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DEVELOPMENT OF INTERACTIVE MEDIA TO ENHANCE SKILLS IN PROMOTING HIGHER-ORDER THINKING SKILLS (HOTS) MATHEMATICS QUESTIONS FOR ELEMENTARY SCHOOL ISLAMIC TEACHER EDUCATION STUDENTS

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Abstrak

Penelitian ini bertujuan untuk mengembangkan media interaktif yang diperuntukkan bagi mahasiswa PGMI agar mereka mampu mengembangkan soal HOTS pada mata pelajaran matematika materi bilangan dan operasinya serta materi aljabar pada kelas tinggi. Selain itu diselidiki pula pengaruh penggunaan media interaktif yang dihasilkan terhadap kemampuan mahasiswa PGMI dalam memahami dan mengembangkan soal yang membutuhkan kemampuan berpikir tingkat tinggi. Metode yang digunakan pada penelitian ini adalah metode *Research and Development* (R & D). Tahapan penelitian pengembangan secara garis besar terdiri dari 3 tahap, yaitu: (1) tahap studi pendahuluan, (2) tahap penyusunan draft produk, dan (3) tahap pengembangan dan evaluasi. Berdasarkan pembahasan dapat diambil kesimpulan sebagai berikut: (1) Pada keseluruhan aspek, media interaktif yang dikembangkan sudah menarik bagi 155 mahasiswa yang terlibat pada uji coba lapangan utama, (2) Pengaruh penggunaan media interaktif yang dihasilkan terhadap kemampuan mahasiswa PGMI dalam memahami dan mengembangkan soal yang membutuhkan kemampuan berpikir tingkat tinggi menunjukkan hal sebagai berikut: (a) Nilai rata-rata pemahaman tentang latar belakang dan definisi-definisi terkait HOTS dan nilai rata-rata pemahaman tentang meningkatkan derajat butir soal LOTS menjadi HOTS pada kelompok yang belum menggunakan media interaktif lebih rendah jika dibandingkan dengan kelompok yang sudah menggunakan media interaktif, dan (b) nilai rata-rata miskonsepsi tentang HOTS pada kelompok yang belum menggunakan media interaktif lebih tinggi jika dibandingkan dengan kelompok yang sudah menggunakan media interaktif, (c) Ketika mahasiswa pada uji coba lapangan utama diminta untuk membuat lima soal HOTS untuk materi bilangan dan operasinya serta materi aljabar, tampak mahasiswa sudah mampu membuat soal HOTS dengan benar. Hal tersebut ditunjukkan dengan skor rata-rata yang diperoleh mahasiswa adalah sebesar 4,3796 dalam skala 5.

Kata kunci : media interaktif, HOTS, bilangan dan operasinya, Aljabar

Abstract

This study investigates the effect of the use of interactive media on the ability of elementary school Islamic teacher education students in understanding and developing questions that need the ability to think at a high level. The method used in this research is the Research and Development method. This research consists of 3 stages, namely: (1) introduction stage, (2) draft arrangement stage, and (3) development and evaluation stage. Based on the discussion,

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it can be concluded that: (1) interactive media developed has been interesting for 155 students involved in the main field trial, (2) The effect of the use of interactive media to the ability of elementary school Islamic teacher education students in understanding and developing questions that need higher order thinking skill refers to: (a) the average score of the understanding about the background and the definition of HOTS and the average score of the understanding about increasing the level of LOTS questions to HOTS questions in the group not using interactive media is lower than the group using interactive media, (b) the average score of misconception about HOTS in the group not using interactive media is higher than the group using interactive media, and (c) the students can make five HOTS questions in algebra, number and its operation material. It can be seen from the score of the students is 4,3796 on 5 scale.

***Keywords**: interactive media, HOTS, number and its operation, algebra*

I. Introduction

Higher-order thinking skills (HOTS) are a requirement in today's education. In addition to implementing HOTS-based learning processes, teachers must be able to develop questions that assess higher-order thinking skills. However, most teachers have difficulty to develop HOTS systems, including the implementation of HOTS-based learning and assessment. This is because the majority of textbook questions are routine and do not assess higher-order thinking skills. This influences the difficulty of implementing HOTS-based learning and assessment. The lack of references on how to create HOTS questions and examples of HOTS questions makes it difficult to overcome these obstacles. According to Alhassora et al. (2017) one of the factors that contribute to the cultivation of HOTS is the teacher factor, which includes: (a) lack of understanding and knowledge; (b) lack of readiness; and (c) lack of confidence.

