



Research article

Development and validation of the Quran – Science, Technology, Engineering, Art, And Mathematics (Q-STEAM) module

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Abstract: This study evaluates the content validity of the Quran-science, technology, engineering, art, and mathematics (Q-STEAM) module, designed to integrate Quranic approach with STEAM (Science, Technology, Engineering, Art, and Mathematics) education. This integration aims to enhance mathematics understanding while fostering Islamic character. The integration of the Quran in this module is dominated by mathematics to deliver the Quran and mathematics with the Quran. The module was designed using Borg and Gall's research method. Ten experts, who are specialists in the domains of mathematics education, STEAM education, Islamic education, and Indonesian language, assessed the module. The assessment resulted in high validity scores, where the results indicated that the content validity index for the Q-STEAM module falls within the range of 83–100%. The instrument used in this research is the content validity form. The experts agreed that the contextual problem should be set at the beginning of the module so that the contextualization of learning can be realized and that learners should be familiarized with triggering questions to stimulate thinking and recall concepts that have been learned. Similarly, the experts explained that the module should be structured according to the students' developmental trajectories to help students understand the context. This module has designed learning that integrates Quranic verses in every engineering design process (EDP) step in completing the project. This module can be used as a reference in professional development training for teachers in courses for mathematics education.

Keywords: module development, Q-STEAM, mathematics education, content validity, project-based learning

1. Introduction

Based on the results of the Organization for Economic Co-operation and Development's (OECD) 2022 Programme for International Student Assessment (PISA), a significant majority of Indonesian students, specifically 82%, demonstrated a lack of ability in comprehending basic reading material or applying fundamental mathematical principles [1]. The COVID-19 epidemic, the suspension of the teaching and learning process for several months, and the ineffective teaching methods in 2020 are all contributing factors to the decline in students' scores. The teaching and learning at school should encompass more than just the cognitive development of students. It should also align with the objectives of national education, which include fostering the development of students' abilities, character, and civilization. The goal is to cultivate students who are faithful, pious, noble, healthy, knowledgeable, capable, creative, independent, and democratic and responsible citizens [2]. Education should be able to provide space for all components and incorporate all parts of knowledge, skills, and attitudes [3]. This notion is in line with *ta'dib*, introduced by Syed Naquib, a concept that states the term *ta'dib* is not restricted to cognitive components but also covers spiritual, moral, and social education [4]. In principle, the concept of education has two fundamental purposes: intellectual development and character building. This also applies to mathematics learning. Soedjadi [5] believes that every process of teaching and learning mathematics in schools involves material and formal purposes. Material purposes stress problem solving and mathematical applications in students' daily lives, while formal purposes stress rational management and the development of students' wisdom.

Apart from inadequate understanding of mathematics, a major problem in Indonesian education nowadays is severe moral degradation. According to data from PISA 2023, almost 25% of girls and 30% of boys said they had experienced bullying at least a few times a month [1]. In addition to bullying incidents, the use of drugs among students is also very alarming, with 5.9 million out of 87 million Indonesian children taking drugs, according to figures released by the National Narcotics Agency (BNN). More worryingly, 24% of drug users are students [6]. This deterioration in student character is evidence of the problems with current education, which is that education cannot shape and influence the formation of morality, ethics, and character of the next generation [3].

Teachers must innovate the teaching and learning process to boost students' motivation and comprehension in order to solve this significant issue. But as required by the education law, educators must also be able to help students improve their character. Teachers must embrace student-centered learning and use the student's environment as a medium, as demanded by the modern workplace. The integration of project-based learning into education is one form of instruction that meets these criteria. According to Yakman [7], STEAM (Science, Technology, Engineering, Art, and Mathematics) is an integrative learning approach which integrates the subjects of science, technology, engineering, art, and mathematics into a single session. Learning with STEAM is a project-based teaching approach and therefore ideal for developing students' mathematical skills, in addition to focusing on aesthetic values and social skills that they will use in their daily lives and also language, which is the main tool for success in today's industrial era [8].

There has been a lot of research and development of teaching media using the STEAM approach has been carried out, however the research ignores the development of students' character and solely concentrates on improving students' STEM skills, such as, impact on favorable impact on Scientific process [9,10], investigative skills [11], and students' creative thinking [12,13]. It also develops

students' reasoning skills [14], critical thinking [15], innovation, creativity, scientific literacy, and problem-solving skills [16]. The teaching and learning process utilizing the STEAM approach will recommend literacy for 21st century abilities so that students can meet the challenges of globalization and engage in modern life [17,18]. In Indonesia educational system teaching and learning mathematics with the STEAM approach have been widely used such as studies carried out by Fazri and Asikin [19], Novianti and Suriyana [20], Ardianti et al. [16], and Rahmawati et al. [21]. All these studies are not focusing on developing students' character as needed by the national education goal.

