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Mathematics module based on STEAM and Quranic approach: A study for student's perception

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Abstract

Monotonous mathematics learning focusing on textbooks only will make students bored and feel that studying mathematics is useless. Using attractive and meaningful approaches, like STEAM and Quranic approaches, is strongly motivated by the need to avoid tedious drilling for students in learning mathematics. This study aims to assess students' perceptions of the development of mathematics modules using science, technology, engineering, and art (STEAM) and AL-Quran approaches. The research approach employed in this research is embedded in mixed methods. Quantitative data was examined using percentages, while qualitative data were transcribed and then developed into codes, categories, and themes. The study recruited 146 Pidie senior high school students in the natural science stream, and five individuals were selected for one-to-one semi-structured interviews. The results of this study show that students have a negative experience in learning mathematics. However, they have a significant interest in integrated math learning with Quranic and STEAM approaches. Furthermore, they believe the modules are one learning medium ideal for mathematics. Finally, based on this study, mathematics teachers should be able to develop learning modules that can integrate STEAM approaches and the understanding of the Quran for senior high school students.

Keywords: Learning Mathematics, Mathematics Modules, Quranic Approach, STEAM Approach, Students' Perceptions

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Teaching mathematics in the classroom must be distinct from the real-life situation. The Indonesian education curriculum has stipulated that mathematics teaching is compulsory at every level and is one of the elective subjects for natural science stream classes (Kemendikbudristek, 2022). However, many students still perceive mathematics as a complex and not exciting subject (Diego-Mantecon et al., 2021), and many students still consider mathematics to be a boring subject (Setyaningsih & Utami, 2021; Suradi & Djam'An, 2021). The teaching of mathematics should be a tribute to the character-building of students to tackle the growing issue of character deterioration among secondary school students, which is in line with the formal objectives of mathematics teaching and learning (Soedjadi, 2000).

Character deterioration among students can be countered by integrating Islamic values into every teaching and learning process in the classroom. The teaching and learning process in Aceh province is regulated by Governor Regulation Number 07 in the Year 2022, where Islamic character building is part of the local wisdom curriculum and must be taught to every student (Peraturan Gubernur Aceh, 2022).

The internalization of Quranic understanding is one of the core elements that affect the personal behavior of students (Aziz & Rahmat, 2023). This aligns with Ibnu Sina's educational views, which state that rational and religious aspects must be combined because both support each other in solving the problems and realities of life (Ansari & Qomarudin, 2021). Integrating Islamic concepts in general education can also be achieved by integrating Islamic religious subject matter with science or other subjects. Hartoyo et al. (2019) research shows that learning mathematics holistically based on the Qur'an can develop competencies in spiritual and social attitudes. Mathematics learning in schools is closely related to Quranic concepts and understanding, allowing Quranic concepts to be integrated directly and implicitly into mathematics learning, deductively and inductively (Abdussakir & Rosimanidar, 2017). In his study, Nu'man (2019) states that using teaching materials sourced from the Quran to teach mathematics can be conducted during assignments or routines, questions and answers, experiments, discussions, observations, reading, thinking, problem-solving, and reflection. Learning mathematics will feel more valuable when students are not only looking at formulas and solving problems; more than that, they will be introduced to the concept of faith a*nd fraud in* (individual obligatory) knowledge regularly.

Previous studies have shown that mathematics teachers are monotonous and textbook-oriented, whereby lessons are taught formally and theoretically (Papadakis et al., 2017). Mathematics teaching is still dominated by abstract mathematical concepts that have yet to be able to change to realistic concepts (Bhagat et al., 2021). The executive summary of the 2019 national examination results published by Indonesia's education ministry states that most students need help solving non-routine problems to acquire high-level thinking skills (Kemdikbud, 2019). The standard for high-level thinking is equivalent to the mathematical literacy question used by PISA. Meanwhile, the 2018 PISA results found that the mathematical literacy of Indonesian students ranked 74th out of 79 countries participating in the PISA (OECD, 2019).

The quality of teaching is the essential element that influences students' cognitive and non-cognitive development (Ismail et al., 2022). A student-centered approach is a teaching and learning process that can actively engage and impact the learner (Demo et al., 2021). One student-centered approach is STEAM, an acronym for Science, Technology, Engineering, Art, and Mathematics (Chung et al., 2022; Wannapiroon & Pimdee, 2022). Traditional perceptions of mathematics lessons can be changed by applying the STEAM approach to teaching and learning mathematics in the classroom (Duo-Terron et al., 2022). Teaching and learning with STEAM methods will recommend literacy for 21st-century skills so that students can face the challenges of globalization and engage in modern science (Chung & Li, 2021; Huang, 2020). The STEAM approach has a positive impact on the scientific process (Ozkan & Umdu Topsakal, 2021; Tran et al., 2021), investigative skills (Lin & Tsai, 2021), and student creative thinking (Sutama et al., 2020). It also develops students' reasoning skills (Garcia-Piqueras & Ruiz-Gallardo, 2021), critical thinking (Fernández-Cézar et al., 2021), creativity, innovation, scientific literacy, and problem-solving skills (Ardianti et al., 2020).

The development of education, which is still changing and requires innovation to adapt the teaching and learning process to the needs of the times, will require teachers to continue innovation and transform to create a humanist and adaptive learning style or the use of learning media that suits the needs of students to answer the needs and difficulties (Mora-Luis & Martin-Gutierrez, 2020). The use of media is one solution that is easily implemented by teachers in the teaching and learning process because media is one of the interactive learning tools that can support the learning process (Astalini et al., 2022). Most researchers believed that hands-on learning was another instructional strategy that could help students

acquire STEM knowledge and skills. The hands-on activities provide an authentic learning experience and a platform for students to put the theories they have learned into practice (Ismail et al., 2022).

