Development Of Integrated Creative And Critical Thinking Module In Problem-Based Learning To Solve Problems

Yee Mei Heong, Nuraffefa Hamdan, Kok Boon Ching, Tee Tze Kiong, Nurulwahida Azid

Abstract: Thinking skills are needed for individuals to come up with new ideas that can prevent failures and better solve problems. Therefore, this study aims to produce a Module of Integrated Creative and Critical Thinking in Problem-Based Learning (PBL). The print module is an individual teaching and learning method that can follow the guidelines and instructions to complete a process or activity. The main objective of this study is to identify the suitability of the format and content as well as the usability of the Integrated Creative and Critical Thinking Module in PBL. The development of this module uses the Sidek Module Development Model, while the content of the module is based on the Universiti Tun Hussein Onn Malaysia (UTHM) publisher guide. Verifying the suitability of the format, content and usability of the module involves three factors: UTHM lecturers with experience in module development, thinking styles and PBL. The study design was a product development and a descriptive survey study using a Likert-scale feedback form as an instrument. The study sample consisted of five lecturers and 10 students from the Faculty of Technical and Vocational Education, UTHM. Data obtained from the lecturers' and students' feedback were analyzed using Microsoft Excel 2013 to obtain the frequency and percentage values. Based on the feedback received, the suitability of the format and content and the usability of the module can be used as a guide for lecturers and students to solve problems during the learning and teaching process. Therefore, this module is an additional scientific tool for solving problems in PBL

Index Terms: problem-based learning, creative and critical thinking skills.

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1 INTRODUCTION

Higher Education Institutions (HEIs) play an important role in producing highly competitive students and the ideal characteristics of a student. As such, quality students who are also equipped with critical features such as innovation, critical thinking and other high values are directly helping Malaysia become a fully developed nation by 2020. Thinking skills are very important in the process of problem solving and decision making. With an understanding of thinking skills, individuals can explain new ideas and insights when interacting. According to [1], understanding students' thinking styles can help teachers become more effective and engaged in classroom activities that meet their students' thinking needs. The importance of thinking style is needed for individuals to generate a variety of new ideas, avoid failure and better solve problems. Thinking style is very important in terms of management, teaching and learning [2]. It is generally known that each individual has his or her own way of thinking. The style in question is the preference of style to thinking. Thinking style is an ability, and how we use our existing abilities. Everyone's thinking style is different. One of the thinking styles used to solve problems is creative and critical thinking.

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Creative thinking is the production of something creative as students are tested on a criterion to determine if the result is truly original or creative. Meanwhile, critical thinking skills are reflective thinking, that is, thinking deeply and giving serious consideration to something [2]. If an individual has a creative and critical thinking style, it can help solve problems in learning. Thinking style is an important dimension of the learning process that defines thinking as a mental activity that can formulate or solve problems [3]. Problem-Based Learning (PBL) is an approach used to help students argue and communicate well. PBL is also an approach that encourages students to work together in groups so that they can share their ideas and solve problems.

2 PROBLEM STATEMENT

Based on the problem background, most students in schools or institutions have a hard time understanding the learning in the classroom. This results in students having difficulty completing assignments given by the lecturers. In addition, graduates are now less likely to apply creative and critical thinking skills especially in solving problems in the classroom [4]. Moreover, these problems also occur due to graduates' poor skills in resolving problems [4] and failing to apply critical thinking skills. In addition, students' critical and creative thinking skill levels are low due to the lack of emphasis on teaching thinking skills during the teaching and learning process. The high unemployment rate in Malaysia is due to the lack of basic skills, expertise, communication skills and knowledge among graduates. The findings from preliminary studies also showed that almost all students are unaware of creative thinking and critical thinking in learning to solve problems. In this regard, this study was conducted to determine whether the format and content of this creative and critical thinking styles' learning module can be used for all HEIs to solve problems in PBL.

