DPJPM
Delta-Phi: Jurnal Pendidikan Matematika
https://www.journal.assyfa.com/dpjpm

Delta-Phi: Jurnal Pendidikan Matematika, vol. 1 (1), pp. 77-85, 2023
Received 15 Feb 2023/Published 30 Apr 2023
https://doi.org/10.61650/dpjpm.v1i1.120

Functional Inverse Material Description Test: Development of Islamic Integrated Communication Ability Instruments

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Abstract

Assessment activities are crucial to measuring learning success in the school system. Assessment can be used to improve education where teachers incorporate Islamic beliefs. This study explains how to create a religiously-integrated mathematical communication skills test. This is ADDIE model development research. The research was tested at a Tulungagung Madrasah Aliyah. The data-gathering method solves ten inverse function math questions using a description test. Data analysis uses strength, reliability, validity, and difficulty. This study found that the social essay exam instrument analyses high school students' mathematics communication skills and Islamic beliefs, with 7 items valid and reliable and 3 items removed. This study found that the Islamic integrated mathematical communication ability test is valid, reliable, discriminatory, and somewhat demanding.

Keywords: Communication Ability; Description Test; Islamic Integration.

Introduction

Assessment is integral to school learning activities (Qomariyah et al., 2023; Wanzer, 2021; Yahya et al., 2021). The purpose of the assessment is to find out whether the learning activities are effective (Deriu et al., 2021; Hung & Wang, 2021) or not. In addition, the assessment also helps teachers to determine the level of development of their students' abilities in cognitive, affective (Utomo et al., 2020), and psychomotor aspects (Hazarianti et al., 2016). As a teacher and teacher students, you must understand the procedure for conducting assessments. The assessment activity begins with data collection regarding student achievement (Ramadhani et al., 2021), preparation and development of assessment instruments, as well as the processing of assessment results (Mustakim et al., 2023; Syaifuddin et al., 2022; Vedianty et al., 2023). The assessment will be correct on target if it uses a quality instrument in terms of the aspects of validity, reliability (Kamid et al., 2020), discriminating power (Otgonbaatar, 2021), and the variety of item difficulties (Perdana et al., 2021). If the process has been carried out and the results are good, the assessment instrument can be trusted and is on target to measure students' mathematical abilities.

The assessment to measure integrated mathematics ability means that learning mathematics can connect mathematics with other sciences (Choirudin et al., 2021), be it the integration of religion (Asikainen et al., 2022), culture (Agustiya et al., 2017), politics (Daryanti et al., 2020) cs, or others. The integration of mathematics is not forced, but mathematics is contextualized in other studies, which, in the context of Islamic mathematics, are part of life based on religious values that exist and are written. The abilities expected by students after studying mathematics are not only practical abilities students can solve problems correctly or still improve (Meirbekov et al., 2022), but more than that, they are expected to be able to apply them in their daily activities (Lou et al., 2016). which can be in the form of communication skills, thinking, or Islamic mathematical values (Muhammad, Angraini, et al., 2023; Rosyid et al., 2023; Triono et al., 2023) they get indirectly (Darmayanti, Utomo, et al., 2023; Sugianto et al., 2023). If we examine it more deeply, mathematics is not only for mathematics but the integration of mathematics with other substances between subjects and the Qur'an (Hasbullah et al., 2019; Sah RWA et al., 2022).

This perspective will encourage students to think about understanding and then interpreting the nature of learning mathematics. By understanding and interpreting this nature, students indirectly learn mathematics, which indirectly accompanies the interpretation of the Qur'an, which is applied in everyday life (Baidowi et al., 2021; Rochmah & Majid, 2020; Surur & Pujilestari, 2021). The comprehensive view of the Qur'an implies the concept of tafakkur (In'am et al., 2023; Laila et al., 2022; Suriyadi et al., 2021), which is seen as very important in every creative thought for the advancement of civilization in all aspects of life. One of them is by integrating mathematical assessment with the values of the Koran, which emphasizes the development of mathematical communication.