Modules are one of the interactive media that help students learn steadily and independently because modules are more specific and detailed and designed for smaller units (Handayani et al., 2020). Modules are organized systematically and user-friendly according to students' understanding and age. Therefore, they can learn independently with minimum teacher assistance. The module will benefit teachers who use the Whoruse approach because it will help students accomplish each step in completing their project. The development of a Mathematics teaching module with a STEAM approach integrated with the Quran will provide students with the ability to understand and discover mathematical concepts and the Quran understanding; afterward, students are asked to solve the problem by integrating their understanding of the Al-Quran concept in science, technology, engineering, art, and mathematics.

As participants in the teaching and learning process, learners should be a primary consideration for a teacher when planning the learning activities because the learning must align with the learner's needs for optimal learning outcomes (Sudargini & Purwanto, 2020). Previous studies have provided essential insights into how tedious mathematics teaching needs to be reformulated into a more attractive and meaningful way by using specific approaches. Much research on STEAM has been done before, but it still focuses on cognitive development and 21st-century skills, so the religious and character components should be addressed in math learning. Previous studies on STEAM-based mathematics education have yet to be able to address character issues significantly. Meanwhile, the combination of STEAM and the Quranic Approach needs to be studied more. This study explored students' perceptions of the process of teaching and learning mathematics in schools and their perceptions of the development of mathematics modules based on the STEAM approach integrated with the Quran. This study was conducted to determine two research questions:

1. What are students' perceptions of the learning Mathematics experience?
2. What are Students' perceptions of mathematics learning difficulties?
3. What are the students' Understanding of the STEAM and Quranic Approaches?
4. What are Students' learning mathematics experiences using the module?

METHODS

Research Design

This study uses an embedded mixed methods design, in which the qualitative data set is embedded within and generally plays a supportive role in the quantitative data. Using a concurrent embedded mixed-methods approach provides a thorough understanding of the instruction patterns by analyzing quantitative data and then supporting the findings with qualitative research findings (Creswell, 2009). Qualitative data were collected using the survey. Student surveys are currently one of the most extensively utilized methodologies in empirical educational research to assess instructional quality (Herbert et al., 2022). Students, as essential actors in the teaching and learning processes in the classroom, have access to highly relevant information. While semi-structured interviews collected qualitative data, interviews were conducted to strengthen respondents' answers to the questionnaire. Quantitative and qualitative data were used concurrently at the study's data collection, analysis, and interpretation stages. Given the nature of the embedded design, quantitative and qualitative data were interpreted together (Plano Clark et al., 2013).

Participants

The participants in this study were 11th-grade high school students from the natural science stream who are Muslims in Pidie district, Aceh Regency, Indonesia. The sampling technique in this study was divided into two parts: the purposive sampling technique was used to select a sample of 146 students to answer the questionnaire distributed, which will be used as quantitative data. While qualitative data was obtained from one-to-one semi-structured interviews, as many as five students were selected from those who had filled out the questionnaire at the previous stage using a purposive sampling technique. These respondents were selected based on their answers. 2 respondents had positive responses to the questionnaire, two had negative responses, and one was selected whose answer was in the neutral category. The names of the respondents were kept confidential so that the research would not violate research ethics, and all respondents in the study volunteered.

Instruments

The questionnaire of students' perspectives on the mathematics teaching and learning process in schools, as well as their perceptions about the necessity for developing a math module based on STEAM and Quranic approaches, is modified from a questionnaire that has been constructed by Vitrianingsih et al. (2021) and was used as the main instrument in this study. This questionnaire consists of four dimensions: learning experiences, difficulties in learning, understanding of the STEAM and Al-Quran approaches, and learning experiences using modules. The questionnaire was designed as a 5-point Likert scale. The Likert-type scale was used to measure perceptions related to statements that focus on a person's perspective on phenomena (Caia et al., 2018; Wu & Leung, 2017). This instrument is retested and validated by the researcher, and the findings show that all items are valid, and the reliability of Cronbach's α reached 0.89. Cronbach's α is essential for evaluating the quality and validity of variables used in research and making decisions regarding the consistency and stability of answers to questionnaires (Creswell, 2014). The test was trailed by 30 senior high school students in the Pidie district.

The interview protocol used for semi-structured interviews comprises items taken from the statements in the questionnaire that have been distributed in the survey, representing each dimension. The interview protocol questions were as follows: What do you feel when you study Math? How does your math teacher teach in your class? What is the most significant difficulty or obstacle you face when learning Math? Are you familiar with math problems at the Higher Order Thinking Skill (HOTS) level? Have you ever heard the term integrated learning? Can learning be integrated into science, technology, engineering, and art lessons? What is your opinion on mathematics? Learning is integrated with the knowledge of the Quran. Do you often use Modules in learning Mathematics? What are your opinions on using modules integrated with Quranic concepts in Mathematics?

Data Analysis

In this study, the data were obtained through questionnaire forms distributed using Google Forms. The questionnaire is a data collection tool that can easily collect and measure all information from research samples using a rating scale (Lupi et al., 2017). The first step of this research began with distributing of questionnaires to respondents, followed by quantitative data analysis. The results of the surveys were analyzed using a percentage formula to answer the research question. In interpreting the answer scores given by respondents using the criteria developed by Riduwan (2012), 0%–20% is frail, 21%–40% is weak, 41%–60% is fair, 61%–80% is strong, and 81%–100% is solid.

In the next stage, five students from the preview respondents were selected to participate in the given one-to-one semi-structured interviews to clarify their perspectives of the mathematics teaching and learning process in schools and their perceptions about the need for developing a math module based on STEAM and Quranic approaches. The same researcher conducted all the interviews. Then, it was followed by an interview transcript analysis. The audio-recorded interviews were transcribed, and the content was analyzed by creating codes, categories, and themes. The researchers carried out the coding independently. The final stage of this research is to interpret the quantitative and qualitative analysis results.

RESULTS AND DISCUSSION

Results

Mathematics Learning Experiences

This section will analyze the research findings to answer the first research question. Descriptive data from the learning experience dimension from the survey results, presented in the form of sums and percentages, is shown in Table 1.