As a result, it is preferable to begin training the ability to write items with LOTS, which is considered easier, and then progress to HOTS. According Sani (2019), one simple way to create HOTS questions is to convert LOTS questions into HOTS questions. If the LOTS question lacks a stimulus, it can be converted into a HOTS question by adding a stimulus relevant to the concept being tested and If the question includes a stimulus but excludes critical analysis, it should be changed to include the critical thinking process. The stimulus should be analyzed critically, information compared, or applied to solve problems.

(Yani, 2019) stated that when writing description items, you should follow the following guidelines: (1) Formulate questions in the form of descriptions in such a way that they can be used to measure learning outcomes as formulated in basic competencies, (2) Arrange the sentences of each item properly and correctly to ensure student comprehension, (3) Each item is a specific and definite problem formulation, and (4) Consider the time required to answer each item.

It is important to understand that basic competence is the minimum competency that students must acquire after learning. If a student can conduct an analysis based

on the basic competencies, the school can create a more advanced competency framework, such as reevaluating or increasing competencies. Therefore, adjusting the questions to the subject matter is the most important factor to consider when developing HOTS

There are numerous theories about HOTS, particularly the cognitive taxonomy proposed by Bloom. As an example, there are numerous auxiliary verbs developed by educational experts. These auxiliary verbs are occasionally misused. To avoid misconceptions, we must carefully understand Bloom's taxonomy. (Stobaugh, 2013). Separate research was conducted on the misconceptions of madrasah ibtidaiyah teacher education students regarding HOTS (Wibowo et al., 2024)

The use of ICT (Information and Communication Technology) in education, for example, requires the development of interactive media that can be widely used by both primary Islamic school teacher and Pre-service primary Islamic school teachers. *(England & Finney, 2011)* explains that interactive media is the integration of digital media is the incorporation of digital media that includes electronic text, graphics, moving images, and sound, into a structured digital computer environment that allows people to interact with data for appropriate purposes. The interactive media should be specifically designed to help improve teachers' ability to develop HOTS questions in mathematics.

As previously stated, interactive media such as this is currently inaccessible to elementary school Islamic teacher education students. In this study, interactive media was developed that can be used by elementary school Islamic teacher education students to develop HOTS in mathematics subject. The participants in this study are active elementary school Islamic teacher education study program students at Fakultas Ilmu Tarbiyah UIN Raden Mas Said Surakarta who have passed the basic concept of arithmetic and algebra courses in the academic year 2022/2023, or fifth semester. This study investigates the development of interactive media for elementary Islamic school teacher education students so that they can develop HOTS questions in mathematics subjects, as well as the impact of using interactive media on elementary school Islamic teacher education students' ability to understand and develop questions that require higher-level thinking skills.

II. Methodology

This study used the Research and Development (R&D) method, also known as development research. Development research focuses on developing and validating educational products *(Borg & Gall, 2003)*. The stages of development research are broadly divided into three stages: (1) preliminary study, (2) product drafting, and (3) development and evaluation.

The study's reviewers or validators included one mathematics material expert at the basic education level and one educational technology expert. Mathematics material experts evaluate interactive media's content, whereas educational technology experts evaluate the design or display aspects and the effectiveness and

efficiency of interactive media. The planned limited trial subjects are active students in the elementary school Islamic teacher education study program at the Faculty of Tarbiyah Sciences, UIN Raden Mas Said Surakarta, who have completed the Basic Concepts of Arithmetic Mathematics and Algebra Mathematics courses. Both courses are offered during the second and third semesters. Meanwhile, the subject of the broad trial encompasses all active students in the elementary school Islamic teacher education study program who have completed the courses 'Basic Concepts of Arithmetic Mathematics' and 'Basic Concepts of Algebraic Mathematics', or active students in their fifth semester in the academic year 2022/2023.

The menu on the interactive media developed for user selection will consist of five menus, as shown in Table 1.

Table 1. Menus in the Developed Interactive Media

No	Nama Menu	Penjelasan
1	HOTS Concept	The menu contains 28 multiple-choice questions with four alternative answers, complete with evaluation and discussion. The 28 items are taken from the "Background and definitions related to HOTS" indicator, and the "Level of cognition" indicator.
2	Modification of LOTS Questions into HOTS	The menu contains 14 multiple-choice questions with four alternative answers, complete with evaluation and discussion. The 14 items are taken from the indicator "Increasing the degree of LOTS items to HOTS".
3	Misconceptions about HOTS	The menu contains 25 True-False questions, complete with evaluation and discussion. The misconceptions of madrasah ibtidaiyah teacher education students about HOTS measured using these 25 items have been studied separately (Wibowo et al., 2024)
4	Numbers and Operations on Numbers	The menu contains 10 illustrations of modifications of LOTS questions into HOTS questions for numbers and operations on numbers,
5	Aljabar	The menu contains 10 illustrations of modifying LOTS questions into HOTS questions for algebra material.

