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Analysis of validity, practicality, and readability of islamic STEAM activity storybook for early childhood

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Abstract

So far, separating science and religion has brought the world into chaos. In contrast, science and religion do not need to be a dichotomy because they can be integrated constructively to solve problems in human life. This study aims to analyze the validity, practicality, and readability of Islamic Science, Technology, Engineering, Art, and Mathematics (STEAM) Activities for Early Childhood (EC), which is part of design research. The research approach uses quantitative methods with a design that refers to the Plomp model. The results of the validity test show that the resulting product is very valid with improvements in standard and non-standard language, use of fonts, enlargement of font sizes, and improvements in Higher Order Thinking Skills (HOTS) questions. After going through the improvement of the prototype, readability, and practicality tests, the results were very good and suitable for use. The results and steps of this study can be used as a reference for other researchers who want to test the validity, practicality, and readability of reading product development for early childhood. In this STEAM Storybook product, more emphasis is placed on integrating Islamic content and activities with the Engineering Design Process.

INTRODUCTION

Pancasila student profile, which focuses on religious character, noble character, cooperation, independence, and critical and creative thinking skills, needs to be nurtured early (Fuadi et al., 2022; Rahayuningsih, 2021; Yuniarti et al., 2021). Learning Science, Technology, Engineering, and Mathematics (STEM) and Science, Technology, Engineering, Art, and Mathematics (STEAM) can encourage 21st-century skills because, in learning, students are expected to be able to solve problems collaboratively by utilizing five disciplines, namely Science, Technology, Engineering, Mathematics and the Arts (Gandi et al., 2019; Perignat & Katz-Buonincontro,2019 ; Taylor, 2016).

However, the elements of the Pancasila Student Profile do not only focus on 21st-century thinking skills but also the relationship between the individual and the relationship with God, namely belief in the one and only God. The United Nations (UN) summarizes the

Sustainable Development Goals (SDGs) as a world problem, and STEAM learning is part of solving these problems (Alabi et al., 2019; Hsiao & Su, 2021; Syahmani et al., 2021). Mehdi Ghalsani emphasized that so far, separating science and religion has brought the world into chaos, even though science and religion do not need to be a dichotomy because they can be integrated constructively to solve problems in human life (Hidayatullah, 2018; Rifenta, 2019; Syarif, 2018). Thus, STEAM learning with Islamic content can foster the Pancasila Student Profile.

Based on these educational goals, the government launched Literacy and STEAM for children as superior programs to improve 21st-century character and skills, referring to the values of Pancasila (Prastyo et al., 2021; Suryawati & Akkas, 2021; Syahmani et al., 2021; Walsiyam, 2021). Literacy teaches children to read and write and invites them to use reading to solve problems around them (Edwards & Potts, 2008; Koyuncu & F\irat, 2020; Machado, 2015). STEAM learning is a step that can foster literacy because children are invited to solve problems by utilizing five disciplines in an integrated manner (Adriyawati et al., 2020; Budiarti, 2022; Permanasari, 2016). Several researchers have studied the relationship between STEAM and early childhood literacy, resulting in a positive relationship (Budiarti, 2022; Nipriansyah et al., 2021; Nirmalasari et al., 2021; Sari et al., 2021).

The picture story books are one of the media for implementing EC STEAM learning. Through picture story books containing STEAM learning, children are invited to formulate and solve problems shown in the storyline. Reading picture story books cannot be separated from the development of EC literacy (Machado, 2015; Saracho & Spodek, 2010; Savva et al., 2022). Various storybook socialization programs and storybook reading methods can build children's literacy early (Beauchat et al., 2009; Ursa & others, 2018; Waldron, 2018). In addition, teachers can easily adapt to STEAM learning through reading story books compared to engineering design (Barber et al., 2020).

Although there are already circulating story books in Indonesia containing STEAM (Siantajani, 2019), the integration of science and the Qur'an has not been found. This research has been carried out on designing an integrated learning model with story books to develop EC creative thinking (Maharani & others, 2020). STEAM learning arises when children are challenged with problems in story books, such as story books containing STEAM learning Rhodes (2019) and (Rivera & Allman, 2018). Therefore, there needs to be a STEAM activity sheet that children can complete independently or collaboratively. The Islamic content of

connecting the content of the Qur'an with the integrated scientific phenomenon of STEAM is a new thing that can be explored further. A credible reference as a source of information linking science with the content of the Qur'an is Tafsir Salman by the ITB Tafsir Team in 2014, which has been reviewed by critics that the method of interpretation used is following the rules of scientific interpretation (Agustin, 2021; ITB, 2014; Muchlisin & Nisa, 2017).

