students to be able to learn and work with groups to find solutions to problems in the real world. Problem simulations are used to activate students' curiosity before starting something and preparing students to think critically (Dewiyani, 2018). Besides, PBL contributes to the development of the skills needed for working as a team (Woods, 2006; Escrivão Filho and Ribeiro, 2008). Wijnia et al. (2014) agreed that through the PBL approach, students will be responsible for their own advocacy and the tutor will be responsible for guiding the students. In fact, PBL is designed to put students in real life situations in which they have to solve the real-world problems they faced (Vaidya, 2020). However, Pinto et al. (2015) in a study indicate that teamwork was also identified as a challenging factor in a study on the use of PBL such as a problem with leadership, role and responsibilities each members.

Besides, active learning through the PBL approach can help students will have a better understanding on the concept and content of the lesson through the problems presented. Solcan (2016) believes that through entrepreneurial education, PBL can be applied through project development such as developing business models and preparing business plans. He added that the use PBL approach in entrepreneurial education is a way to allow the student to experience in practical practices and provide opportunities for students such as gaining knowledge and practical skills in entrepreneurial activity, forming teamwork abilities, developing spoken and written communication skills, developing abilities for solving problems, developing independence from external sources of information and expert advice, collaboration with the business community in order to solve their real problems and collaboration between students and lecturer (Solcan, 2016; Swart, 2014; Kain, 2003; Liu et al., 2015). According to Da Silva et al. (2018), the use of PBL can be help students create knowledge structures that will help them apply what was learned to future situations and provide students more effective opportunity to develop problem-solving skills. Besides, these learning activities also allow students to work in teams, improve communication skills, integrate information from many sources and apply creative thinking to ambiguous problems (Liu et al., 2015).

The PBL concept applied in the teaching and learning process of entrepreneurship was in line with constructivism learning theory that emphasizes student-centered learning. The constructivism theory creates an active learning that gives students an opportunity to engage in group learning, stimulation, collaboration and so on (Nachiappan et al., 2008). Thus, it could be seen that the approach adopted in the T&L process was to assist students in developing their thinking through the exploration of knowledge and to find problem-solving steps either individually or in groups (Hapsari, 2011). Therefore, it can be seen that the concept of learning outlined in this theory was consistent with the PBL method and in line with the entrepreneurial field that emphasized the exploration of entrepreneurial knowledge prior to taking up the business. Therefore, conventional methods were inadequate in the application of learning that aims to create creative and innovative students Dewiyani (2018). In fact, learning using specific and accurate methods can have a profound impact on one's exploration of knowledge. Generally, PBL can be attributed to a learning approach where the problem as the starting point for the learning process, which is based on perspectives such as student-centered learning, experience-based learning, activity-based learning, interdisciplinary learning, a focus on practical examples, and collaborative group learning (Da Silva et al., 2018). Overall, PBL activities can help students gained extensively practice in various aspects of skills and be able to apply in real-world of entrepreneurship.

**Methodology**

**Modified Delphi Technique**

The Modified Delphi research approach was used for the purpose of gaining expert consensus on Problem Based Learning (PBL) items that were applied in entrepreneurship education to produce technical entrepreneurs. In carrying out this phase, the researcher would first identify the experts involved to assist in this study. In this study, a total of 12 specialists were involved, including the lecturers from the Community College and the Institute of Teachers in Malaysia whose expertise was in the field of entrepreneurship. Through this phase, it involved literature review, instrument development, expert review of instrument refinement, data collection through designated experts and data analysis.

The Modified Delphi technique proposed by Wiersma and Jurs (2009) was applied in this study as it was a procedure for finding consensus among the selected experts using a face-to-face questionnaire as well as the best way to get a high-quality feedback on problems and questionnaires from a team of experts (Mohd Said, 2015). In this study, the first round of interviews in the actual Delphi method was not required and the modified Delphi process was continued into the second round of the subject exploratory questionnaire. This is because issues in the first round of the Delphi method have been sufficiently defined by researchers through a literature review related to the entrepreneurship and PBL, particularly technical entrepreneurs. Generally, a modified Delphi typically did not consult the expert panel to generate answers in the round 1 questions only (Avella, 2016). Table 1 provides an overview of the implementation procedures for the modified Delphi study while Table 2 is a summary of the implementation, data collection and analysis of the modified Delphi studies.