Mathematical communication skills can change students' perspectives on mathematics (Rachmawati et al., 2023; Suharsiwi et al., 2023; Yuniwati et al., 2024). This is possible if prospective mathematics teachers describe mathematics reasonably (Darmayanti, Hidayat, et al., 2023; Rizki et al., 2023; Triono et al., 2023). According to Widjajanti Wahyudin (2010), students' misconceptions about mathematics are influenced by their experiences in learning mathematics. Thus, how the mathematics teacher communicates concepts, structures, theorems, or mathematical formulas to students will affect students' descriptions of mathematics (Baskoro et al., 2006; Darmayanti, 2023; Wicaksono et al., 2020). Son (2015) revealed that mathematical communication skills are essential for a mathematics teacher as a facilitator and mediator in learning. Teachers can change the view of mathematics that is difficult and very abstract for students with the right way of delivery. Therefore, prospective mathematics teachers must be able to take advantage of the time in college to practice their mathematical communication skills both orally and in writing.

Results of MA math teacher interviews Darul Hikmah Tulungagung found that class XI math students had poor mathematical communication abilities, notably in inverse function material. Inverse function information is hard to express for students. Students struggle when asked to discover the beginning function of a given function's inverse. Religion is unrelated to the idea that pupils should not learn math. Most students live in boarding schools where most activities are Islamic. Therefore, they do not think math is important. This discourages students from learning well. Assignments and arithmetic problems make kids less able to put down what they know and analyze pictures. Most students struggle to write out their solutions in mathematical language. Students who took the mathematics eye had trouble perceiving mathematical ideas in visuals or mathematical models of lecture topics. The solution technique or answers are also poor while arguing or explaining concepts.

Nayazik Arie (2017) also found that prospective mathematics teacher students' written communication showed low mathematical communication skills. Even with story questions, kids had trouble solving them and constructing models. Mathematics. A test instrument, including written communication questions, was created to measure students' mathematical communication skills. According to Teledahl (2016), written communication has traditionally been employed to assess mathematical understanding. Questions that improve pupils' Islamic-based communication abilities are scarce. This study designed a mathematical communication ability test to assess students' mathematical communication abilities' integration with Islamic beliefs. The created test instrument can also include questions, notably for inverse function material.

Research Method

This study was done in January 2022. According to Branch (2009), this research used the R&D process with the ADDIE model. This paradigm has five development steps: analysis, research, information collecting, planning and early product development (design), and development. The final steps include field trials, main product revisions, important field trials, operational product modifications (evolving), and evaluations. However, this research merely took three steps: development. These steps flow as shown in Figure 1 (Astutik et al., 2022).

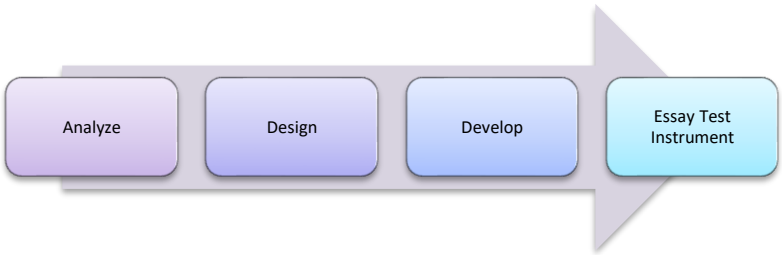


Figure 1. Development of an integrated mathematics communication skills instrument with Islamic values using the ADDIE model theory (Karim et al., 2021).

The development of an integrated mathematical communication ability test instrument with Islamic values is described by the Exploration plot design described in Figure.

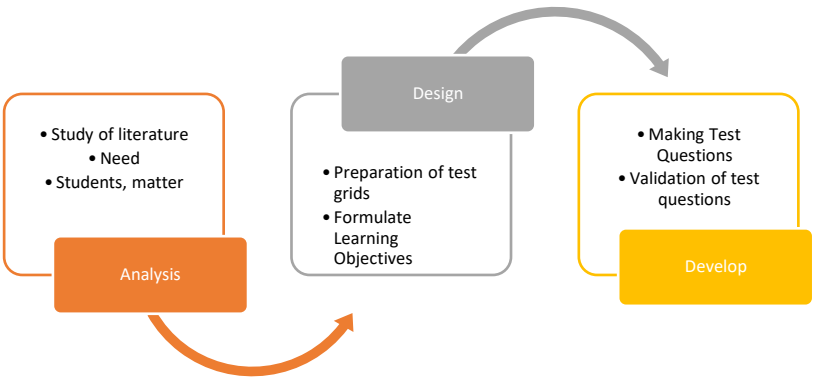


Figure 2. Flowchart of the Development Stages of the Mathematical Communication Ability Test Instrument integrated with Islamic values