Referring to the above, this study aims to test the validity, readability, and practicality of Islamic STEAM activity storybooks as part of the design research process.

METHODS

The trial was carried out at RA Plus AS. The school was chosen as a limited trial location because this school is a kindergarten that implements an Islamic religious curriculum and represents kindergartens in general at an affordable cost for the middle class. In addition, it is known that the majority of EC parents' education is high school as shown in Figure 2 so it is hoped that the results of the study will not be too influenced by the educational disparity of EC parents. The formative test of prototype one was carried out by testing the content validity of the media feasibility to three experts, namely two experts in the field of Early Childhood Education (ECE) and one expert in the field of Natural Sciences education. Furthermore, the validity was carried out by seven teachers of RA Plus AS. The instrument used is a questionnaire with a Likert scale of 1-5. The calculation of content validity is based on the Vaiken formula (Bashooir & Supahar, 2018; Kurniawati, 2021; Utari et al., 2021) as follows:

This research was carried out using a design research approach with the scheme shown in Figure 1.

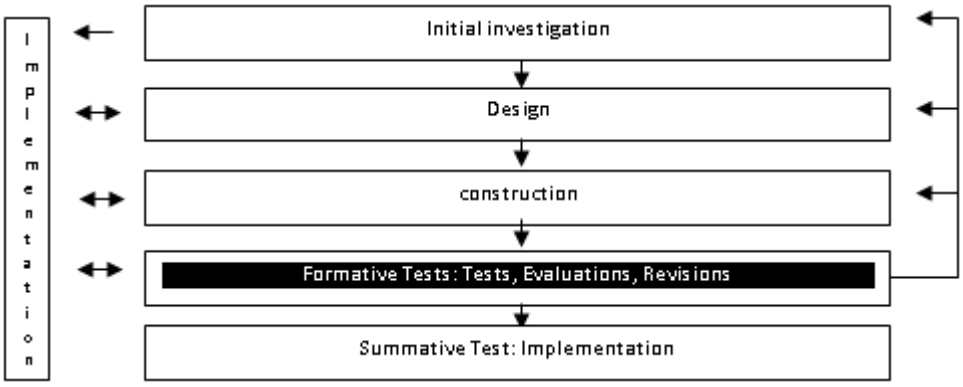

Figure 1. Plomp Model Design Research Schematic

RESULTS AND DISCUSSION

A. Result

The initial investigation of the characteristics of the prototype development of the Islamic STEAM Activity Storybook before entering the formative test stage has been published (Metafisika et al., 2022). The difference between this product and the previous STEAM Storybook products for EC (Rhodes, 2019; Rivera & Allman, 2018; Siantajani, 2019) is in the characteristics of the STEAM Storybook, which emphasizes integration with Islamic content and activities with the Engineering Design Process (EiE, 2021) inside it.

Table 3 shows the results of the prototype content validity test of the three expert validators.

Table 3. Content Validity Test Results

Aspects of Assessment	Content Validity	Criteria
Conformity of material with KI and KD	0,75	Valid
The material presented has no wrong concepts	0,725	Valid
The extent of the material according to the development of EC	0,725	Valid
The depth of the material corresponds to the development of EC	0,725	Valid
The suitability of the material with the development of science	0,8	Valid
The images and graphics used to clarify the material	0,8	Valid
The language used is easy to understand and unambiguous	0,75	Valid
Writing following linguistic rules	0,75	Valid
Font size fits	0,8	Valid
Font match	0,75	Valid
The colour of the letters corresponds to	0,8	valid
The layout of the images and tables corresponds to	0,8	Valid
Interesting to read and learn	0,9	Very valid
The colour combination matches	0,9	Very valid

The results of the content validity test show that the results of the assessment of prototype 1 are valid and very valid. Very valid values are obtained in the combination of colours, and books are considered interesting to study. There are corrections from the

validator regarding the consistency of using standard or non-standard language, font size that is not large enough, and the use of the HOTS command, which is considered confusing to readers. This is corrected and discussed again with the validator to get an agreement.

