Design-Based Learning as Medium STEM Development Among Students of Ungku Omar Polytechnic

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Abstract

STEM development emphasizes the concept guided by the 4C components which are communication, collaboration, creativity, and critical thinking as contained in 21st-century learning (PAK-21) as well as higher-level thinking skills (KBAT). Design-based learning is an effort to ensure the strengthening of STEM Education initiatives. The effort to implement this competition can produce students who can create, logical thinking, use technology, solve problems, and create ideas or something new through integrated learning that includes STEM that applies the real-world context. Therefore, this competition will be the symbolic identity of the logo and tagline of STEM concept awareness. That, STEM education can produce human capital skilled in the field of technology. Through STEM education, the young generation can be creative and innovative and produce people who have the potential to create interesting projects that can compete. This study involved a total of 110 respondents consisting of STEM Club students, semester 1, 2, and 3 students at Ungku Omar Polytechnic. This competition focuses on cognitive, psychomotor, and affective development among participants. In this competition, students are given theallowedight of their talent and ability in producing a STEM Logo and Tagline. The students should provide a rationale for the design of logos and symbols and colours used based on STEM concepts and submitted online to be evaluated at the polytechnic level. This STEM education approach can realize the aspiration of becoming a developed country through quality resources to produce creative and innovative human capital in the future.

Keywords**:** *STEM education; Design-Based Learning; Logical Thinking*

I. INTRODUCTION

STEM is an acronym for the integration of science (S), technology (T), engineering (E), and mathematics (M) STEM education is promoted in many countries to prepare their citizen to understand STEM and have multidimensional capabilities to use in modern life. STEM Education is provided to achieve educational aims that prepare people for future life and the workforce [1].

STEM education is Education based on the integration of the four fields of Science, Technology, Engineering, and Mathematics. STEM education is one of the agendas emphasized in the implementation of the Malaysian Education Development Plan (PPPM) 2013-2025.

STEM education in PPPM is implemented in three phases [2].

(i) Wave 1 (2013-2015): strengthening the quality of STEM education was initiated through strengthening the curriculum, testing, and training teachers, and the use of multimodal learning models.

(ii) Wave 2 (2016-2020): campaigns and collaborations with related bodies are implemented to attract community interest and awareness in STEM.

(iii) Wave 3 (2021-2025): STEM will be moved towards excellence through increased operational flexibility.

STEM education is a teaching and learning approach that involves the application of STEM knowledge, skills, and values to solve problems in the context of daily life, society, and the environment [3].

In connection with that, there has been an improvement in STEM education methods, now STEM has been changed to STEAM or STEM-A (Science, Technology, Engineering, Mathematics, and Art). For the countries that have started it, improvements are needed, especially the

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'curriculum' in science and mathematics education; provide skills training to existing educators and ensure the improvement of prospective educators in STEM and STEAM programs. With the addition of art elements in STEM education, it can produce students who think creatively to produce a product in a real situation. Art is not just about working in a studio. Art is about finding and creating clever ways to solve problems, integrate principles, or convey information. Integrating literature-related skills, knowledge, and activities into STEM programs is an effective way to increase student interest and achievement. Therefore, this activity has been planned and implemented to increase student involvement to focus on current issues, increase motivation and build creativity among students [4].

STEM moves beyond simple test performance and focuses on developing higher-level thinking skills by connecting classroom learning to the real world. STEM emphasizes collaboration, communication, research, problem-solving, critical thinking, and creativity, skills that students need to be successful in today's world regardless of specific interests or career goals. STEM is a direct response to the realization that our future will be built on our capacity for innovation, invention, and creative problem-solving.

Problem Statement

One of the biggest concerns people often hear about STEM education is the lack of resources. Funding for the latest technology, training in the use of new technology, and effective knowledge in mastering STEM fields.

More efficient implementation of STEM requires lecturers to have in-depth knowledge of Science, Technology, Engineering, and Mathematics content [5].