Table 1: Implementation phase of Modified Delphi

Round 1	Round 2	Round 3
<ul style="list-style-type: none"> <li>• Explain the issues, problems and identify the literature review items.</li> <li>• Select a Delphi panel (experts in entrepreneurship)</li> <li>• Prepare the questionnaire</li> </ul>	<ul style="list-style-type: none"> <li>• Distribute the questionnaire</li> <li>• Feedback analysis: agreements, assumptions and conflicting opinions</li> <li>• Prepare and distribute questionnaires based on the findings for the 3rd round</li> </ul>	<ul style="list-style-type: none"> <li>• Distribute the questionnaire</li> <li>• Feedback analysis: agreements, assumptions and conflicting opinions</li> <li>• Final interpretation and conclusion</li> </ul>

Table 2 Summary of Modified Delphi

No	Implementation Phase	Method of Data Collection	Analysis Technique
1	Round 1	Past studies, literature review	None
2	Round 2	Questionnaire	Range of Quartile (ROQ)
3	Round 3	Questionnaire	Range of Quartile (ROQ)

*i. Stage One (round one)*

The first step taken by researchers at this level was to review the literature and questionnaires related to PBL. Subsequently, as a result of the literature review, questionnaire research instruments were developed for the second and third rounds. In this round, 12 experts from the Community College and Teaching Institute in Malaysia were selected and this group of experts agreed to contribute their expertise through the formulation of ideas, feedback, criticizing and improving the content of the questionnaire items identified in this study. These selected experts had the same expertise and experience in entrepreneurship as well as teaching in the field.

**ii. Stage Two (round two and round 3)**

There were two phases of data collection process in stage two namely the second and the third stages in which both phases involved the same experts.

**a. Round Two**

The panel of selected experts would be given a questionnaire to answer for the second round of the modified Delphi study. The statements and items constructed in the questionnaire were the result of the analysis and literature review. In this study, there are eight items in the questionnaire (see Table 4). Through the questionnaire, experts were required to evaluate, mark the level of agreement and comment on the statements made in relation to PBL used in entrepreneurship education to produce technical entrepreneurs. Each expert would be given a week to 2 weeks to respond to the questionnaire by commenting as well as giving ideas, agreements and improvement for the items in the developed questionnaire. In this second round, a panel of experts was asked to state the level of agreement on each item on a 5 point Likert scale (strongly disagree, disagree, disagree, agree and strongly agree). The completed questionnaires were returned for analysis and the results were used to construct the questionnaire on the third round of modified Delphi.

**b. Round Three**

Next, each panel of experts would be given a questionnaire in the third round of modified Delphi study. The questionnaire developed was the result of feedback from experts in the second round. The process in the third round was the same as the second round in which the experts were required to answer the questionnaire by marking the level of agreement on a 5 point Likert scale (strongly disagree, disagree, disagree, agree and strongly agree). Also in this round, the panel will review and evaluate all the analyzed items. After considering all the factors, the expert will need to make a decision on the choice made. In this case, the expert is free to make the decision as to whether he or she has the right to retain or to change any item option. The results obtained would be analyzed. Therefore, the items that had been selected and agreed upon would be used in determining the Problem Based Learning (PBL) indicators for technical entrepreneurs.

**Data Analysis of Modified Delphi**

Data analysis for the modified Delphi in this study used the Statistic Package for the Social Science (SPSS) software for each round in which the data were obtained through the distributed questionnaires. Furthermore, the analysis results from the SPSS would be presented in the form of descriptive statistics namely percentage score, mode score, median score and ROQ that represented the expert consent decisions in this study. Descriptive statistics were used to describe variables in a phenomenon and they needed to be interpreted

logically in a specific way (Balnaves and Caputi, 2001; Piaw, 2006; Vogt, 2007). One possible way was to use descriptive statistical methods called a measure of central tendency (MCT). According to Minghat (2012) the MCT involved several calculations, such as the percentage score and frequency to obtain a panel view of the questionnaire items, the mean score used to describe the order of priority of the items contained in the questionnaire, the median score used to identify the statements needed in shaping the items of the questionnaire and ROQ was used to determine the relationship between each item and the expert panel.

Subsequently, the surveys data from the Likert scale obtained through the second and third rounds were translated into a modified Delphi data and analyzed using Excel software. This data analysis technique was known as the Modified Delphi Technique. Comments and suggestions expressed by a panel of experts were also taken into account to improve and refine items related to PBL.

In this modified Delphi, there were two important aspects: Range of Quartile (ROQ) and the process of obtaining ROQ values. ROQ is composed of Q1, Q2 and Q3 values and is usually represented in the form of Q3-Q1. In general, the value of Q1 was the first quartile value while Q3 was the third quartile value. Levels for modified Delphi scales were 0, 1 and 2 where ROQs with values 0 to 1 indicated that the level of expert agreement was high and the items developed were acceptable (Peck & Devore, 2012). Table 3 shows a summary of the three point modified Delphi and the calculation method for ROQ as follows:

$$= \text{Quartile 3} - \text{Quartile 1}$$

$$= Q3 - Q1, \text{ where } Q1 = n/4,$$

$$Q3 = 3n/4$$

Three point Modified scale

Table 3

Modified Scale	Level of Consensus	Result
0 - 1	High consensus	Accepted
1.01- 1.99	Moderate consensus	Accepted
≥2	No consensus	Rejected