After being improved into prototype 2, a limited trial was carried out to assess the readability of the book and its practicality of the book. The readability and practicality test involved 30 parents and students of RA A and RA B RA Plus AS. Following pandemic conditions where learning is carried out from home, the trial's technical implementation involves parents accompanying children to read books. Children work on activity sheets, hands-on, and small tents. The trial implementation was carried out in schools to monitor the trial's implementation. The conditions of the implementation of the field trial showed a slight difference between the learning atmosphere of classes RA A and RA B. In the scope of RA, children were enthusiastic when they received books, tools, and hands-on materials. Children are also interested in the contents of the book. When the parents/guardians read the book, some children actively listen and pay close attention, but others cannot focus on listening and have difficulty understanding the storyline.

For level RA B, the children are enthusiastic when they receive books, tools, and materials. The children are also interested in the contents of the book. When parents/guardians read the books, some children actively listen and pay close attention. They were conducive when listening and understanding the storyline. The parents were enthusiastic about reading stories. They were also asked how to fill out the link for the readability test. However, some parents did not read stories but were immediately drawn to activity sheets and hands-on.

The scores obtained were analyzed descriptively using SPSS. The results are shown in Table 4.

Table 4. Descriptive Analysis of Readability Test and Practicality

Descriptive Statistics									
Item	N	Mini-mum	Maxi-mum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
1	37	2.00	5.00	4.1622	.92837	-1.000	.388	.301	.759
2	37	3.00	5.00	4.2703	.80445	-.543	.388	-1.230	.759
3	37	2.00	5.00	4.1351	.88701	-.782	.388	-.090	.759
4	37	2.00	5.00	4.1892	.81096	-.699	.388	-.120	.759
5	37	2.00	5.00	4.0811	.92431	-.614	.388	-.608	.759

6	37	2.00	5.00	4.1892	.87679	-.913	.388	.224	.759
7	37	2.00	5.00	4.2703	.90212	-1.059	.388	.281	.759
8	37	3.00	5.00	4.2703	.76915	-.516	.388	-1.100	.759
9	37	2.00	5.00	4.1892	.84452	-.674	.388	-.435	.759
10	37	2.00	5.00	4.0811	.82927	-.775	.388	.404	.759
11	37	3.00	5.00	4.2973	.70178	-.492	.388	-.806	.759
12	37	3.00	5.00	4.2162	.71240	-.343	.388	-.916	.759
13	37	2.00	5.00	4.1622	.83378	-.625	.388	-.413	.759
14	37	2.00	5.00	4.3243	.88362	-1.218	.388	.769	.759
15	37	2.00	5.00	4.2432	.89460	-1.007	.388	.245	.759
16	37	2.00	5.00	4.1892	.84452	-.966	.388	.632	.759
17	37	2.00	5.00	4.2703	.80445	-.881	.388	.218	.759
18	37	2.00	5.00	4.1892	.77595	-.726	.388	.267	.759
19	37	3.00	5.00	4.3514	.75337	-.696	.388	-.867	.759
20	37	2.00	5.00	4.2703	.80445	-.881	.388	.218	.759
21	37	2.00	5.00	4.1892	.77595	-.726	.388	.267	.759
22	37	2.00	5.00	4.1622	.83378	-.929	.388	.666	.759
23	37	2.00	5.00	3.9730	.86559	-.490	.388	-.361	.759
24	37	2.00	5.00	4.0541	.81466	-.428	.388	-.489	.759
25	37	2.00	5.00	4.1622	.86646	-.872	.388	.240	.759
Valid N (listwise) 37									

Based on the above assessment, the average value of each item is 3.9-4.2, which indicates that the legibility test results and the prototype's practicality are very good. The value of skewness and kurtosis of each item shows a number close to 1, which indicates that the data is normally distributed

B. Discussion

In the EC area, stimulation from the home and school environment is necessary to maximize their development. The function of the STEAM activity book media is not only to introduce science, technology, engineering, art, and mathematics but also to develop HOTS

from thinking activities to analyze, evaluate, and create activity sheets, train fine motor skills from hands-on carried out, and develop children's literacy through understanding the content of the story.