Accordingly, another area where many lecturers struggle is with a system that focuses on assessment and grades rather than programs that foster innovation, creativity, critical thinking skills, and problem-solving skills. Therefore, various activities related to STEM concepts often need to be specially organized for students to participate. Participants must possess proper knowledge of the colour palette. A thorough understanding of colour theory will help aspiring

Research objective

This study was conducted to find out the students' perception of designing a STEM logo and tagline that has been carried out.

Scope of the research

This study only focuses on the perception of students who participated in the competition to create and tagline STEM. This study only looked at students' enjoyment and new exposure in improving the creativity of STEM logo object design and tagline.

Limitations of the study

This study involves Ungku Omar Polytechnic students. The respondents consisted of 110 students who as participants in the competition, created the STEM logo and tagline. This study uses a questionnaire from Google Forms for data collection.

II. LITERATURE REVIEW

This section talks about STEM education, design logos, and logical thinking.

STEM Education

STEM Education is the future, the driver of the new economy, producing creators, innovators, and problem solvers. An innovation-based economy requires STEM talent who will be the scientists, innovators, and creators of the future. STEM education can produce STEM-literate students who are creative, innovative, and inventive and apply and integrate STEM concepts to understand problems and solve them [6].

The emphasis on the STEM field in Malaysian education has become more aggressive since 2007. Several STEM initiatives in Malaysia were designed and carried out to ensure that it moves in line with the country's ability to develop successfully.

Logically Thinking

Characteristics of STEM literate students include technological literacy, logical, creative, innovative, inventive thinking, and problem-solving. Computational thinking can help students solve problems in a systematic and creative way. Logical thinking allows students to think logically and rationally. Being creative, innovative, and inventive, students can create ideas, and invent new products.

The STEM curriculum through teaching and learning needs to involve thinking cognitively or effectively. It should be applied from a STEM perspective. To achieve reform efficiently and effectively, a country needs students who have innovative thinking [7]. This along with logical

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thinking is a fundamental skill required to become a successful designer. To communicate the personality and identity of various brands through unique symbols and should have a creative spirit.

Teachers need to understand how to implement STEM effectively to provide the best learning experience for students. Active and quality STEM learning and teaching. This shows that STEM education is a form of an integrated curriculum that integrates these core academic subjects. based on specific theme units and skills [8].

Although education experts advocate the incorporation of integrated STEM curriculum units to overcome limitations in current STEM teaching and learning, therefore, those curriculum units do not mediate the construction of deep STEM knowledge [9].

A STEM education approach emphasizes a new way of teaching and learning that focuses on hands-on inquiry and open-ended exploration. The approach allows students with diverse interests, abilities, and experiences to develop skills, they will need in the 21st-century workforce (e.g., problem-solving, creative thinking, collaborative teamwork, and technology literacy) [10]

STEM education can link scientific inquiry, by formulating questions answered through investigation to inform the student before they engage in the engineering design process to solve problems [11].

Design-Based Learning

Design-based learning is a learning strategy that requires students to use their theoretical knowledge to develop an artifact to tackle a real-life problem [12].

Designing is based on technology and emphasizes student creativity. This aims to educate students to equip themselves with knowledge, skills, values, and creative, critical, innovative, and inventive thinking as well as potentially nurture themselves with sustainable practices with the transformation of the development and expansion of the country's industry [13]. Design Based Learning enhances students' imagination, creativity, and talents while improving higher-order thinking and understanding.

There is several logo creation software that can be used. This software includes canvas and Adobe Illustrator applications. Through the Canva application, students can easily create a logo for free online. Canva provides all the necessary materials to create a suitable logo, fast and for free. Canva has provided logo templates that have been created with colour combinations. But if students have something specific in mind, they can easily adjust the colours throughout the logo design. The result of the logo designed by canvas is in PNG format. PNG is the best choice for producing clearer, higher-quality images than other file formats. The advantage of PNG images is that they can use a transparent background so that the logo can be used on top of another coloured background without any colour clash. Creating a logo stimulates awareness by attracting people's attention [14].