Figure 2 displays the ADDIE model's stages in Baranch's theory of development flow. Step one is analysis. First, a literature search is conducted to find and read articles about mathematical communication skills and Islamic values related to inverse function material in international and national journals. Then, observe and interview students to analyze needs, student analysis, and material analysis connected to their mathematical communication issues. This follows the works (Darmayanti et al., 2022; Inganah et al., 2023; Rizki et al., 2022). Step two is design. This stage involves instrument design. Using a material inverse function grid, the instrument

integrates and indexes mathematical communication skills. After design comes development; this stage involves question and content verification to develop Islamic-valued mathematics communication questions (Ats-Tsauri et al., 2021; Ningtyas et al., 2023; Putri et al., 2023). Face validity depends on the clarity of language, expression, picture, symbol, and illustration exam questions. The magnitudes, criteria, and Islamic values should be considered when validating the requested content (Al-Hanifah et al., 2023; Inganah et al., 2018). Six people were validated: one mathematics lecturer, two teachers, two mathematics education practitioners, and one Islamic religion instructor. The draught is changed based on validator feedback. Revised tools were tested on students to assess question efficacy, dependability, discriminating power, and complexity.

The visual and content validity scoring criteria are 1 for valid and 0 for invalid. After determining the score, use Cochrane's Her Q test with alpha = 5% to analyze the validator's results. Test items are valid or understood as a weighing tool if the calculation significance is more than alpha = 5%. Tools validated by many validators were evaluated. The test subjects in this study were selected using purposive sampling, a non-probability sample with specific identification criteria. The research subjects were 30 class X pupils. Researchers examined test data to assess item efficacy, reliability, discriminating power, and complexity. The correlation coefficient between the item and overall scores assesses item efficiency. Pearson product-moment correlation calculates the correlation coefficient. Test reliability was calculated using Cronbach's alpha. The confidence coefficient test, selectivity, difficulty, and category-based correlation coefficient interpretation (Suherman, 2003).

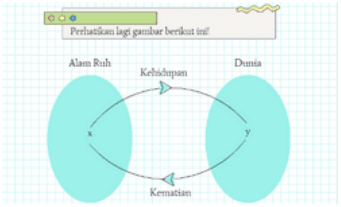
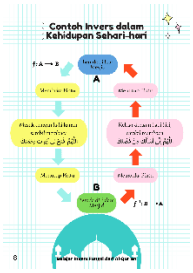
Result and Discussion

Developing an integrated mathematical communication ability instrument for Islamic values refers to the sequence of stages of the ADDIE model theory. The detailed steps in developing the instrument are described as follows.

1. Analysis

At this stage, the first step taken is a preliminary study. Conduct literature studies, interviews, and unstructured observations to determine what obstacles occur in the field. Next, start by gathering references to solve the math communication ability test. Analyzing the material needs of integrating Islamic values, the suitability of indicators on the material and values contained in the Qur'an. Researchers can use the results obtained to help design integrated mathematical communication problem instruments as a guide. Based on this, in this study, the material integrated with Islamic values in context, subject, and material is inverse function material, as shown in Table 1.

Table 1. Integrated Mathematical Content of Islamic Values

Content	Material	Context of Material Inverse of Integrated Mathematical Functions
Videos	Definition of Inverse	*QS Al-Ankabut: 57* *Based on this verse, the researcher integrates the inverse function into the material content.* 
Question	Mathematical problems related to inverse functions	*QS Al-Isra': 7* *This proverb inspires Zidan to do good and help others constantly. Zidan started his determination by uploading a YouTube video on Islam to help others. Suppose Zidan's video benefits 50x + 100 persons, where x is the number of videos. To help 1000 individuals, Zidan needs how many videos?*
Application in everyday life	Stages or steps in and out of the mosque	Prayers Entering and Exiting the Mosque: Made the basis for illustrating an example in everyday life 
Videos	An example of an inverse function	QS Al-A'raf: 26 Capitalize on knowledge from verses Through QS Al-A'raf: 26, Allah SWT orders us to cover our genitals. Based on that, the researcher created a question with the content of opening a hijab or hijab business tailored to broadcast Islamic law if a tailor can make $f(x)$ with x meters of material.