The activity in the storybook refers to the Engineering Design Process (EDP), namely through the stages of learning to ask questions, imagine, plan, create products, and develop (Kelana et al., 2020; Lin et al., 2021; Lottero-Perdue et al., 2016). The EDP learning process is expected to develop critical and creative thinking skills and train collaboration. What is emphasized in STEAM EDP learning is that children can identify problems and find solutions to solve these problems by making a product and considering the tools needed to solve problems (Cunningham et al., 2018; Lottero-Perdue et al., 2016). In contrast to inquiry science learning which aims to build conceptual understanding (Hodson, 2014), STEAM learning needs to pay attention to elements of engineering and technology learning that aim to solve problems (Lottero-Perdue et al., 2016) so that EDP is a suitable approach to be applied in STEAM learning. Based on the study's results, it is known that STEAM EDP learning for early childhood can increase children's interest and understanding of the world of engineering and technology (Malone et al., 2018).

The current paradigm change based on Golshani's thoughts on the relationship between science and religion and STEAM learning for EC needs to be studied through design and development research because it involves a paradigm shift in viewing the relationship between science and religion. The relationship between the concept of science and the Qur'an's arguments provides children with insight into the relationship between science and the power of Allah. This is in line with Golshani's thought that studying natural sciences should be part of worship to Allah if studied from the right point of view (Thoyib, 2013). Teaching children to connect science with the Qur'an's arguments is expected to illustrate that science can be studied from the point of view of the Islamic religion. This point of view does not only look at empirical things but also pays attention to the ethics and values so that the scientific products obtained can be Rahmatan Lil Alamin (Rifenta, 2019).

Based on the validation results of three experts and seven practitioners, it is known that this Islamic STEAM Activity Storybook is feasible and valid to be given to Early Childhood Education. Although the product has been declared valid, the validator suggests improvements, namely the consistency of using standard or non-standard language, using fonts that are easy for children to read, and increasing the font size so that it is easy for

children to read and improvements to HOTS questions. It is known that font size affects legibility (Rello et al., 2016) and is proven to make it easier for someone to remember letters or words (Yang et al., 2018).

Another expert opinion states that there needs to be a reduction in the standard on HOTS questions for EC. The HOTS activities on the product prototype are considered too difficult for early childhood to complete independently, so they need improvement in the choice of question sentences. The following is an example of the questions presented in Figure 3.

Figure 3. An Examples of HOTS Challenges for EC Containing Mathematics Elements as Revised Results from Expert Validation.

Based on Figure 3, the HOTS question given to EC is to predict and analyze how the child can determine the symmetrical shape so that the tent can stand upright. Before the validation was carried out, the HOTS questions that were raised were as follows:

"For the tent to stand upright, approximately what point should
the line BC be connected to?"

Expert validators argued that the questions were too open-ended to make it difficult for EC to analyze the answers. Thus, to make it easier for EC to answer HOTS questions involving analysis, the questions need to consider the information that EC needs to know first (Simoncini, 2017).

After an agreement was made between the expert validator and the researcher regarding the results of the revised prototype, a readability and practicality test was carried out. The readability test results showed that, on average, the resulting product had excellent legibility and practicality. From a practical point of view, interesting findings were obtained. Children with RA B have greater interest than children with RA A. This is possible because as they age, the concentration level in listening to children increases. Bartgis et al. (2008) stated

that children aged seven years have better attention than children aged five. Thus, to increase children's attention to reading books together, teachers and parents are expected to learn interactive methods for reading books, such as reading aloud or shared reading (Håland et al., 2021; Neumann, 2020; Torr, 2019)

CONCLUSIONS

From the results of the improvement of prototype 1, the Islamic STEAM Activity Storybook was tested for readability by teachers and parents of students. It was found that the product is of excellent quality and suitable for use, so it can be continued in the implementation phase study. The validation of the Islamic STEAM Activity Storybook shows that the book is already valid with improvements in font size, consistency in the use of standard language, and HOTS-based interrogative sentences that need to be improved. The results of this study can be a reference for other researchers who want to test the validity, practicality, and legibility of the results of developing reading products for EC.

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