According to Sugiyono (2020) research and development can be defined as a scientific method of researching, designing, manufacturing, and testing the validity of previously produced products. According to this perspective, research and development activities can be summarized as the four Ps: *Penelitian* (research), *Perancangan* (design), *Produksi* (production), and *Pengujian* (testing).

III. Finding and Discussion

Initial research study data to identify research findings relevant to the product to be developed. This suggests that research and development should begin with preliminary findings. A researcher must decide which initial findings will be investigated. Then he must determine which products will be researched and whether the product will be useful or not. If the product findings are not useful, there is no reason to continue. The initial findings revealed that most teachers have difficultices to develop HOTS systems, including the implementation of HOTS-based learning and HOTS assessment. Meanwhile, the product to be developed will be interactive media that can be widely used by both MI teachers and MI pre-service teacher. The development of interactive media aims to improve skills in developing mathematics

HOTS questions for elementary school Islamic teacher education students at UIN Raden Mas Said Surakarta.

The interactive media design stage was conducted after conducting a needs analysis. Based on the previous discussion, there is a need to develop interactive media that can help students understand the concept of HOTS, modify LOTS questions into HOTS and minimize misconceptions about HOTS. In addition, it is necessary to illustrate examples of modification of LOTS questions into HOTS questions for the material: (1) numbers and operations on numbers, and (2) Algebra. The interactive media was created using the Macromedia Flash version 8.0 application, both by utilizing buttons (Wibowo, 2013) and scripts available in the application (Wibowo, 2020). The application is actually quite old, but it can still be used to create interesting interactive media today. Macromedia Flash is a learning media maker application that allows you to create or combine video, animation, images, and audio easily and efficiently (Fakhri et al., 2018). Fahmi (2014) as cited in (Sarwendah et al., 2023) states that of the various applications available Macromedia FIash 8 Professional can be used to develop multimedia-based learning media. (Wahyuni & Surikno, 2023) stated that Macromedia Flash 8 can display an interactive and simple learning animation that stimulates students' interest in participating in the learning process.

The design of the initial appearance or user interface of the interactive media for MI Mathematics HOTS questions for grades 4, 5, and 6 is presented in Figure 1.

Figure 1: Interactive Media Initial Display Design

Figure 1 depicts several components or features that were provided during the initial stage of interactive media. These features include (1) a password, (2) a HOTS

question menu provided based on the material, and (3) a menu that makes it easy for users and interactive media developers to connect easily.

The first feature, password, serves as a place for students to log in. The second menu, the HOTS question menu, is generated based on the material. This feature allows elementary school Islamic teacher education 5th-semester students to quickly select HOTS questions based on the material, which includes numbers, operations on numbers, and algebra. The third menu is the "How to Contact Us" menu. This feature allows users and interactive media developers to easily connect. The fifth menu is the help menu. This feature includes assistance from interactive media developers so that users can use interactive media quickly, easily, and effectively.

Users of interactive media can select from one of five menus, which are classified as (1) "HOTS Concepts" menu which includes 28 multiple choice questions with four alternative answers, complete with evaluation and discussion, (2) "Modification of LOTS Questions into HOTS" menu which includes 14 multiple choice questions with four alternative answers, complete with evaluation and discussion, (3) "Misconceptions about HOTS" menu which includes 25 True-False questions, complete with evaluation and discussion, (4) "Numbers and Operations on Numbers" menu which contains 10 illustrations of modifications of LOTS questions into HOTS questions for number and operations on numbers, and (5) "Algebra" menu which contains 10 illustrations of modifications of LOTS questions into HOTS questions for algebra material.

A. Internal Test

Product designs are validated by a number of experts and practitioners. FGD (Focus Group Discussion) was used to validate the product design by asking experts and practitioners to provide feedback and suggestions for improvement. Mr. Winarno, S.Si M.Eng, served as the media validation FGD's resource person. Mrs. Dr. Laelatul Badriah, M.Pd., served as the resource for the material validation FGD. Furthermore, researchers improved the product design so that it could be internally tested. The design was revised based on the results of the internal tests.

The internal validation instrument for the media contained 27 assessment items, including an 8-question general application assessment and 19-question assessment of task/test features in the application. Details of the assessment and dimensions, as well as the number of questions in the internal validation are presented in Table 2.

Table 2. Details of Assessments and Dimensions, as well as the Number of Questions on Internal Validation

No	Penilaian	Dimensi	Banyak Butir
1	A. General Application	–	8
2	B. In-App Task/Test Features	*Content*	4
		Accuracy	3
		Format	4

No	Penilaian	Dimensi	Banyak Butir
		Ease of Use	4
		Timeliness	4
Total Number of Items			27

Furthermore, Table 3 presents the media validation instrument for internal validation.