2. Designing

Second, design the product. This project designs a grid of integrated mathematical communication ability instruments to establish specialized and universal learning objectives. Organise questions to assess students' mathematical communication abilities and attainment of learning objectives, then choose learning strategies and materials. Table 3 shows the instrument grid for integrated mathematical communication skill description questions.

Table 3. Grid of Mathematical Communication Ability Instruments Integrated with Islamic Values

Component	Information	Question item
Describing written text, mathematical ideas, situations, and relationships in writing	Students can write down the problems they know and ask questions appropriately	*1, 2, 3, 4, 5, 6, 7, 8, 9, 10*

Component	Information	Question item
Drawing Explaining mathematical concepts in visual form (pictures, tables, or diagrams)	Students can present ideas, situations, or solutions to mathematical problems through clear and precise pictures.	
Description of ideas, problems, situations, pictures, or natural objects using mathematical expressions, symbols, models, or mathematical expressions:	Students can use mathematical models entirely and accurately to express ideas and problem situations. Students can use mathematical symbols to express ideas appropriately.	

Steps The instrument (description test) developed consists of test indicators, questions, and evaluation tables. The four steps are curriculum analysis, material analysis, student analysis, and problem design.

a) The goal of curriculum analysis is to discover challenges in establishing a test of mathematical communication abilities. The research examined MA Darul Hikmah Tulungagung's 2013 curriculum. Learning Analysis uses face-to-face learning. Researchers will analyze first-semester XI class pupils to teach first-year students about inverse functions. Every class has 35 students. All class XI students have 6 classes with 210 students. Researchers chose 35 pupils for specific reasons (limited trial). Unstructured interviews with students revealed that semester 1 students' mathematics communication abilities had never been thoroughly investigated because they were new students migrating from class X.

b) Material Analysis identifies key concepts for building an integrated math communication test. Curriculum analysis revealed that the research content is from the 2013 odd semester curriculum. Select "Inverse function." Figure 3 shows the required capabilities and achievement markers.

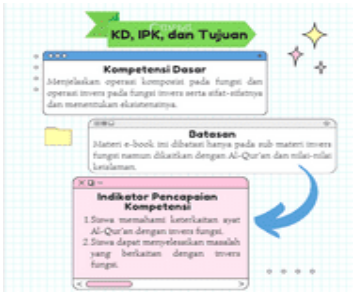


Figure 3. KD dan Indikator yang ingin dicapai pada materi invers fungsi

3. Develop

The third stage is product development. From the research results, ten instrument designs describe integrated mathematical communication skills and assessment instructions. The instrument's design, which describes the integrated mathematical communication ability that has been completed more or less, can be seen in Figure 4.

Figure 4. Question design presentation showing integrated mathematical communication skills.

The validator then checks the question design. The validation included facial and content validation. Editorial changes were made based on validator concerns. Q-Cochran analysis analyzes the validator's flaws' effects.

The content validity test score on Asym. Sig is 0.813. The Q-Qochran test score of 0.813 is much higher than α = 0.05. These results indicate that each validator equally treats the integrated mathematical communication skills instrument's content validity. The advance validation test score on the Asym.sig statistic is 0.425 in Table five. The Q-Qochran test score of 0.425 is more significant than α = 0.05. These results indicate that each validator pays equal attention to the face validity of the integrated mathematical communication ability-solving instrument (Padulo et al., 2020). The results show that the instrument of students' mathematical communication abilities in three-dimensional material is valid for advanced and content material.

The tool should be tested on many students who followed the three-dimensional material. Thirty-five students were tested. Scoring guidelines are used to correct and arrange student solution sheets. Table five lists assessment instructions.

