

Development and Usability of STEAM Textbook Integrated Character Education with Local Wisdom Themes for Primary School Students

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This study aims to develop a valid, usable, and creative for project-based learning STEAM (Science, Technology, Engineering, Arts, and Mathematics) textbook integrating character education with local wisdom themes for primary school students. Design and Development Research (DDR) based on the ADDIE model was used as the research design. Three experts were used to validate the STEAM textbook and 58 mathematics teachers and 60 students of Year 4 from the Perak Tengah district participated in the usability survey. The data were analyzed descriptively (percentage, mean and standard deviation) and Pearson correlation. The results show the STEAM textbook has excellent validity with 90% agreement from the experts. The usability of the STEAM textbook was rated well by teachers with a mean of 4.21 (SD = 0.45) and by students with a mean of 3.69 (SD = 0.17). This indicated that the textbook is usable for teachers and students. Pearson correlation also revealed a strong relationship between the variables with $r = 0.967$. Overall, the STEAM textbook has high validity and usability among teachers and students.

Keywords: character education, development, local wisdom, STEAM, usability

INTRODUCTION

The human resources profile in Malaysia shows the lack of skilled workers who are ready to work with various competencies to meet the needs of being the seventh largest economy in the world by 2035 (CIPD Report, 2019). Not only competent, but Malaysia also needs workers who have good character and can preserve and develop Malaysian culture and local potential. Education is the main target for establishing quality human resources from an early age, especially in improving the education system by industry needs and technological development. "STEAM education," with its addition of "arts" to STEM subjects, is a complex and contested concept. The addition of the arts may point to the recovery of educational aims and purposes that exceed economic growth: for example, by embracing social inclusion, community participation, or sustainability agendas (Laura et al., 2019). This research will develop STEAM in the form of textbooks for primary school students integrated character education to develop student personality from an early age. The theme of Local Wisdom is contained in the textbook to increase love for the motherland in students. The textbook that will be developed contains five STEAM elements that are integrated with character education and contain the theme of local wisdom of Perak Tengah District (Pasir Salak). In this research, the Kutai house in Pasir Salak is a historical element to be used in this study. One of the uniqueness of the Kutai house is built without nails. With the uniqueness of this Kutai house (the design and structure), it is fit to be the main focus of the STEAM textbook. This research was conducted at a Primary school in Perak Tengah District (Pasir Salak area). This research use ADDIE development methods, namely Analysis, Design, Develop, Implement, and Evaluate. Research benefits as an effort to improve the quality of human resources early on, researchers can evaluate critical thinking skills and improve student character.

The field of science and technology has been emphasized in the policy of national development since 1967. The policy of science student ratio: literature (60:40) began in 1970 in our country's education system. The Malaysian Science and Technology Indicators Report 2004 shows that science and technology graduates produced by the HEIs are only 32.4% compared to the requirements of 60% in this field. Unfortunately, the problem of students pursuing science and technical trends is still unresolved in our country's education system. Only 19% of the approximately 447,000 candidates who took the Form Three Assessment (PT3) entered the stream of science when they made their way to Form Four.

Fatin Aliah Phang et al. (2012) in their study on 344 undergraduate and doctoral theses conducted at nine HEIs for the period 2001-2010 found that many undergraduate students have the necessary qualifications to pursue a degree in science. They also have a high interest in and a positive attitude toward science and mathematics. However, anxiety about learning difficulties and low levels of academic confidence in science and mathematics subjects prevented them from continuing their studies in the science stream. Teacher teaching factors, assessment systems, demographic factors, and school management indirectly influence student participation in the science stream. Relevant studies have been conducted on the factors that reduce the percentage of student participation in the science stream.

In addition, students generally think that science and mathematics subjects are difficult to learn. This perception arises because many students experience learning difficulties and achieve low achievement in science and mathematics. Common problems faced by students are an inadequate understanding of science and mathematical concepts, weaknesses in the mastery of science and mathematics, and difficulty in building and mastering science concepts (Abdullah & Wei, 2017). Besides that, the majority of primary schools in Malaysia do not prepare their students' education for the needs of industry and technological development. However, the existence of technology is currently causing a lack of love for the homeland of Malaysian teenagers due to the influence of outside cultures that enter through technology. Whereas the textbooks which are the reference for student learning have not been able to attract students' interest in learning. Malaysian culture needs to be introduced early on through education to keep up with rapidly developing technology. Malaysian culture needs to be introduced early on through education to balance the rapidly developing technology, one of the ways is by developing textbooks. This textbook will be suggested to be used by the Ministry of Education (MOE) as one of the textbooks at the primary level. It can serve as one of the teaching aids in STEAM education. It is because STEAM education uses STEM plus the subjects of Art (Arts), Literature, and Culture (Art / Culture). Thus scientists/engineers born can integrate art and

beauty and culture into a product produced. STEAM strengthens creativity in problem-solving. In the opinion of experts, STEAM is more comprehensive and better for future career prospects (Aminah, 2020).