The objectives of this study are as follows:
1. Design the format of the Integrated Creative and Critical Thinking Module to solve problems in Problem-Based

Learning.

2. Produce the content of the Integrated Creative and Critical Thinking Module to solve problems in Problem-Based Learning.
3. Determine the usability of the Integrated Creative and Critical Thinking Module to solve problems in Problem-Based Learning.

3 RESEARCH METHODOLOGY

The design of this study is the development of a learning module and is a form of survey study using a quantitative approach. The data was obtained through a feedback form adapted by the researchers and cited by [5] for distribution to the respondents. The population of this study consisted of all institutes of Higher Education students and lecturers. The sample consisted of 5 lecturers and 10 students from the Faculty of Technical and Vocational Education, comprising students in Building and Constructions, Electric and Electronics, General Machining, Air Conditioning and Refrigeration, and Welding and Metal Fabrication courses at Universiti Tun Hussein Onn Malaysia.

3.1 Research Instrument

In this study, the researchers used the test form as a research instrument. This study used a Likert scale with five scale options. The Likert scale method is suited to be used in this study as it is an inventory showing the respondents' agreement using the scale set from one extreme to the other extreme [6]. The likelihood scale weights are shown in Table 1.

TABLE 1
LIKERT SCALE SCORES

Score	Scale
1	Strongly Disagree (SD)
2	Disagree (D)
3	Agree (A)
4	Strongly Agree (SA)

3.2 Student's Feedback

This feedback form was divided into four sections, namely A, B, C and D. The descriptions of the items of the students' feedback form are shown in Table 2.

TABLE 2
FOUR SECTIONS OF THE STUDENT'S FEEDBACK FORM

Section	Items	No of Items
A	Demographics of respondents.	3
B	Is the Integrated Creative and Critical Thinking Module's format suitable for solving problems in PBL?	11
C	Is the Integrated Creative and Critical Thinking Module's content suitable for solving problems in PBL?	13
D	Is the Integrated Creative and Critical Thinking Module useful for solving problems in PBL?	7

3.3 Lecturer's Feedback

This feedback form was divided into four sections, namely A, B, C and D. The descriptions of the item of the lecturers' feedback form are shown in Table 3.

TABLE 3
FOUR SECTIONS OF THE LECTURERE'S FEEDBACK FORM

Section	Items	No of Items
A	Demographics of respondents.	3
B	Is the Integrated Creative and Critical Thinking Module's format suitable for solving problems in PBL?	5
C	Is the Integrated Creative and Critical Thinking Module's content suitable for solving problems in PBL?	14
D	Is the Integrated Creative and Critical Thinking Module useful for solving problems in PBL?	6

4 DATA ANALYSIS

Descriptive statistics such as frequency and percentages were used to explain the data distribution as well as to resolve the research objectives. Data analysis was performed in Microsoft Excel 2013.

5 RESULT AND DISCUSSION

The following is an analysis of the findings of the three objectives:

5.1 Suitability of the Integrated Creative and Critical Thinking Module's format in Problem-Based Learning based on the lecturers' and students' feedback

The findings show that a majority of lecturers (92.0%) and students (100%) agreed that the format of this module is appropriate. This is because the layout of the module has a high-quality, clear and easy-to-understand description of each step. This is important in the development of a quality module so that students can improve their understanding and mastery of the content on their own. However, two lecturers (8.0%) disagreed with the format of the module regarding the visual element used. This is because some visuals used in the module is unclear. The use of media in the process of presenting information can produce more interesting presentations [7].

TABLE 4
SUITABILITY OF INTEGRATED CREATIVE AND CRITICAL THINKING MODULE'S FORMAT IN PROBLEM-BASED LEARNING BASED ON LECTURER'S FEEDBACK

	Item	Lecturer			
		D		A	
		f	%	f	%
1	All units have a description of the logical steps in each learning.	0	0	5	100
2	Learning activities are divided into small steps.	0	0	5	100
3	All visual elements are integrated into each learning.	2	40	3	60
4	All the units that make up the steps are organized according to each unit of learning.	0	0	5	100
5	Continuity of learning has been identified with dividers in each section.	0	0	5	100
	Total	0.4	8.0	4.6	92.0

Table 5 shows the results of the study showing that all students agreed that the format of this learning module is

appropriate.