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Table 5. Instructions for Assessment of Mathematical Communication Ability Ability Test Instruments

Aspect	Indicator	Sub indicators	Score
Integrated Mathematics communication skills.	Describing written text, mathematical ideas, situations, and relationships in writing.	Students can seriously describe written texts, mathematical ideas, situations, and relationships in writing, find out what is known, and ask about the problem with the correct final answer.	4
		Students can describe written texts, mathematical ideas, situations, and relationships in writing seriously. They can find out what is known and ask about the problem, but the final answer is wrong.	3
		Does not describe the written text, mathematical ideas, situations, and relationships in writing some of the problems but mentions what is known and states what is asked of the problem.	2
		Does not describe the written text, mathematical ideas, situations, and relationships in the writing of some problems but mentions what is known and does not mention what is asked of the problem.	1
		Students do not answer.	0
	Drawing Explains mathematical concepts in visual form (pictures, tables, or diagrams).	Students can draw and explain mathematical concepts in visual form (pictures, tables, or diagrams) and integrate communication skills with the correct final answer.	4
		Students can draw and explain mathematical concepts in visual form (pictures, tables, or diagrams) and integrate communication skills with wrong final answers.	3
		Students can draw and explain mathematical concepts in visual form (pictures, tables, or diagrams) solutions, but only some are correct.	2

	Students can draw and explain mathematical concepts in visual form (pictures, tables, or diagrams) but not correctly (not according to plan).	1
	Students do not answer.	0
Able to compile mathematical models and be able to apply strategies of integrated communication capabilities	Students can compile mathematical models and apply integrated communication skills strategies according to plan, do the questions correctly, and ensure the final answers are correct.	4
	Students can compile mathematical models and apply communication skills and strategies according to plan, do the questions correctly, and the final answer is wrong.	3
	Students can compile mathematical models and apply communication skills and strategies to several problems.	2
	Students in compiling mathematical models and can apply communication skills strategies not according to plan.	1
	Students do not work.	0
Description of ideas, problems, situations, pictures, or natural objects using mathematical expressions, symbols, models, or mathematical expressions	Students can draw descriptions of ideas, problems, situations, pictures, or natural objects using mathematical expressions, symbols, models, or mathematical expressions from the answers obtained and recheck answers with the final correct answer.	4
	Students can draw descriptions of ideas, problems, situations, pictures, or natural objects using mathematical expressions, symbols, models, or mathematical expressions from the answers obtained and recheck answers with wrong final answers.	3
	Students can conclude the problem, but it is not quite right.	2
	Students cannot describe ideas, problems, situations, pictures, or natural objects using mathematical expressions, symbols, models, or mathematical expressions of the problem.	1
	Students do not work.	0

ription: Value=$\frac{Jumlah\ skor\ yang\ diperoleh}{jumlah\ skor\ maksimal}\ x\ 100\%$

Then, student assessment records were examined for item validity. Each item's reliability, discriminating power, and difficulty index are also assessed. Each item's validity is determined by comparing it to the total rating. Table 6 shows the correlation coefficients for each object.

Table 6. Q-Qochran Test Results Using SPSS 16

unit-th	Results Correlation coefficient value	Category
1	0.523	Enough
2	0.435	Enough
3	0.762	Tall
4	0.527	Enough
5	0.731	Tall
6	0.448	Enough
7	0.721	Tall
8	0.446	Enough
9	0.426	Enough
10	0.745	Tall

The correlation coefficient in Table 6 shows that each question may be utilized to assess students' Islamic integrated mathematical communication skills in inverse function material. After the questions are utilized, assess the test's dependability. Test reliability is calculated using the Cronbach Alpha formula. Students' test scores after answering questions about measuring mathematical communication skills. Tables 7 and 8 provide dependability coefficient results.

Table 7. Cronbach Alpha Scores Measure reliability coefficient with SPSS 16

Alpha Cronbach	Cronbach's Alpha Based on Standard Items	N of Items
0.847	1,000	10

Table 8. Cronbach Alpha test results Using SPSS 16 to determine deleted items

th item	Scale Means if Item Deleted	Variance scale if the item is Deleted	Corrected item-total correlation	Multiple Quadratic Correlation	Cronbach's Alpha if the item is removed
1	32.7968	96,769	0.275	0.107	0.675
2	37.7421	94,145	0.322	0.345	0.674
3	45.6543	79,446	0.547	1,000	0.849
4	37.8776	64,321	0.284	0.118	0.675
5	37.7421	94,145	0.322	0.345	0.674
6	30.6532	88,346	0.527	1,000	0.711
7	42.7635	82,769	0.285	0.107	0.691
8	39.7154	96,769	0.510	0.118	0.684
9	37.7421	94,145	0.322	0.345	0.674
10	40.6542	78,347	0.547	1,000	0.712

Table 8 shows r=0.849. This makes the question believable and very high. This study created a four-competency tool to assess mathematics communication skills in three-dimensional content. Following the theory and framework, these variables were created. The research used different primary theoretical studies than those above. The instrument has also undergone multiple conditional tests in evaluation instrument development.