Kutai house (Figure 1) in Pasir Salak is a historical element to be used in this study. One of the uniqueness of the Kutai house is built without nails. With the uniqueness of this Kutai house (the design and structure), it is _ to be the main focus of the STEAM textbook. Therefore, even though students are studying in the STEAM field, the local history element remains intact. Therefore, to ensure that the increasing ratio of students interested in science and technical education and at the same time local wisdom need to be known, this study needs to be carried out. To achieve the goal of becoming a developed nation capable of meeting technological challenges and economic demands by 2050, each of these students needs to be shaped according to future needs.

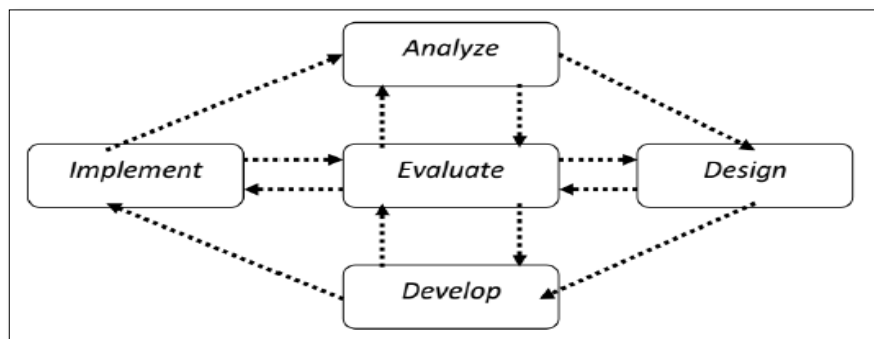
**FIGURE 1
KUTAI HOUSE**



METHODS

This research is development research with the ADDIE development model, namely Analysis (preplanning), Design (designing concepts), Development (developing tools), Implementation (implementing products on learning), and Evaluation (measuring the achievement of product development) (Nada, 2015). The stages of ADDIE development can be seen in the following Figure 2.

**FIGURE 2
ADDIE DEVELOPMENT PHASE**



Zoe, 2020

Data collection techniques using the purposive sampling method, the sampling technique with certain considerations (Sugiyono, 2017). The population in this study is SK Jalan Pegoh, Ipoh, Perak taking 2

classes as a sample. While the data collection techniques used the method of documentation and questionnaires. The instruments used in this study include expert validation instruments and questionnaire instruments. For data processing, several analyses were carried out, including:

- Expert validation analysis of the results of the validation instruments that have been given to experts to find out the validity of the product.
- Analysis of the questionnaire and STEAM Textbook that will be tested for validity

FIGURE 3
STEAM TEXTBOOK DESIGN



Figure 3 shows the STEAM textbook was developed for Year 4 students on the Measurement topics. It was developed with five elements, science, technology, engineering, art, and mathematics (STEAM), by integrating character education with local wisdom themed for primary students. The addition of an art element helps to train and improve students' creative and artistic thinking skills. The integration of character education is good for individual personality development and must be taught at a young age. The theme of local wisdom included in this textbook aims to strengthen students' love for the homeland despite widespread borderless technological development. This theme of wisdom focuses on the historical elements, namely the design and uniqueness of the Kutai house structure in Pasir Salak. This textbook was developed as a supplementary textbook for teachers and a guide for teachers to effectively apply the elements of STEAM by integrating character education and local wisdom themes in teaching and learning. The project-based learning (PBL) approach and the 5E instructional model were used to promote constructivism in students. This approach helps students develop new ideas based on their old ideas. The 5E instructional model stands for Engage, Explore, Explain, Elaborate, and Evaluate in the learning process. It is a complete phase that allows students and teachers to perform an activity by applying basic knowledge, shaping, and ultimately improving their understanding of the next concept.

RESULTS AND DISCUSSIONS

The content validity of the STEAM textbook consists of 27 items that include the content, exercises, projects, presentation, language, and terms used in the development of the STEAM textbook as shown in Table 1. The results show the STEAM textbook has excellent validity with 90% agreement from the experts.

TABLE 1
VALIDITY OF THE STEAM TEXTBOOK'S CONTENT

Item	Terms	Percentage (%)
1,2,3,4,5,6	Content	88
7,8,9,10,11	Exercises	88
12,13,14,15,16,17	Projects	91
18,19,20,21,22	Presentation	93
23,24,25,26,27	Language and Terms	92
Overall		90

Table 2 shows the interpretation of the mean value for the students' usability of the STEAM textbook. There are four terms in textbook usability which formats, content, objective accessibility, and satisfaction. The satisfaction of the textbook shows the highest mean with 3.77 (SD=0.22) compared to the other terms. This concludes that the usability is perceived as good by the respondents. Followed by the format of the textbook shows the mean is 3.71 (SD=0.17) also in high mean value for the usability of the STEAM textbook. Item 8 with a mean of 3.80 (SD = 0.40) shows that the project provided is appropriate. Next, overall, the textbook's content developed, shows a mean of 3.67 (SD = 0.20). Item 20 shows that the style of writing textbook is suitable with the highest mean is 3.87 (SD = 0.34) than other items. In terms of the objective accessibility of the teaching and learning process from the student's perspective the lowest mean is 3.63 (SD=0.29) than other terms. Item 20 shows that the students can carry out the assigned tasks with the highest mean is 3.72 (SD = 0.49) than items 21, item 23, and item 24. Overall, the terms show that they are rated with a high mean. It concludes that the 28 items of textbook usability result in a mean value of 3.69 (SD=0.17). This interpretation of the mean value for the students' usability of the textbook revealed that the usability is perceived as high by the respondents.