Table 1. Students' perceptions of the learning experience

Statements	SA	A	U	D	SD	A + SA
The math learning process stimulates my brain.	10	27	6	81	22	37
	7%	18%	4%	55%	15%	25%
In the teaching and learning of mathematics, teachers only use textbooks.	17	87	5	28	9	104
	12%	60%	3%	19%	6%	72%
Math is meaningless because it has nothing to do with the hereafter (*Akhirat*).	17	65	2	37	25	82
	12%	45%	1%	25%	17%	57%
The process of teaching and learning Math is separate from real-life situations.	22	71	3	37	13	93
	15%	49%	2%	25%	9%	64%
Mathematics teaching and learning are conducted exclusively through a lecture-and-drill approach.	18	89	6	28	5	107
	12%	61%	4%	19%	3%	73%

Note: SA (strongly Agree), A (Agree), U (Neutral), D (Disagree), SD (Strongly Disagree)

The first questionnaire statement is, "The math learning process stimulates my brain." Based on the responses provided by the respondents in the table above, only 37 (25%) students agreed and strongly agreed that the learning process of mathematics stimulates their minds; the respondents' agreement with this statement can be categorized as weak. The second statement of the learning experience dimension is that teachers only use textbooks in teaching and learning Mathematics. 104 (72%) students agreed and strongly agreed with this statement; this categorization of the agreement was in a strong category. A descriptive analysis of this survey shows students' views that mathematics lessons are not helpful in their lives because it is not related to the needs of the hereafter; as many as 82 (57%) students agreed and strongly agreed; this agreement can be categorized as moderate. The following statement is that the teaching of mathematics is not associated with students' daily lives. As many as 93 (64%) students agreed strongly with this statement so it can be categorized into the strong category. The last statement of the learning experience dimension is that teaching and learning Mathematics is only done with the lecture and drill approach. 107 (73%) respondents agreed and firmly agreed with this statement so that it can be grouped in the strong category.

Analysis of the interview transcripts for students' feelings toward learning mathematics indicated

that students still need to be stimulated by the teacher's mathematics learning in the classroom. The majority of respondents (3/5) still believe that math study is tedious; the following are some of the example's answers given by the participants:

S2: Learning mathematics is so dull to me, so I often skip math class
S3: Numbers and formulas are two things that make me lazy and bored.
S5: Mathematics is a highly boring lesson for me.

Generally, respondents remarked that for some reason, "The teacher never connects the material being taught with the real context that surrounds the students," said respondents S1 and S3. Based on respondent S1, he stated that the mathematics material presented by the teacher is quite remote from his life, and he believes he is on a different planet when learning mathematics. He further added that "he disliked mathematics since it had nothing to do with the hereafter (*akhira*h). According to respondent S2 "teachers never link the topics taught with the concept of Al-Quran understanding." According to respondent S1, "teachers often remind students of religious issues during math lessons, but the advice given has nothing to do with the math topic being taught." Respondent (S1) quotes that "math is terrifying for me since my brain would stop thinking if I looked at the numbers that offer."

Only one student (S4) has a positive feeling towards mathematics subject. “I love math, and it stimulates my brain. I understand and know the benefits of studying mathematics”. He further mentioned that.

S4: I will explore every new topic I learn with the teacher outside classroom hours or in a private study space.

The following code of the learning experience dimension is the method used by the teacher in the teaching and learning process. The researcher opened the discussion with the question, "How does your math teacher teach in your class? " Almost all respondents (4/5) answered that the lecture and drill approach still dominate the process of teaching and learning mathematics in the classroom. The results of the interview transcripts show that the responses offered by respondents were highly diverse.

S1: The teacher only instructed students to work on the problems in the textbook by replicating questions.
S5: We copied every solution the teacher discussed on the blackboard.
S3: The teacher only utilized textbooks to teach and focused on answering the questions presented.
S5: The teacher concentrated on the completeness of the notes without putting any pressure on our understanding.

All respondents agreed that teachers still use the textbook provided by the school as their only reference in the teaching and learning process. "Teachers never introduce problems other than those in the textbook," according to respondent S3. The same thing was also confirmed by respondents S1, S2, and S5; even for them, learning mathematics is answering questions and memorizing formulas.

Based on interview transcripts on the learning experience dimension, there are two principal codes: (1) students' feelings towards learning mathematics and learning methods implemented by the teacher. The emerging themes and codes are summarized using the schematic diagram in Figure 1.