Media Validation Instrument for Internal Validation: (1) Application in General, and (2) In-app Task/Test Features in the Application.

(1) Application in General

No.	Questions
1.	The app's instructions are understandable
2.	The app's display is attractive
3.	The registration process is simple
4.	Login can be done quickly
5.	Attractive homepage display
6.	The information on the homepage feature is understandable
7.	The application can be accessed via the device (laptop/smartphone)
8.	The application is easy to use

(2) In-app Task/Test Features

Dimentions	ID	Questions
Content	C1	The instructions for using the task/test feature are understandable
	C2	The information in the task/test feature is complete
	C3	The information in the assignment/test feature is clear
	C4	The menu in the student account as needed
Accuracy	A1	The information in the assignment / test feature can be accounted for the truth
	A2	The menu and information in the menu are appropriate (example: the "Correction" menu contains questions and answers from students)
	A3	The timer menu when working on multiple choice questions can run well
Format	F1	Well-structured layout of multiple-choice test and true-false test pages
	F2	The layout of the multiple choice test and true-false test pages is well structured
	F3	Easy to read writing
	F4	Menu placement in the task/test feature is neat
Ease of Use	E1	The task/test feature can be opened on various devices (cellphone, laptop, pc)
	E2	The process of opening the application is easy
	E3	The menus in the task / test feature are easy to use
	E4	Access to the score menu is easy to do
Timeliness	T1	Loading time is relatively fast
	T2	Moving between menus is fast
	T3	The process of entering the task/test feature can be done quickly
	T4	The submit process can be done quickly

Figure 2 shows a pie chart of the assessment results for internal validation of media.

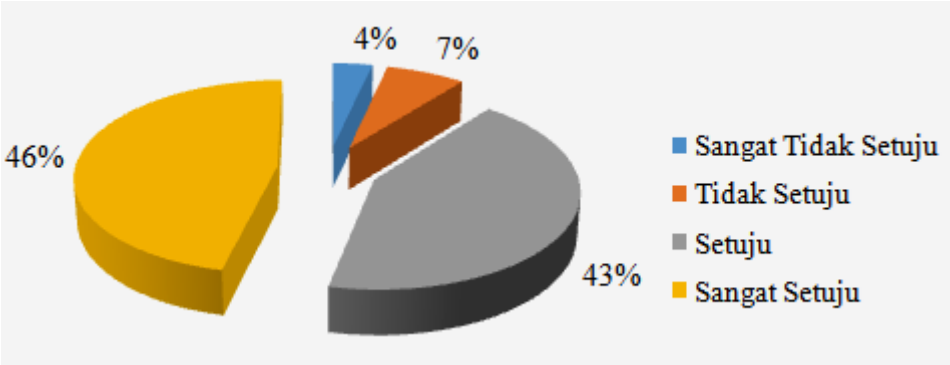

Figure 2. Circle Diagram of Assessment Results on Media-Related Internal Validation

Based on Figure 2 and after being traced, the data obtained for questions rated with "Disagree" and "Strongly Disagree" on internal validation related to the media are presented in Table 4.

Table 4. Data on Questions Rated with "Disagree" and "Strongly Disagree" on Media-Related Internal Validation.

Dimensions	ID	Questions	Assessment
General Application		3. Registration is easy	Disagree
Accuracy	A3	The timer menu when working on multiple choice questions can run well	Strongly Disagree
Ease of Use	E1	The task/test feature can be opened on various devices (cellphone, laptop, pc)	Disagree

Furthermore, based on Table 4, the interactive media was followed up to be improved according to the dimensions and questions considered unsatisfactory. The follow-up based on the media validation FGDs included changing the user interface as shown in Figure 3.

Figure 3: Revised interface after media validation FGDs

Figure 3 shows some interface revisions following the media validation FGD. The revisions affect the appearance of the menu group as well as how to log in or enter the interactive media. The "Practice Questions" menu combines the first, second, and third menus. The fourth and fifth menus are combined into the "Examples of Modification of LOTS Problems to HOTS Problems" menu. These changes are intended to give interactive media users an initial overview of each menu. Meanwhile, changes to the login process are expected to make registration easier for users. Users simply enter their name and password, already displayed on the interactive media display.

While the revisions following the material validation FGDs were to improve some of the question items and illustrations of the modification of LOTS questions to HOTS, the sentences needed to be revised. Expert assessment is divided into three parts: (1) language assessment of the test for understanding the concept of HOTS and modifying LOTS questions into HOTS, (2) language assessment of the misconception test on HOTS, and (3) expert assessment in the form of a checklist to review HOTS questions modified from LOTS questions. Meanwhile, knowledge competencies and skill competencies for grades 4, 5, and 6 Mathematics subjects adjust Permendikbud Number 37 of 2018.