This study used three validity degrees based on the findings. Adequate expertise comes first. Professionals perform the effectiveness test to determine the practical applicability of equipment for each variable based on theory and indicators (in this example, mathematical problem-solving). According to Nichols-Barrer et al. (2016), relevance includes importance, utility, character, diagnostic potential, practicality, and relevance. Next, verify the expert evaluation results and update the instruments without additional revision.

Six validators (1 mathematics professor, 2 teachers, 2 practical mathematicians, and 1 Islamic religion instructor) scored each item on the rating scale. They calculated the findings using Aiken's V coefficient calculation to test the content's effectiveness. This test

determines depth and relevance based on indicator scope and tool content. Content validation requires a value that is not excessive to assess content strength and breadth (Nichols-Barrer et al., 2016). Evaluators offer feedback and suggestions. These proposals enhance the equipment. According to Srirahayu and Arty (2018), expert reviewers evaluate, discuss, and suggest all instruments utilized to improve research instrument rewriting.(Muhammad, Darmayanti, et al., 2023; Putra et al., 2023; Yuniwati et al., 2023)

The evaluator's evaluation analysis suggests that the integrated mathematical communication ability variable is very successful. The empirical or criteria adequacy of the updated instruments was assessed in a study sample. To determine item connection and internal consistency. According to Mellinger and Hanson (2020), test findings presented to respondents determine empirical validity. This SPSS-analyzed test uses product-moment correlation (Asgafi et al., 2023; Jayanti et al., 2023; Santiago et al., 2023). Thus, three erroneous inputs for the third item in the mathematically integrated communication ability variable reversed their conclusions. The variable ability mathematical communication abilities verified 7 items.

Reliability tests follow validity testing. A reliability test determines an instrument's evaluation feasibility and efficacy. To determine a reliable measuring device (Leung, 2015), reliability is done. Reliability compares equipment to measurements (Maulida & Lubis, 2018). Cronbach's alpha was utilized to calculate SPSS application reliability in this study. The analyzed problem of integrated mathematical communication abilities can be used to measure them in inverse function material because the confidence value is 0.849.

Determine the problem's discriminating power next. The discriminating power of the questions measures how well they can identify high-ability from low-ability students. Table 9 shows item-discriminating power calculations.

Table 9. Distinguishing power test results Using SPSS 16 to determine the discriminating coefficient

goods to	*1*	*2*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
Difference between	0.68 B	0.32 S	0.35 S	0.32 S	0.54 B	0.53 B	0.62 B	0.31 S	0.38 S

After knowing the discriminating power of each item, the item difficulty index is determined. Table 10 shows the results of the difficulty index calculation.

Table 8. Difficulty test results Using SPSS 16 to determine the item difficulty index

goods to	*1*	*3*	*4*	*6*	*7*	*8*	*10*
Difficulty between	0.37 Su	0.74 Your	0.49 Se	0.73 Your	0.31 Su	0.29 Su	0.45 Se

Table 8 shows that all items are moderately ranked (items no. 4 and 10) in the easy category (items no. 3 and 6), except for items 1, 7, and 8, categorized as complex questions. Thus, it can be concluded that all items can be used to measure the ability of mathematical communication skills. Because the question numbers, namely numbers 2, 5, and 9, have been deleted (because they are invalid).

Conclusion

From the facility development stage, it can be concluded that the integrated mathematical communication ability instrument in the inverse function material for class XI MA Darul Hikmah Tulungagung students can be classified as a valid tool for 7 questions. Namely, students can use it to measure mathematical communication ability integrated with Islamic values.

Suggestions for future researchers to develop tools for the same material to measure other Islamic integrated abilities such as understanding, critical thinking, etc**.** It can also be used on other materials.

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