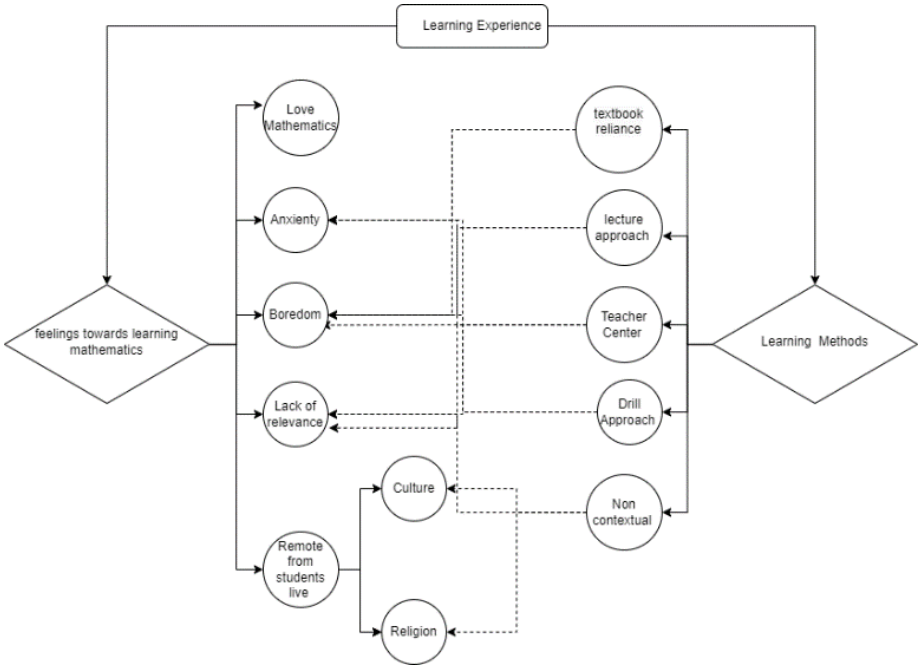

Figure 1. Students learning mathematics experiences

In conclusion, based on quantitative and qualitative data, this study's findings indicate that many students still need to like mathematics lessons. They still have a negative view of mathematics lessons. This is influenced by non-contextual mathematics learning and a lack of exposure to the benefits of mathematics lessons in everyday life, and many students feel that mathematics lessons are useless because they are not connected to their spiritual needs. This research also shows that many teachers are still glued to textbooks provided by the government and rely on lecture and drill methods in teaching mathematics.

Learning Difficulties

This section will analyze the research findings to answer the second research question. Descriptive data on the dimensions of learning difficulties as a result of the survey, presented in the form of sums and percentages, are presented in Table 2.

Table 2. Students' perceptions of the learning difficulties

Statements	SA	A	U	D	SD	A + SA
It is difficult for me to understand mathematical concepts because they are interconnected and linked from one topic to another.	20 14%	76 52%	5 3%	35 24%	10 7%	76 66%
I usually need help with basic math concepts.	22 15%	78 53%	12 8%	27 18%	7 5%	100 68%
I need to improve my understanding of higher-order thinking problems in mathematics.	28 19%	80 55%	9 6%	18 12%	11 8%	108 74%

Note: SA (Strongly Agree), A (Agree), U (Neutral), D (Disagree), SD (Strongly Disagree)

This section will explore the challenges students face when learning mathematics. The statement begins with, "It is difficult for me to understand mathematical concepts because they are interconnected and related from one topic to another." The findings of this study showed that 76 (66%) respondents agreed and strongly agreed; the respondents' agreement can be included in the strong category. The next obstacle students face in learning mathematics is remembering and applying basic mathematical

concepts to advanced concepts. 100 (68%) respondents agreed and strongly agreed that they usually had difficulty understanding basic mathematical concepts; the agreement given by the respondents is categorized in the strong category. The next difficulty faced by respondents in learning mathematics was difficulty understanding problems in the form of higher-order thinking (HOT), with 55% of respondents agreeing and 19% strongly agreeing; this statement is based on solid criteria.

The quantitative data above is consistent with the interview transcript analysis results. Based on interview transcript analysis, all respondents stated they had difficulty learning mathematics because the concepts were interrelated and there were too many formulas to master to solve a problem. Most respondents (4/5) stated that previous concepts matched the studied topic. He took much work are some students' responses:

S3: I always need help solving math problems because I forget the previous concepts.
S1: I get very annoyed when solving math problems, and I always have problems with the basic math concepts, even though sometimes I already understand the concepts being studied.
S2: Studying mathematics is like a chain; if you missed last week's lesson, you will not understand the next concept.
S5: I am always scolded by the teacher just because I need to remember the essential mathematics concepts, so I cannot solve the math problems the teacher gives me.

Only respondent S4 reported that he thoroughly enjoyed working on the math assignments assigned by the teacher. On the other hand, many respondents (3/5) were frequently dissatisfied while answering math problems, as expressed by respondent S5, "usually I will be able to use the formula correctly, but still, in the final solution, I am always constrained ."The same response was also shared by the S2 respondent, who indicated that my biggest weakness was remembering the mathematical content I had learned in earlier classes. Because of this weakness, eventually, all math topics became difficult for me.

Most respondents admitted they were familiar with basic math concepts such as addition, multiplication, and subtraction. However, they acknowledged needing help grasping the basic principles of trigonometry, algebraic operations, and geometry used in each math topic. "Teachers often ignore our basic skills and assume we already understand," said respondent S1. Teachers often ask us to repeat this concept at home; this must be addressed because we need help to help them, said S5. More extreme, the S2 respondent stated that:

"Let alone repeating material at home; for me, this was impossible because even when studying at school, I often skipped classes."

The second code for learning difficulties concerns students' performance when working on HOTS problems. The findings from the interview transcripts show that all five respondents experienced difficulties working on math problems at the HOTS level, with different experiences.

S4: I needed help understanding the context of the problems.
S3: I tried to solve some HOTS problems but needed help.
S1, S2, and S5: I did not know what HOTs level problems were, and I had never worked on problems that required a higher level of thinking.

According to respondents, teachers rarely introduce questions at the HOTS level. S3 and S1 said we often introduce routine questions in textbooks. Respondents S2 and S5 further stated that for questions at the regular level, we still have problems that need to be resolved, especially since we must consider questions at a higher level.

Based on interview transcript analysis, the dimension of learning difficulties consisted of two principal codes: the characteristics of mathematics and the High Order Thinking Skills (HOTS) Problem. The emerging themes and codes are summarized using the schematic diagram in Figure 2.