B. Limited Field Trial

After the design is revised, it is turned into an initial product that is field tested on a limited scale. Based on the limited field testing, the weaknesses will be identified or the product will not meet the specified specifications. Furthermore, the findings from these flaws are used to improve the stage 1 product, which will be tested in the main

field trial. Figure 4 shows a bar chart of the results of the limited trial, which was attended by six elementary school Islamic teacher education students from the fifth semester of their study.

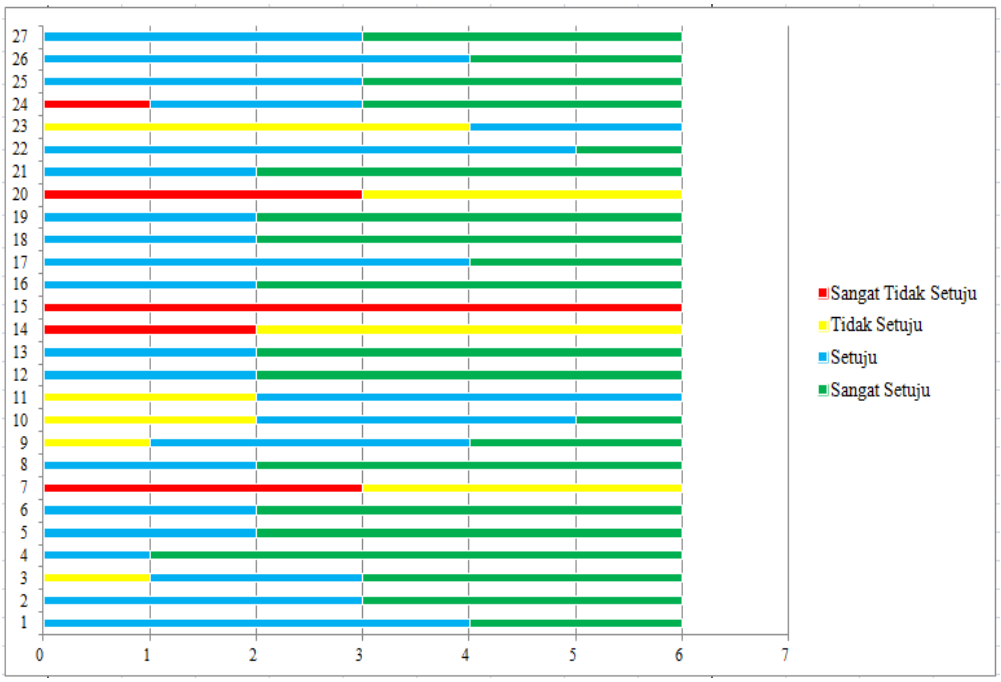

Figure 4. Bar Diagram of Limited Trial Results.

Based on Figure 4, the list of questions containing the answers "Disagree" and "Strongly Disagree" in the limited trial is then traced as presented in Table 5.

Table 5. List of Questions that Contain "Disagree" and "Strongly Disagree" Answers in the Limited Pilot Test

No	Item Number	Questions	SD	D	A	SA	Description
1	3	Registration is easy	0	1	2	3	Followed up
2	7	Application can be opened on the device (Laptop / Smartphone)	3	3	0	0	Followed up
3	9	Instructions for using the task/test feature can be understood	0	1	3	2	Followed up
4	10	The information in the task/test feature is complete	0	2	3	1	Followed up
5	11	The information in the task/test feature is clear	0	2	4	0	Followed up
6	14	The menu and information in the menu are appropriate (for example: the "Correction" menu contains questions and answers from students)	2	4	0	0	Followed up
7	15	The timer menu when working on multiple choice questions and true-false questions can run well	6	0	0	0	Followed up
8	20	The task/test feature can be opened on various devices (Smartphone, laptop, PC)	3	3	0	0	Followed up

No	Item Number	Questions	SD	D	A	SA	Description
9	23	Access to the score menu is easy to do	0	4	2	0	Followed up
10	24	Loading time is relatively fast	1	0	2	3	Not Followed up

C. Main Field Trial

When a product has been used but still exhibits flaws, it must be revised. In the main field test, user feedback is prioritized as revision material. The product will then be field tested in the operational field. The product is then disseminated or implemented throughout the wider community. Dissemination is accomplished by reporting the results of product research to professional groups and publishing them in scientific journals.

The main field trial involved 155 students. In the main field trial, 36 statements were asked to students. The graph of the main field trial interactive media assessment is shows in Figure 5.