Source

Peck &amp; Devore (2012)

## Results

Table 4 shows the details of case study data for Problem Based Learning (PBL) indicators. Based on the findings, there were seven items under the PBL indicator through the teaching and learning strategies implemented in entrepreneurship education. The items developed under the PBL indicator as shown in Table 4 were as follows: 1) ability to apply information; 2) teamwork skills; 3) problem solving skills; 4) decision making efficiency; 5) knowledgeable entrepreneur; 6) stimulate critical thinking; and 7) communication skills. Overall, the expert panel agreed on a high level of consensus on items representing the PBL indicator for both rounds with ROQ scores of 0 and 1 while mod and median values were 4 and 5. Therefore, all items are accepted upon obtaining agreement or consensus from all experts.



Table 4: The detail data of Modified Delphi Technique (MDT) for second and third round of Problem Based Learning (PBL)

No	Indicators/Items	Round Two				Round Three			
		M	Med	ROQ	Consensus Level	M	Med	ROQ	Consensus Level
<b>Problem-based Learning</b>									
1	<b>Ability to Apply Information:</b> Able to apply the information obtained to the actual business situation	4	4	0.75	High	5	5	1	High
2	<b>Teamwork Skills:</b> PBL activities are capable of enhancing the skills needed for teamwork	4	4.50	1	High	4	4	1	High
3	<b>Problem Solving Skills:</b> PBL activities can enhance problem-solving skills through discussion	5	5	1	High	5	5	1	High
4	<b>Decision Making Efficiency:</b> PBL activities are capable of improving decision-making efficiency	4	4	1	High	4	4.5	1	High
5	<b>Knowledgeable Entrepreneur:</b> PBL activities are capable of increasing knowledge	4	4.50	1	High	4	4.5	1	High
6	<b>Stimulate Critical Thinking:</b> PBL activities are able to stimulate critical thinking through the sharing of ideas during brainstorming sessions	5	5	1	High	5	4.5	1	High
7	<b>Communication Skills:</b> Able to apply communication skills in completing assignments	4	4.50	1	High	5	5	1	High
ROQ = Range of Quartile, Med = Median, M = Mod									

## Discussion

This analysis of the survey findings began by testing the reliability and validity of the content reviewed by experts in entrepreneurship based on the sentence structure, clarity of meaning and language used so that it is easy to understand in measuring a criterion. In line with the views of Flowers (2006) states that the validity of the content is important to implement to prove the content of the relevant items and represent the variables studied. The PBL indicator was capable of explaining sufficient variation in the measured construct, indicating that the survey instrument was reliable. Based on the Modified Delphi analysis, the measurement analysis demonstrated adequate the validity of the content and assessed using Content Validation Index (CVI) as reliability. Thus, the analysis proved to be not only solid but also flexible enough incorporate and measure of PBL indicator in entrepreneurial learning in order to produce technical entrepreneurs based on the agreement of the expert panels using a questionnaire for two round as a process in Modified Delphi Technique.

Overall, the results of the analysis (refer to Table 4) demonstrate that through Problem Based Learning (PBL) approach can encourage students to ability apply information, teamwork skills and decision making efficiency. This clearly indicates that the PBL approach applied through teaching and learning in entrepreneurship education had positive effects on students and able to produce competitive technical entrepreneurs that were capable to withstand the challenges ahead (Liu et al., 2015; Hosnan, 2014). This finding supports previous studies which found that the learning activities through PBL approach allow student to integrate information from many source, able to apply the information to the actual business and can use to analyze the situations before make the decision (Liu et al., 2015; Munawaroh, 2020) positive implication for student learning and teamwork through practical experience with professional activity, which can make learning more meaningful (Da Silva et al., 2018; Dewiyani, 2018) and promote the development of decision-making abilities through the identification and analysis of real problems (Da Silva et al., 2018). The current findings also parallel recent results indicating that PBL applied helps students in applying new knowledge in problem solving, sharing ideas with others, improving practical knowledge and skills in entrepreneurial activities, developing teamwork skills, freedom to find sources of information, cooperation with business community to solve real problems and co-existence between students and lecturers (Swart 2014; Solcan, 2016; Kain, 2003). Taken together, these findings suggest that the effective application of PBL can help students in the development of their thinking in exploring knowledge, identify real-life challenges in entrepreneurship and able to guide their business organization later.