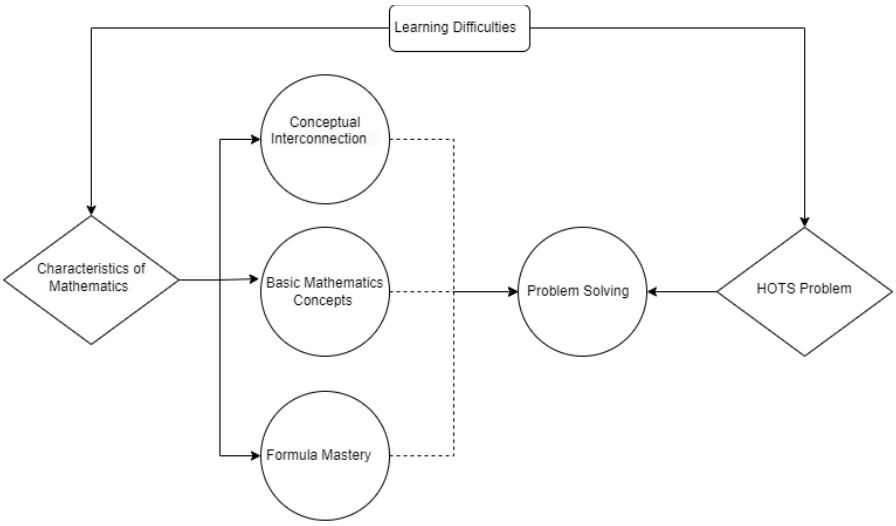

Figure 2. Students' learning difficulties.

Based on the results of the survey and interview data analysis, several things can be concluded. First, students have problems solving mathematical problems that involve several concepts in one problem because they need help remembering and connecting one concept with another. Apart from that, they also need help understanding basic mathematical concepts. Second, students need help solving problems at the HOTS level due to a lack of understanding of mathematical concepts, and teachers need to use HOTS problems in the teaching and learning process routinely.

Understanding of the STEAM and Quranic Approaches

This section will analyze the research findings to answer the third research question. Descriptive data from the understanding of the STEAM and Quranic approaches dimension of the survey results, presented in the form of sums and percentages, is shown in Table 3.

Table 3. Students Understanding of the STEAM and Quranic Approaches

Statements	SA	A	U	D	SD	S + SA
I often hear about the concept of integrated learning.	4 3%	35 24%	27 18%	70 48%	10 7%	39 27%
Math learning can be integrated with science, technology, engineering, and art subjects.	44 30%	94 64%	3 2%	4 3%	1 1%	138 94%
Math learning should be integrated with the concept of Al-Quran.	50 34%	68 47%	12 8%	12 8%	4 3%	118 81%

Note: SA (Strongly Agree), A (Agree), U (Neutral), D (Disagree), SD (Strongly Disagree)

The analysis of the descriptive data in Table 3 above shows that students are very unfamiliar with

the concept of integrated learning; only 39 (27%) students agreed and strongly agreed that they often listen to the concept of integrated learning, the agreement of students can be categorized in the weak category. The following statement is about the idea of integrating mathematics with other subjects. Almost all respondents (94%) agreed and strongly agreed that mathematics learning can be integrated with science, technology, engineering, and art subjects; the agreement given by the respondents to this statement can be categorized as very strong. Furthermore, the respondents also agreed and strongly agreed that mathematics learning should be integrated with the concept of Al-Quran. As many as 118 (81%) students agreed and strongly agreed with this statement so that it can be categorized as vital.

Based on the analysis of the interview transcripts, respondents S1, S2, and S5 "had never heard of the term integrated learning"; hence, they were confused and hesitant to respond. While respondents S3 and S4 said,

> *S3: I have heard the term integrated learning but needed to know what the term meant.*
> *S4: I have seen biology teachers teach biology material related to the religious and social sciences.*

However, all respondents believe there are relationships between one subject and another, although they do not know what those relationships are. Most respondents (3/5) stated that "teachers never mention the connection of mathematics topics with other disciplines, so the learning of each subject stands on its own without any connection or relationship ."However, respondents S4 and S3 stated that "they often do mathematics problems that are applied in other fields, as presented at the end of each chapter in the textbook; for them, it is simply a contextual problem that they have to solve."

Similar to the findings in the quantitative data, analysis of the interview transcripts also showed that all respondents answered positively to the question, do you think mathematics learning can be integrated with science, technology, engineering, and art lessons? All answers stated that math learning should be interconnected with other subjects such as science, technology, engineering, and art. According to respondent S4, these subjects are applications of mathematical concepts, so mathematics must be connected to these subjects. Respondent S5 also believed that math lessons should be integrated, but I need to figure out how to relate math material to other lessons. Respondents S1 and S2 explained that this integration is critical and should be done by all teachers, not just math teachers, but we are still confused and have never seen how the integrated learning process is done. All respondents are very anxious to join a class that integrates mathematics with other concepts so that students can understand the benefits of learning mathematics.

The interview results show that the respondents are very interested and feel that mathematics learning can be integrated into an understanding of Al-Quran concepts but are skeptical about this integration because the Quran and mathematics have nothing to do with each other, said S3. Respondent S4 believes that the integration process can be done if the teacher has a deep knowledge of mathematical concepts and an understanding of the Al-Quran concept. Meanwhile, respondents S1, S2, and S5 stated that math learning should be integrated because learning religion is compulsory, and teachers should learn to integrate every math concept with an understanding of Al-Quran. All respondents hope teachers can integrate mathematics lessons with Al-Quran knowledge to increase students' interest and motivation in mathematics. Furthermore, respondent S1 stated that.

S1: If we memorize symbols and numbers, learning mathematics is a waste of time, but if we can relate it to Al-Quran knowledge, it will be more helpful.

The results of the interview analysis, based on students' understanding of STEAM and the Al-Quran approach, consist of two principal codes: students' understanding of integrated learning and their perceptions of integrating mathematics with other subjects. The emerging themes and codes are summarized using the schematic diagram in Figure 3.