TABLE 5
SUITABILITY OF INTEGRATED CREATIVE AND CRITICAL THINKING MODULE'S FORMAT IN PROBLEM-BASED LEARNING BASED ON STUDENT'S FEEDBACK

	Item	Students			
		D		A	
		f	%	f	%
1	Module size easy to carry.	0	0	10	100
2	The design of the pages of the module is interesting.	0	0	10	100
3	The text in the module is easy to read.	0	0	10	100
4	The number of diagrams in the module is sufficient.	0	0	10	100
5	The diagrams in the module are placed in the right place for reference.	0	0	10	100
6	Photos in the module are placed in the right place for reference.	0	0	10	100
7	The table in the module is easy to reference.	0	0	10	100
8	The text order in the module is easy to follow.	0	0	10	100
9	The instructions in the module are clear.	0	0	10	100
10	The spelling is correct	0	0	10	100
11	The use of punctuation is correct	0	0	10	100
	Total	0	0	0	100

5.2 Suitability of the Integrated Creative and Critical Thinking Module's content in Problem-Based Learning based on the lecturers' and students' feedback

The results of the survey conducted show that 100% of the lecturers and 97.70% of the students agreed that the content of this module is appropriate. This is because the module has appropriate learning objectives, good content and easy-to-understand steps within each module unit. This is supported by [8], who stated that   the use of appropriate materials is essential in the content of a module. Good teaching and learning materials are not only effective, but they attract and motivate students to stay engaged in learning [9]. In addition, the modular teaching method is a well-organized and guided teaching method. Planned teaching is a structured content-based learning system according to the sequence or steps of learning [10]. However, three students (2.30%) disagreed with the content of this module. The content may make students find it difficult to understand the steps shown in the module, as well as the use of less understood text. The students may not review every instruction and some of the texts given are too long. According to [11], the content delivery of a reading material should be concise and compact for easy comprehension.

TABLE 6
SUITABILITY OF INTEGRATED CREATIVE AND CRITICAL THINKING MODULE'S CONTENT IN PROBLEM-BASED LEARNING BASED ON LECTURER'S FEEDBACK

	Item	Lecturer			
		D		A	
		f	%	f	%
1	This module meets the requirements.	0	0	5	100
2	The purpose of the module has been explained to all users.	0	0	5	100
3	The introduction of this module gives a clear picture of the scope.	0	0	5	100
4	The general goals are clearly related to the purpose of the module.	0	0	5	100
5	All objectives tend to clearly achieve the goals of the module	0	0	5	100
6	All module content is directly related to the objective.	0	0	5	100
7	The contents of the module have been arranged logically in the order of learning.	0	0	5	100
8	The whole of each module unit is clearly categorized by category.	0	0	5	100
9	All learning activities fit into the content and objectives of the module.	0	0	5	100
10	All instructions are clear and understandable.	0	0	5	100
11	All instructions are easy to follow.	0	0	5	100
12	Page layout is well organized.	0	0	5	100
13	Page layout makes the module interesting.	0	0	5	100
14	Page layouts are easy to learn.	0	0	5	100
	Total	0	0	5	100

Table 7 shows the results of the study on the suitability of the learning module based on the students' feedback

TABLE 7
SUITABILITY OF INTEGRATED CREATIVE AND CRITICAL THINKING MODULE'S CONTENT IN PROBLEM-BASED LEARNING BASED ON STUDENT'S FEEDBACK