III. RESEARCH METHODOLOGY

Participant and procedure

A total of 110 students from the first semester until the third semester in Ungku Omar Polytechnic.

Instruments

This study uses a quantitative research design, a survey method that uses a questionnaire with the Google Form application to collect data. The survey conducted is to see the perception, and views of students towards creating STEM logos and taglines. The data obtained were analyzed using descriptive statistics such as mean and percentage.

Table 1: Scoring Likert Scale Items

Scale	Measurement
1	Strongly Disagree
2	Disagree
3	Agree
4	Strongly Agree

Data Analysis

The Data obtained from the questionnaires were analyzed and presented using descriptive statistics such as mean and standard deviations.

IV RESULT AND DISCUSSION

Students Profile

The questionnaire was administered to 110 students. The student sample was a convenience sample of which students from three semesters.

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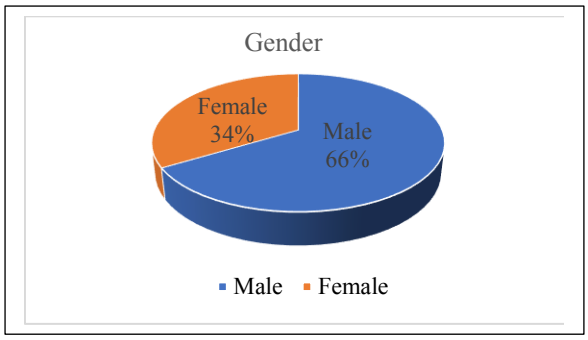
The number of respondents involved is a total of 110 respondents consisting of 73 male respondents which are 66% and 37 female respondents 34%.

Table 1: Demographic

	Demographics	Number	Percentage
Gender	Male	73	66
	Female	37	34
	Total	110	100

Figure 1: Background of Respondents



Category

The number of respondents involved in the Semester 1 category is 48, which is 44%. Semester 2 category is 17 respondents who are 15%. While in Semester 3 Category 33 respondents are 30%. Next for the STEM Club category, there are 12 respondents, which is 11%.

Table 2: Respondents' category

		Number	Percentage
Category	Semester 1	48	44
	Semester 2	17	15
	Semester 3	33	30
	STEM Club	12	11
	Jumlah	110	100

Figure 2: Respondents' category

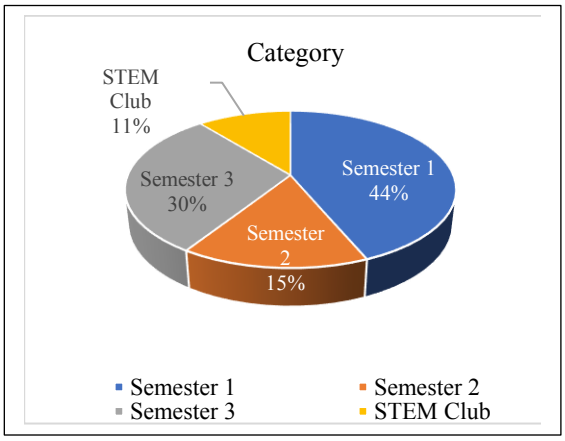


Table 3: B1 I have participated in programs like this before

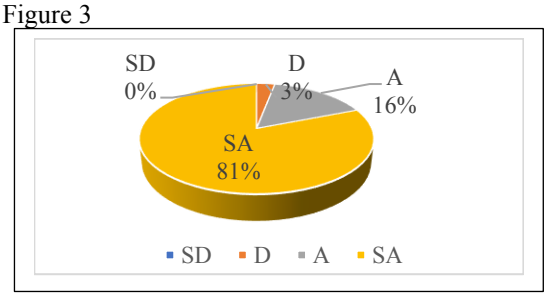
Gender	Yes	No
Male (n=73)	13 (87%)	60 (63%)
Female (n=37)	2 (13%)	35 (37%)
Total	15 (100%)	95 (100%)

Based on the findings of the study, a total of 15 respondents have participated in this program and 95 respondents have never participated in this program. Among them, there are 13 male respondents which is 87%, and 2 female respondents which is 13% who have participated in the program.