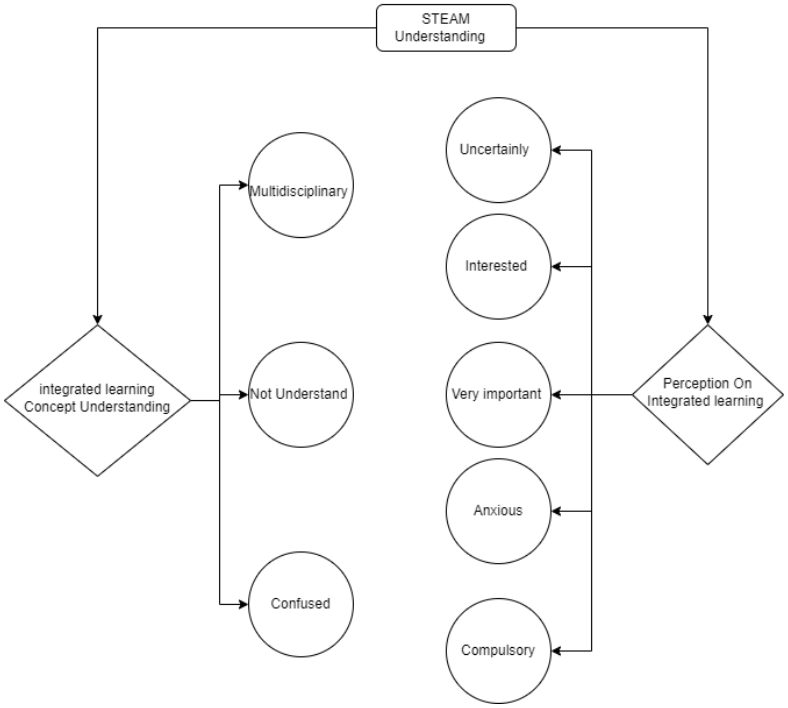

Figure 3. Students' understanding of STEAM and the Al-Quran approach

The conclusion from the quantitative and qualitative data analysis in the dimension of Understanding STEAM and Quranic approaches is that many students need to learn the concept of integrated learning in mathematics and other subjects. However, they strongly agree that mathematics lessons are integrated with other subjects such as science, technology, engineering, and art. Respondents strongly agreed that mathematics lessons are linked to general religious understanding and the Quran, even though they did not know the relationship between mathematics and the Quran. All respondents would like to feel that the learning climate is integrated so that they will know the usefulness of the mathematical concepts being learned, and it is also more helpful if it is integrated with Al-Quran understanding.

Learning Experience using the Module

This section will analyze the research findings to answer the fourth research question. Descriptive data from the learning experience using the module dimension from the survey result as sums and percentages in Table 4.

Table 4. Students learning experience using the module

Statements	SA	A	U	D	SD	S + SA
Modules are frequently used in my learning.	5 3%	47 32%	8 5%	66 45%	20 14%	52 35%
Modules are one of the learning media that are suitable for mathematics.	39 27%	90 62%	8 5%	9 6%	0 0%	129 89%
Developing mathematics modules integrated with the Quran is suitable for improving the understanding of mathematics and religion.	49 34%	77 53%	4 3%	9 6%	7 5%	126 87%

Note: SA (Strongly Agree), A (Agree), U (Neutral), D (Disagree), SD (Strongly Disagree)

The descriptive data above shows that only 52 (35%) respondents agreed and strongly agreed that the statement module is frequently used in my learning; the agreement the respondents gave needs to be stronger. However, respondents were very optimistic about the statement, "Modules are one of the learning media suitable for mathematics."As many as 129 (89%) respondents agreed and strongly agreed with this statement, respondents agreed so this statement can be categorized as very strong. Furthermore, the respondents strongly agreed that developing mathematics modules integrated with the Quran is suitable for improving the understanding of mathematics and religion. As many as 126 (87%) respondents agreed and strongly agreed with this statement, meaning that the respondents' agreement with this statement can be categorized in a potent category.

Based on the findings of the analysis of the interview transcripts, The respondents had different responses to the experience of using modules in learning, while their opinions were:

> *S1: From elementary school, I never saw a mathematics teacher teaching using a module; they always brought textbooks into class.*
> *S2: If the math class comes, our task is to write down all the answers the teacher has written and explained on the blackboard.*
> *S3: Every math lesson, I only see the teacher come to the classroom and write some problems on the board, then discuss some of them, and the rest will be practice for us.*

In general, all respondents claimed that they never use modules in learning mathematics; they exclusively use the textbooks offered in the library. Sometimes, they are provided with the student worksheet if the teacher cannot attend the class, but it only contains questions without any additional material that needs to be studied. Respondent S4 felt a different experience: "I have used modules to study, but when studying other subjects, it is scarce." Similar to respondent S5, "The modules that teachers use are like the practical materials used in biology and chemistry classes, which we only use once per semester."

The respondents strongly agreed that the module should be used as a medium for learning mathematics because it would be by the environment and the learner's ability. All respondents responded positively to the development of mathematics teaching modules that integrate religious values into mathematical learning, especially the Al-Quran concept. As mentioned by respondent S1,

S1: "Developing the mathematical module that integrates the Qur'an is interesting and makes me curious about studying it."
S3: the development. " This integrated module would make students who do not like math curious, and they would study the modules provided.
S4: Developing mathematical modules integrated with the Qur'an will boost our learning. Finally, learning mathematics will be a future ukhrawi reward for us.

Four out of five respondents indicated that the module would become a teacher's charity if other teachers or people later used it. Furthermore, all respondents said they were very enthused about the development of mathematics teaching modules combined with the comprehension of the Quran, which students in Aceh need. Respondent S5 mentioned that "teachers who usually only teach symbols and numbers will now teach Fiqh (Islamic jurisprudence) or tawhid (the indivisible oneness concept of monotheism in Islam), so they will become Ustaz (religion teacher) at the same time."

The results of the interview analysis based on the dimensions of Students' learning experience using the module consist of two principal codes: (1) students' experiences of module use and (2) students' perceptions of integrated mathematics module development. The emerging themes and codes are summarized using the schematic diagram in Figure 4.