	Item	Students			
		D		A	
		f	%	f	%
1	I understand the objectives of the module clearly.	0	0	10	100
2	I can easily understand the steps shown.	1	10	9	90
3	I can understand the contents of the module.	0	0	10	100
4	The guide in the module is interesting.	0	0	10	100
5	I can do everything that the module directs.	1	10	9	90
6	The idea in the module is interesting.	0	0	10	100
7	The words used in the module are easy to understand.	0	0	10	100
8	The module's writing style is appropriate.	0	0	10	100
9	I understand all the texts in the module.	1	10	9	90
10	This module made it easy for me to learn.	0	0	10	100
11	I enjoy learning using modules.	0	0	10	100
12	The grammar used is easy to understand.	0	0	10	100
13	The terms used are correct	0	0	10	100
	Total	0.23	2.3	9.77	97.7

5.3 Usability of the Integrated Creative and Critical Thinking Module's in Problem-Based Learning based

on the lecturers' and students' feedback

Based on the results of module usability analysis, 100% of the lecturers and 98.57% of the students agreed that the Integrated Creative and Critical Thinking Module in PBL is applicable to the lecturers and students. This is because this module encourages students to engage in creative thinking using diagrams, tables, flow charts and graphs that are used clearly and easily. It can be argued that using diagrams, graphs, charts, maps, pictures, animations and videos in one module can help students during the teaching and learning process [12]. A majority of students said that this module can be used as the main reference for solving problems as it has explained step by step on how to integrate creative and critical thinking styles in PBL to solve problems. However, the information in this module also helps students to master the creative and critical thinking styles as well as solve tasks to solve problems in PBL. The glossary section also helps users to understand the meaning of words that are not understood in the module. Meanwhile, the indexes in the module help users easily find terms. However, one student (1.43%) said this module could not be used throughout the teaching and learning process in the classroom. It is likely that the student felt that the content of this module is not related to the learning syllabus and is not required by the lecturer, so it will not be evaluated in the course's test.

TABLE 8

USABILITY OF INTEGRATED CREATIVE AND CRITICAL THINKING MODULE'S IN PROBLEM-BASED LEARNING BASED ON LECTURER'S FEEDBACK

	Item	Lecturer			
		D		A	
		f	%	f	%
1	All learning activities encourage active participation and feedback.	0	0	5	100
2	Diagrams, tables, flow charts and other graphics are used to provide a clear explanation.	0	0	5	100
3	The reinforcement exercises available to each unit of learning are appropriate.	0	0	5	100
4	Overall, this module can motivate students.	0	0	5	100
5	High-level thinking skills can be integrated well into the module.	0	0	5	100
6	All aspects of the module can be used as a resource for learning success.	0	0	5	100
	Total	0	0	0	100

Table 9 shows the results of the study on the usability of the module based on the feedback from the students.

TABLE 9

USABILITY OF INTEGRATED CREATIVE AND CRITICAL THINKING MODULE'S CONTENT IN PROBLEM-BASED LEARNING BASED ON STUDENT'S FEEDBACK

	Item	Students			
		D		A	
		f	%	f	%
1	This module can be used as the main reference for solving problems in PBL by using creative and critical thinking styles.	0	0	10	100
2	I can use this module on my own.	0	0	10	100
3	I can use this module throughout the teaching and learning process in the classroom.	1	10	9	90
4	The information contained in the module helps me to master the creative and critical thinking styles to solve problems in PBL.	0	0	10	100
5	This module helps me to carry out PBL assignments provided by the lecturers.	0	0	10	100
6	The glossary section of this module helps me to easily find the meaning of a term.	0	0	10	100
7	The indexes in this module help me to easily find terms.	0	0	10	100
	Total	0.14	1.43	9.86	98.57

6 CONCLUSION

Overall, the results show that the Integrated Creative and Critical Thinking Module in Problem-Based Learning has been successfully developed. The module is designed to meet the requirements of lecturers and students. In terms of format and content elements, it achieves the research objectives, in which lecturers and students provided positive feedback

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