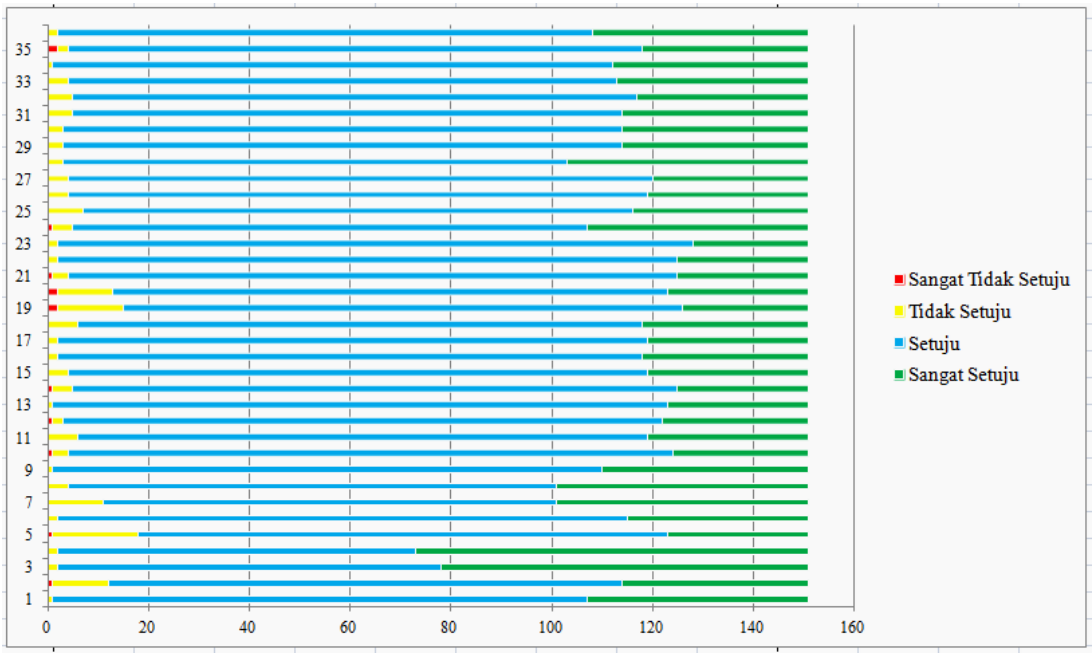

Figure 5: Interactive Media Assessment Graph of Main Field Trial

Figure 5 shows that the majority of students answered "Agree" to all of the statements asked. Few students responded with "Disagree," let alone "Strongly Disagree." This means that the overall aspects of the interactive media were appealing to the 155 students who participated in the main field trial.

Furthermore, the impact of using the interactive media produced on elementary school Islamic teacher education students' ability to understand and develop questions requiring higher-level thinking skills is investigated.

a. Analysis of 28 items to measure understanding of the background and definitions related to HOTS

The box-line diagram is used to investigate data anomalies, including the presence of outliers. According to the box-line diagram, the non-interactive media group contains three minor outliers, namely data with observation numbers 1, 23, and 28, whereas the interactive media group does not contain any outliers. As a result, these three data points were removed or excluded from future data analysis. This is due to the fact that outliers frequently have a negative impact on data analysis because they can distort statistical tests based on two classical estimators, which are sample mean and sample covariance (Wibowo, 2017). Table 6 also shows the normality test performed using the Kolmogorov-Smirnov test.

Table 6. Normality Test with Kolmogorov-Smirnov for the Variable Understanding of Background and Definitions Related to HOTS

		Have Not Used	Have Used
N		42	155
Normal Parameters[a,b]	Mean	40,3917	71,6592
	Std. Deviation	8,73039	25,73050
Most Extreme Differences	Absolute	0,183	0,146
	Positive	0,126	0,135
	Negative	-0,183	-0,146
Kolmogorov-Smirnov Z		1,184	1,820
Asymp. Sig. (2-tailed)		0,121	0,003

a. Test distribution is Normal.
b. Calculated from data.

Table 6 shows that the variable of understanding of the background and definitions related to HOTS in the non-interactive media group is normally distributed (Asymp. Sig. (2-tailed) = 0.121 > 0.05), whereas the variable of understanding of the background and definitions related to HOTS in the interactive media group is not normally distributed (Asymp. Sig. (2-tailed) = 0.003 < 0.05 Because the normality assumption was not met, a non-parametric test (the Mann-Whitney test) was used. According to Sugiyono (2009) the Mann-Whitney test technique can be used to test the hypothesis of two independent samples with interval / ratio data scales that are "not" normally distributed.

Table 7. Ranks of Understanding Variables on Background and Definitions Related to HOTS

	Student Group	N	Mean Rank	Sum of Ranks
Understanding of the background and definitions related to HOTS	Groups that have not used interactive media	42	45,39	1906,50
	Groups that have used interactive media	155	113,53	17596,50
	Total	197		

Based on the "Ranks" output table above, the number of data points on understanding of the background and definitions related to HOTS for student group A (the group that has not used interactive media) is 42 students, while for student group B (the group that has used interactive media) is 155 students. In addition, it is

clear that the mean score for students who have used interactive media is higher than the mean score for students who have not (113.53 > 45.39). Table 8 also shows the results of the test statistics.