Students' perception of creating a STEM logo and tagline

B2 I enjoy participating in this program because it helps me in improving my creativity.

Figure 3



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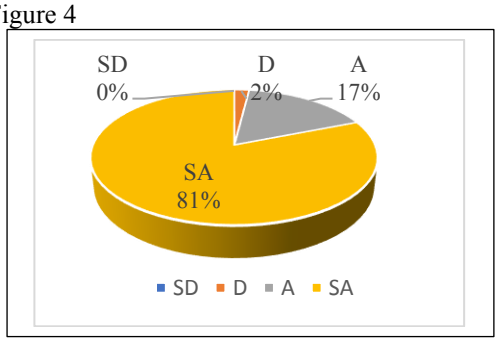
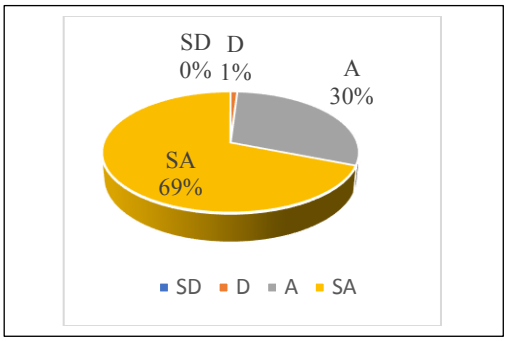
B3 This program has given me new exposure to the production of quality CSTEM logos.

Figure 4



B4 I joined this program because I am interested in creating a new design for a product.

Figure 5



Notes:
SD-Strongly Disagree
D- Disagree
A- Agreed
SA – strongly agree

From Figure 3, there are 89 respondents which are 81% strongly agree that participating in this program because it helps me in improving my creativity and this program has given me new exposure to the production of quality CSTEM logos.

From Figure 4, there are 89 respondents 81% strongly agree that I participated in this program because I am interested in producing a new design for a product.

From Figure 5, there are 69% of respondents strongly agree that I joined this program because I am interested in creating a new design for a product.

Table 4
B5 I will join the CSTEM program again if it opens in the future

Gender	Yes	No
Male (n=74)	73 (67.0%)	1 (100.0%)
Female (n=36)	36 (33.0%)	0 (0%)
Total	109 (100.0%)	1 (100.0%)

From Table 4, 109 respondents will participate in the CSTEM program again if it opens in the future including 73 which is 67% of male respondents and 36 which is 33% of female respondents.

DISCUSSION

This section discusses the results of the study after the researcher analyzed the data obtained from the respondents. The findings of this study show that respondents gave a positive response to the design of CSTEM's logo and tagline. This statement is also supported by [15] who stated that thinking logically can give important implications to students to try to improve students creativity and innovativeness.

The competition to create a logo and tagline for this form is an activity that is being implemented for the first time. The STEM education initiative in the school education curriculum is an effort to improve and encourage students to be involved in the STEM field where through this statement, it can be concluded that the organization of this competition can help the development of initiatives from education. In addition, organizing this competition, can still students' interest in STEM education as in the study by [16].

VI CONCLUSION

Overall, the skills of creating logos and taglines as a medium of STEM development have a positive response from students. This competition can produce students who can create, think logically, use technology, solve problems, and create ideas or something new through integrated learning that includes STEM that applies the real-world context. Therefore, this competition will be the symbolic identity of the Logo and Tagline of STEM concept awareness. This competition can unearth the talent and skills of the students to produce quality CSTEM logos and taglines that can then be used as the official CSTEM PUO logo.

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