TABLE 2
STUDENTS' USABILITY OF THE STEAM TEXTBOOK

	Item	Mean (Min)	Standard Deviation (SD)
Format	1, 2, 3, 4, 5, 6, 7, 8	3.71	0.17
Contents	9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20	3.67	0.20
Objective Accessibility	21, 22, 23, 24	3.63	0.29
Satisfaction	25, 26, 27, 28	3.77	0.22
Overall		3.69	0.17

Table 3 shows the interpretation of the mean value for the teachers' usability of the textbook. There are five terms in textbook usability which are the formats, content, accessibility, and feasibility of objectives, and satisfaction. The format of the textbook shows the highest mean with 4.34 (SD=0.42) compared to the other terms. This concludes that the usability is perceived as good by the respondents. Followed by the contents of the textbook shows the mean is 4.25 (SD=0.48) also in the high mean value for the usability of the textbook. Item 10 with a mean of 4.33 (SD = 0.57) shows that the ideas found in the textbook are

interesting. Item 19 and item 20 show the same mean of 4.31 (SD =0.57 and SD 0.54). This shows that the words used are easy to understand and the writing style fits the textbook developed. The lowest mean value compared to the others item in textbook content describes that item 15 (the prepared project can be well followed by the students) has the lowest agreement with the mean value of 4.07 (SD = 0.59). Overall the objective accessibility of the textbook developed, shows a mean of 4.14 (SD = 0.52). Item 21 shows that the teaching project helps to achieve the objectives set with the highest mean is 4.24 (SD = 0.60) than item 22, item 23, and item 24. In terms of the feasibility of the teaching and learning process from the teachers' perspective, two items show that item 25 and item 26 are below 4 with a mean of 3.83 (SD = 0.68) and 3.81 (SD = 0.66), respectively. Respondents' agreement is lower when it comes to the adequacy of the proposed time for teaching each sub-textbook and the sufficiency of the proposed time for the student project. In addition, the satisfaction textbook shows that the mean value of 4.12 (SD = 0.61) corresponds to the feasibility of the teaching and learning. The lowest mean, which is above 3, shows that item 36 (the textbook helped me teach more effectively) is lower than other items with a mean of 3.98 (SD = 0.76). This item shows that the respondents least agree with the effectiveness of the textbook in helping them teach. Overall, the terms show that they are rated with a high mean, based on the interpretation table of [9]. It concludes that the 38 items of textbook usability result in a mean value of 4.21 (SD=0.45). This interpretation of the mean value for the teachers' usability of the textbook revealed that the usability is perceived as high by the respondents.

TABLE 3
TEACHERS' USABILITY OF THE STEAM TEXTBOOK

	Item	Mean (Min)	Standard Deviation (SD)
Format	1, 2, 3, 4, 5, 6, 7, 8	4.34	0.42
Contents	9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20	4.25	0.48
Objective Accessibility	21, 22, 23, 24	4.14	0.52
Feasibility of Teaching and Learning Processes.	25, 26, 27, 28, 29, 30, 31, 32, 33	4.12	0.47
Satisfaction	34, 35, 36, 37, 38	4.12	0.61
Overall		4.21	0.45

Table 4 shows the relationship between teachers and students towards the development and usability of STEAM textbook integrated character education with local wisdom themes for primary school students. The data were also analyzed inferentially using Pearson's r with 0.967 to show the two variables was a strong relationship. Whereas the value $p=0.006 < 0.05$ (2 tailed) indicates the null hypothesis is rejected because there is a significant relationship between teachers and students.

TABLE 4
RELATIONSHIP BETWEEN TEACHERS AND STUDENT TOWARDS STEAM TEXTBOOK

Variables	Total (N)	Correlation, r	Sig. (2 tailed)
Teachers	58	0.967	0.006
Students	60		

CONCLUSION

In conclusion, the STEAM textbook has high validity and usability among teachers and students. The results of this study show that the STEAM textbook can be used as an alternative teaching material for teachers and helps to improve student understanding, especially in the subjects of measurement and geometry. The findings are generally expected to contribute to the production of high levels of human capital. This is because, even though students are studying in the STEAM field, the local history element remains intact. This means, the characteristics and customs of the Malay are still stored neatly within them.

In addition, the STEAM Textbooks Integrated Character Education with Local Wisdom is expected to help the country achieve a better position in the TIMSS and PISA assessment tests. In conclusion, it is hoped that the findings will be helpful to various parties, especially the Ministry of Education Malaysia, the Institute of Teacher Education, Public and Private Universities, the State and District Education Departments and most importantly to the schools, their teachers and students.

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