Table 8 Test Statistics of Variable Understanding of Background and Definitions Related to HOTS

	Understanding of the background and definitions related to HOTS
Mann-Whitney U	1003,500
Wilcoxon W	1906,500
Z	-6,896
Asymp. Sig. (2-tailed)	0,000

a. Grouping Variable: Limited and Main Field Trial

The "Test Statistics" output in the Mann-Whitney test above indicates that the Asymp. Sig. (2-tailed) of 0.000 is less than the probability value of 0.05. As a result, using the Mann-Whitney test decision above, it is possible to conclude that "H_0 is rejected". As a result, there is a significant (real) difference in student group A's (the group that has not used interactive media) understanding of the background and definitions related to HOTS versus student group B's (the group that has used interactive media). As a result, the mean score of understanding the background and definitions related to HOTS in the non-interactive media group is lower than in the interactive media group.

b. Analysis of 14 items to measure the understanding of increasing the degree of LOTS to HOTS items

To detect the presence of outliers in the data on understanding of increasing the degree of LOTS to HOTS items, a box-line diagram was created. Based on the box-line diagram, it can be seen that the group that has not used interactive media and the group that has used interactive media both do not contain minor or major outliers. As a result, all of the data is used for further analysis. Table 9 shows the normality test using the Kolmogorov-Smirnov test.

Table 9 Normality Test with Kolmogorov-Smirnov for the Variable Understanding of Increasing the Degree of LOTS Question Items to HOTS

		Have Not Used	**Have Used**
N		45	155
Normal Parameters[a,b]	Mean	40,0007	74,5163
	Std. Deviation	12,31512	26,23823
Most Extreme Differences	Absolute	0,236	0,194
	Positive	0,119	0,166
	Negative	-0,236	-0,194
Kolmogorov-Smirnov Z		1,585	2,418
Asymp. Sig. (2-tailed)		0,013	0,000

a. Test distribution is Normal.
b. Calculated from data.

Table 9 shows that the variable of understanding about increasing the degree of LOTS items to HOTS in the group that has not used interactive media is not normally

distributed (Asymp. Sig. (2-tailed) = 0.013 < 0.05), while the variable of understanding about increasing the degree of LOTS items to HOTS in the group that has used interactive media is not normally distributed (Asymp. Sig. (2-tailed) = 0.000 < 0.05). As a result of the lack of normality, a non-parametric test (Mann-Whitney test) is required. Table 10 shows the Ranks results from the Mann-Whitney test.

Table 10 Ranks of Understanding Variables on Increasing the Degree of LOTS Question Items to HOTS

	Student Group	N	Mean Rank	Sum of Ranks
Understanding of the background and definitions related to HOTS	Groups that have not used interactive media	45	47,36	2131,00
	Groups that have used interactive media	155	115,93	17969,00
	Total	200		

According to the "Ranks" output table above, the number of data points on understanding of increasing the degree of LOTS items to HOTS for student group A (Group that has not used interactive media) is 45 students, whereas for student group B (Group that has used interactive media) is 155 students. Furthermore, the average score for students who have used interactive media is higher than the average score for students who have not (115.93 > 47.36). Furthermore, the output of Test Statistics is shown in Table 11.

Table 11. Test Statistics Variable Understanding of Increasing the Degree of LOTS Question Items to HOTS

	Understanding of increasing the degree of LOTS to HOTS items
Mann-Whitney U	1096,000
Wilcoxon W	2131,000
Z	-7,060
Asymp. Sig. (2-tailed)	0,000

a. Grouping Variable: Limited and Main Field Trial

The "Test Statistics" output in the Mann-Whitney test above indicates that the Asymp. Sig. (2-tailed) of 0.000 is less than the probability value of 0.05. As a result, using the Mann-Whitney test decision above, it is possible to conclude that "H_0 is rejected", As a result, there is a significant difference in (real) understanding of improving the degree of LOTS items to HOTS between student groups A (not using interactive media) and B (using interactive media). Thus, the average value of understanding of increasing the degree of LOTS items to HOTS in the non-interactive media group is lower compared to the interactive media group.

c. Analysis of 25 items to measure misconceptions about HOTS

To identify the presence of outliers in the misconception data on HOTS, a box-line diagram was created. The box-line diagram shows that the group that did not use interactive media has no outliers, whereas the group that did use interactive media has 29 outliers, consisting of 7 minor outliers and 22 major outliers. As a result, the 29 data points were dropped or excluded from subsequent data analysis. Table 12 shows the normality test performed with the Kolmogorov-Smirnov method.