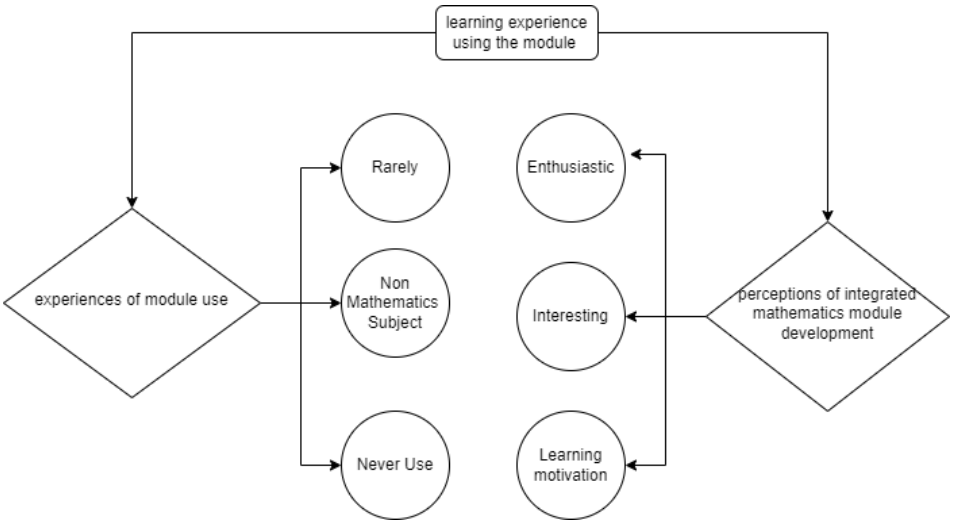

Figure 4. Students' learning experience using the module.

From the above review, students still need to familiarize themselves with using modules in school. However, they strongly agree that modules should be used as a medium in mathematics learning. All respondents agreed that developing a mathematics module integrated with understanding the Quran is very relevant to the Acehnese context, which implements Islamic law and is influenced by local wisdom.

Discussion

The findings of this study show that students still have a negative experience of learning mathematics; many feel bored with math class and afraid of math, and even students feel that math lessons are not helpful for their lives. The results of this study align with research conducted by Setyaningsih and Utami (2021) and Suradi and Djam'An (2021). Based on analysis of interview data, it is known that the leading cause of students' dislike of mathematics is that mathematics learning at school is not contextual, so what students learn seems strange and useless to them. Learning that pays attention to students' social environment will make

mathematics learning more memorable and meaningful for students. This viewpoint is consistent with Li and Schoenfeld (2019), who emphasize the importance of viewing mathematics as a human activity, ensuring its relevance to students, and developing students' mathematical thinking about ideas rather than simply absorbing a set of static and disconnected knowledge and skills.

In the Acehnese context, the understanding of Islam is a culture that cannot be separated from the Achenes (Ar-Rahmany, 2022). Here is an expression that the Acehnese people often echo as a characteristic of the Acehnese: "*Adat ngen hukom lage zat ngen sifeut*" (custom with the law is like substance with nature). This expression is about the inevitable unification between Islamic teachings and culture in the daily lives of the Acehnese people (Idris, 2022; Muthia et al., 2021). This is also reinforced by Aceh Governor Regulation No. 07 of 2022, where Islamic character building is part of the local wisdom curriculum and must be taught to all students. Therefore, Teachers must be able to integrate religious values into mathematics learning. Learning by integrating religious values can help develop competencies in spiritual and social attitudes holistically (Hartoyo et al., 2019; Muslimin et al., 2020). Mathematics education in the classroom must also broaden students' perspectives on mathematics as a more valuable and desirable discipline (Blanco et al., 2022). The Islamization of mathematics learning will be able to shape students' characters (Kusmaryono & Basir, 2020). This is essential to reducing the number of incidents of bullying in schools, reducing the number of students involved in drugs, and forming students who have good morals and Pancasila profiles following the hopes of religion and the state.

Other adverse experiences by students indicate that many teaching and learning processes are still centered on textbooks and that the findings of this study are consistent with research conducted by Jäder et al. (2020). According to the book's authors, using textbooks in mathematics learning will influence students' mindsets and ability to grasp math concepts (Jiang & Li, 2023). In addition, the use of textbooks will have an impact on the use of methods by teachers in the teaching process so that students will focus on reading and practicing (Wang & Fan, 2021). Furthermore, using textbooks in teaching and learning will hinder students' critical thinking skills and contextual understanding due to the generality of mathematical concepts in textbooks (Kristanto & Santoso, 2020). In line with this view, the results of this study also show that the teaching and learning process in mathematics classes is still dominated by teachers who use lecture and drill methods. Schools' teaching and learning process is expected to increase students' creativity by using a fundamental approach to teaching and learning that can be student-centered, focus on student needs, and prioritize learning facilitation.

According to the findings of this study, the biggest challenge students face when learning mathematics is difficulty understanding mathematical concepts because the basic principles of mathematics are hierarchical. Agustina (2018) came to the same conclusion in her research. Learning mathematics should be systematic and continuous without skipping steps or mathematical concepts. In addition, the findings of this study indicate that many students struggle with basic mathematics concepts, which will significantly impact their future academic performance. Low numeracy impacts many parts of people's lives (Fritz et al., 2019). Teachers must be able to implement differentiated learning to develop each learner's ability to understand mathematical concepts (Louie, 2020; Powell et al., 2021). Teachers must be able to provide individualized support to any students who are struggling with basic math concepts so that the teaching process is smooth.

Students also need help understanding questions at the HOTS level. This study's results are in line with results released by PISA 2018, which state that about 1% of Indonesian students can mathematically represent complicated scenarios (OECD, 2019). One of the limitations students face in solving mathematical problems is difficulty developing mathematical models, mathematical concepts are

communicated informally in teacher-centered learning, and students are forced to solve many problems without a deep understanding (Agusta, 2020).