Besides, the study was also found that the PBL approach can enhance the problem solving skills among students. This resonates with the results of several studies indicating that the active learning approach such as PBL can develop the problem solving skills of students and putting the wealth of knowledge as practice in real business (Kissi et al., 2020; Warnock and Mohammadi-Aragh, 2016; Solcan, 2016; Swart, 2014). The finding is also in line with Da Silva et al. (2018) claim that the real-world cases, sharing experience or business problem from businessman can help students create knowledge structures and provide more effective opportunity to develop problem-solving skills. Such statement indicate indirectly that students are able to acquire or expand their ability to understand reality of the field, finding the ideas and come up with innovative solutions to transform it (Da Silva et al., 2018; Abd Kadir, 2019; Vaidya, 2020).

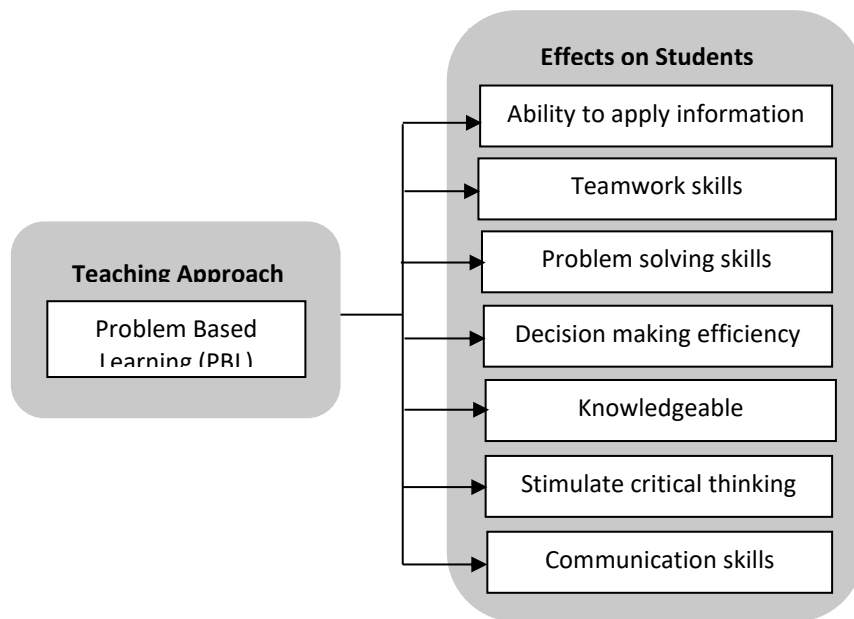
Next the study revealed that the PBL approach in teaching and learning of entrepreneurship education could provide opportunities for students to stimulate critical

thinking, knowledgeable entrepreneur and improve communication skills. Clearly, this findings inline those of previous research Pyykkönen and Kallioma (2013), found that the application of PBM in teaching and learning is able to improve students' knowledge and be able to understand more deeply with respect to marketing, accounting and human resource management. According to Liu et al. (2015), the PBL practice is able to have a positive effect on students, namely improving communication skills, decision making, stimulating critical thinking then be able to apply the knowledge gained in the field of entrepreneurship. This is consistent with Noor and Hafezali (2019), graduates who have experienced the PBL approach will have improved professional awareness and communication skills, also improved marketability and a stronger foundation for becoming high-tech entrepreneurs in the future. In general, activities through PBM can encourage students to learn how to work together as a team in solving problems, can increase students' curiosity before implementing or starting something and prepare students to think critically in solving problems (Dewiyani, 2018).

### **Conclusion**

Overall, the results of the study have provided valuable new insights regarding of Problem Based Learning (PBL) approach are an important method for producing TVET entrepreneurs in particular compared to the conventional approach in applying entrepreneurship education. In particular, this study reveals that the implementation of PBL as an active learning strategy in entrepreneurial learning has a suitable and significant effect on students to improve entrepreneurial skills. It can be concluded, the PBL approach can help students to ability to apply information, improve teamwork skills, problem solving skills, decision making efficiency, knowledgeable entrepreneurs, stimulate critical thinking and communication skills. It has also determined that the PBL approach is important for educators to introduce PBL as it plays an important role in producing competitive and capable technical entrepreneurs in facing future challenges. In addition, it will also assist policymakers in shaping a more effective education program with the right method of entrepreneurship teaching and learning in line with current industry needs.

The result and conclusions of the study must be considered in light of its limitations, to inform directions for future research. First, the study is early enquiry into the aims to identify the Problem Based Learning (PBL) approach in entrepreneurial learning in order to produce technical entrepreneurs. As it is a quantitative study, causal relations cannot be determined from the data. Although the positioning of the variables in in the present study is supported by the literature, future research is needed to examine the relations of the items so that causal relations can be established. Second, the experts consisted solely of lecturers from Community Colleges and Institutes of Teacher Education, IPG. Therefore, future studies is to expand the size of expert involvement by involving more experts such as NGOs, entrepreneurial agencies that involved in entrepreneurial development. In addition, future studies can address themes related to the PBL implications towards students' entrepreneurial intention.

**Appendix: Conceptual framework****References**

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