Table 12 Normality Test with Kolmogorov-Smirnov for Misconception Variable about HOTS

		Have Not Used	Have Used
N		64	131
Normal Parameters[a,b]	Mean	51,19	98,69
	Std. Deviation	15,122	3,921
Most Extreme Differences	Absolute	0,083	0,501
	Positive	0,072	0,369
	Negative	-0,083	-0,501
Kolmogorov-Smirnov Z		0,663	5,739
Asymp. Sig. (2-tailed)		0,772	0,000

a. Test distribution is Normal.
b. Calculated from data.

Table 12 shows that the misconception variable about HOTS in the non-interactive media group is normally distributed (Asymp. Sig. (2-tailed) = 0.772 > 0.05), whereas the misconception variable about HOTS in the interactive media group is not normally distributed (Asymp. Sig. (2-tailed) = 0.000 < 0.05). As a result, a non-parametric test (Mann-Whitney test) should be used because the normality assumption is not met. Table 13 shows the Mann-Whitney test's Ranks output.

Table 13. Ranks of Misconception Variables about HOTS

	Student Group	N	Mean Rank	Sum of Ranks
Misconceptions of HOTS	Groups that have not used interactive media	64	32,52	2081,00
	Groups that have used interactive media	131	129,99	17029,00
	Total	195		

According to the "Ranks" output table above, the number of misconception data about HOTS for student group A (Group that has not used interactive media) is 64 students, whereas for student group B (Group that has used interactive media) is 131 students. Furthermore, the mean score for students who have used interactive media is higher than the mean score for students who have not used interactive media (129.99 > 32.52). Furthermore, the output of Test Statistics is shown in Table 14.

Table 14. Test Statistics of Misconception Variable about HOTS

	Misconceptions of HOTS
Mann-Whitney U	1,000
Wilcoxon W	2081,000
Z	-12,663
Asymp. Sig. (2-tailed)	0,000

a. Grouping Variable: Limited and Main Field Trial

Based on the "Test Statistics" output in the Mann-Whitney test above, it is known that the Asymp. Sig. (2-tailed) of 0.000 is smaller than the probability value of 0.05. herefore, as the basis for making the Mann-Whitney test decision above, it can be concluded that "H_0 is rejected". Thus, it can be said that there is a significant (real) difference in misconceptions about HOTS between student group A (group that has not used interactive media) and student group B (group that has used interactive media). Thus, the mean value of misconceptions about HOTS in the group that has not used interactive media is higher than the group that has used interactive media.

d. Creating Five HOTS Questions in the Main Field Trial

During the main field trial, 145 elementary school Islamic teacher education study program students were asked to create five HOTS questions about numbers and their operations, as well as algebra material. Students were asked to write five questions on the provided paper. Furthermore, the five questions developed by the students were evaluated, and the results were presented in a box-line diagram. Figure 9 shows six minor and two major outliers. The six minor outliers are observations 1, 48, 53, 54, 88, and 120, and the two major outliers are observations 74 and 87. Furthermore, six minor outliers and two major outliers were removed from the data, leaving 137 data points. Table 15 shows the descriptive statistics for the 137 data.

Table 15. Descriptive Statistics of Making Five HOTS Questions

Statistics		Score
N	Valid	137
	Missing	8
Mean		4,3796
Median		5,0000
Modus		5,00
Standard Deviation		0,88394
Varians		0,781
Minimum		2,00
Maximum		6,00

Based on Table 15, it can be seen that out of 137 students, the majority were able to create five HOTS questions for number and its operations and Algebra correctly. Based on the average, on a scale of 5, the average score obtained by students is 4.3796 in making HOTS questions correctly.

IV. Conclusion

Based on the discussion described in the previous section, the following conclusions can be drawn. (1) The development of interactive media intended for elementary school Islamic teacher education students so that they are able to develop HOTS questions in mathematics subjects shows that in all aspects the interactive media is attractive according to 155 students involved in the main field trial. (2) The impact of using interactive media on elementary school Islamic teacher education students' ability to understand and develop questions that require higher order thinking skills: (a) The group that has not used interactive media has a lower average score of understanding of the background and definitions related to HOTS than the group that has used interactive media. (b) The mean score of understanding about increasing the degree of LOTS items to HOTS in the group that has not used interactive media is lower than the group that has used interactive media. (c) The mean value of misconceptions about HOTS in the group that has not used interactive media is higher compared to the group that has used interactive media (d) When students in the main field trial were asked to create five HOTS questions for number and operations, as well as Algebra material, it appeared that they could do so correctly. This is demonstrated by the students' average score of 4.3796 on a 5-point scale.

V. References

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