Traditional teaching's transition from teacher-centered to student-centered must be smooth and take time (Brouwer et al., 2022). Monotonous learning and teacher-centered teaching must be changed to student-centered learning by adapting teaching materials and learning media to the times, students' needs, interests, and the workforce's needs (Balgan et al., 2022). Thus, mathematics will become more popular and become a favorite subject. The teacher-centered teaching approach makes students' understanding of the diversity of learning models blind; teachers should be able to introduce integrated teaching models as demanded by 21st-century learning. Mathematics education in school should be integrated with science, technology, engineering, and the arts because integrated learning is a 21st-century learning need (Beswick & Fraser, 2019). Blended learning is a pedagogical strategy in which students learn by integrating experiential learning in educational and real-world situations (Shcherbatykh & Lykova, 2022). Teachers should be able to teach as a team or individually to introduce the disciplines of each topic so that students can observe the application of their knowledge in the real world and realize the connections between lessons.

Learning mathematics with the integrated Science, Technology, Engineering, and Art known as the STEAM (Science, Technology, Engineering, Art, and Mathematics) approach, introduced by Yakman (2010), which integrates art skills in the teaching and learning process with the STEM approach, is a solution in 21st-century learning. Learning with the STEAM approach can change computational thinking to creative thinking (Park & Ko, 2012), improve scientific thinking processes and improve project competence (Lin & Tsai, 2021), enhance creative thinking (Sutama et al., 2020), reasoning ability (Garcia-Piqueras & Ruiz-Gallardo, 2021), critical thinking (Fernández-Cézar et al., 2021), and improve creativity, innovation, scientific literacy, and problem-solving skills (Ardianti et al., 2020).

The last issue that is also a learning experience for students in this study is using modules in the teaching and learning process. The results of the data analysis of this study, both quantitatively and qualitatively, indicate that students very rarely use modules in the teaching and learning process. Respondents believe that modules are a very suitable medium for teaching mathematics. This is consistent with Mardiyah et al. (2020), who argue that respondents believed the module was a suitable learning media for teaching mathematics. The use of teaching modules in the teaching and learning process is significant because it allows teachers to communicate learning content more effectively, make abstract material more tangible, and make complex material more accessible to understand, as well as alleviate the problem of space and time limits (Pujiastuti et al., 2020). Using modules in teaching and learning mathematics improves students' understanding of mathematical concepts (Taufikurrahman et al., 2021). The usage of modules in mathematical learning can increase mathematics communication abilities (Gistituati & Atikah, 2022), help the students understand mathematic concepts (Insorio & Macandog, 2022), and improve mathematical reasoning (Hidayat et al., 2022).

National education aims to develop students' personalities and morals, beginning with Pancasila and based on Indonesian religious and cultural values, and to equip them with the skills to continue living in the modern world (Depdiknas, 2003). Educators must be able to present a balance in technological developments in the industrial era 4.0 with religious elements as a catalyst in the development of science and be able to balance elements of knowledge (cognitive), skills (psychomotor), and attitudes (affective) (Akhwani & Romdloni, 2021; Al-Attas, 1991). Character building will be easy to shape if integrated into every lesson so that children will always get an invitation to do good and get new knowledge from the lessons they are learning (Ulia et al., 2020).

More than half of the respondents also agreed that developing mathematics modules integrated with the Quran is suitable for improving the understanding of mathematics and religion. Mathematics will feel more practical when students are frequently introduced to the concept of faith a*nd the foundation* of knowledge rather than just looking at formulas and solving problems. Including the Quranic component in mathematics teaching and learning will increase students' knowledge of the development of the Islamic character demanded by Islamic teachings. The Quran can influence and improve human values, including mental, physical, emotional, and spiritual qualities (Ramli & Ibrahim, 2017). Mathematics learning that integrates STEAM and the Quran will make learning mathematics helpful and also be based on Lev Vygotsky's Social Constructivism Theory and Syed Muhammad Naquib Al-Attas's (1991) educational concept of integrating the Quran and science.

CONCLUSION

This study has shown that senior high school students in Aceh have a negative experience of the teaching and learning process of mathematics in the classroom. Most respondents in this study felt that math lessons were dull and useless for their lives. Furthermore, the results of this study also found that the teaching carried out by teachers in schools still relied on textbooks and lecture and drill methods. One of the reasons students dislike mathematics lessons is that teachers need to integrate mathematical concepts into their daily lives. Even fewer teachers can integrate Islamic values into learning mathematics at school, whereas understanding Al-Quran knowledge is an essential component that students must master. The next factor that makes mathematics scary for students is a lack of crucial mathematical ability, which is required to understand advanced concepts, and the hierarchical nature of mathematics, which causes students to feel disappointed when their answers are interrupted in the middle of the road.

Most respondents need help addressing issues at the HOT level, as required by 21st-century skills and the Indonesian curriculum. Respondents still need to familiarize themselves with integrated learning. Still, for them, the learning of mathematics integrated with other lessons such as Science, Technology, Engineering, and Art is ideally in line with the demands of the present time. Further, they agree that learning Mathematics should be integrated into Al-Quran understanding as a balancer of modern life. This study provides a significant contribution for mathematics teachers to design learning according to students' wishes and maximize the concept of national education. For researchers and academics, the results of this study can be used as a reference to design modules based on the needs and religious demands of the times.

According to the findings of this study, teachers should be able to develop modules or learning media that can integrate STEAM approaches to meet the demands of 21st-century skills and understanding of the Quran for the development of student personality and character. Finally, more research is recommended to develop learning modules that integrate the STEAM approach with Al-Quran understanding and further examine those modules' feasibility and usefulness. The designed module may also be modified for other subjects. The limitations of this study are the relatively small size of the sample and the focus on one location. Future research might apply various numbers, areas, and levels of education. This study only looks at the dimension of Learning Experience, learning difficulties, understanding of the STEAM approach and the Quran, and learning experience using the module. Similar research should be undertaken in other courses to consider students' perspectives on the teaching and learning process.

Declarations

Author Contribution	:	M: Conceptualization, Writing - Original Draft, Editing, and Visualization. HZ: Writing - Review & Editing, Validation, and Supervision. RAAR: Validation and Supervision.
Conflict of Interest	:	The authors declare no conflict of interest.
Additional Information	:	Additional information is available for this paper.

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