In order to address the absence of the student's character development in STEAM Approach, this project will develop a mathematics teaching module that combines the understanding of the Quran into mathematics teaching through a STEAM approach, which will be shortened as Q-STEAM module. This module will assist students in developing their STEM skills while engaging in character development by using brief passages from the Quran as a reminder at each step of the assigned project. Students' characters will be strengthened by integrating their understanding of the passages from the Quran since it will serve as a constant reminder of religion and deity [22,23]. Regular practice can help these ideas become more ingrained in long-term memory and the subconscious, making them easier to utilize and even appearing on their own without the user recognizing it. Students who engage with the Quran daily will become acquainted with the idea of Islam in terms of monotheism and sharia law. This concept is also in line with Einstein's view that states that science without religion is blind, religion without science is lame [24].

The integration of the STEAM idea with the understanding of Quran is carried out in an integrative method; this model is chosen because the school project learning follows the topics and subjects produced in the curriculum rather than relying on current projects and existing science concepts. Integrating the Quran into teaching and learning will be included in the core step of finishing the given project. In this study, the Q-STEAM module will be constructed using the engineering design process (EDP) paradigm developed by Massachusetts Department of Education.

Integrating the understanding of the Quran with the STEAM approach in teaching mathematics necessitates the use of media that facilitates the learning process for both teachers and students. Modules are an optimal way for implementing project-based teaching and learning. The use of modules will help students learn gradually, although slowly. The usage of modules will train student independence because modules are more particular, comprehensive, and created for smaller units [25]. Furthermore, modules will make abstract materials more concrete and complex materials easier and alleviate the problem of space and time restrictions [26]. Furthermore, including modules into the teaching and learning of mathematics will enhance students' understandings of mathematical concepts [27,28]. The development of modules should be systematic and user-friendly, taking consideration of the students' comprehension and age in order to facilitate independent learning with minimal guidance [29]. To get a valid and reliable module, expert judgment is needed. Design validation is the process of reviewing drafts to ensure that all components and indicators used contain all features or ideas to be measured to measure what should be measured [30].

The objectives of this research are to assess the validity of the Q-STEAM module in the learning derivatives of algebraic functions. The research question is: Does the developed Q-STEAM module for derivatives of algebraic functions have satisfactory validity?

2. Methodology

2.1. The design of the study

This study uses a multi-method research approach based on the research and development (R&D) method developed by Borg and Gall [31], including (1) potential and problems, (2) data collection, (3) product design, (4) design validation, (5) design revisions, (6) product testing, (7) product revisions, (8) product testing, (9) product revisions, and (10) mass production. This research focuses on design validation. The data from this study are the module validity scores established by experts. Then, in order to strengthen and standardize the researcher's perception with the expert, the next step is to interview the expert.

2.2. Sample of the study

The number of samples selected in the module validity review process was ten experts. There are no specific requirements regarding the determination of the number of experts in determining the validity of the module. Zamanzadeh et al. [32] mentioned that at least five people are recommended to have sufficient control over chance agreements, further explaining that it is unlikely that more than ten people are used. However, as the number of experts increases, the likelihood of a chance agreement decreases. The selection of the research sample in this phase was made based on purposive sampling. The experts are one professor who specializes in the field of STEAM, one professor who has expertise in the field of mathematics and STEAM, one lecturer with the criteria of having expertise in mathematics and STEAM education, one lecturer who has expertise in the field of Islamic mathematics education, two mathematics teachers with more than ten years of experience teaching mathematics and expertise in the STEAM field, one Islamic education lecturer and one professional trainer in the field of Islamic education, both experts in the field of Islamic education are experienced in Islamic education research, and two language experts who have expertise in Indonesian language with more than ten years of experience teaching Indonesian language.

2.3. Research instrument

The research instruments used in this study are the content validity form (CVF). The Q-STEAM module validity evaluation questionnaire instrument, which is a module evaluation form that has been modified according to the requirements provided by the Indonesia Education Requirements Agency [33]. For the Q-STEAM qualification, the questionnaire was modified from the instrument that had been built by Arifin et al. [34] and Amatan et al. [35], while the questionnaire for the Islamic education qualification was modified from the instrument that had been developed by Yuniati and Sari [36]. The combination of these instruments represented the needs of the module development assessment from all aspects that influence the Q-STEAM module. Each of the instruments adopted in this study have a good level of validation. All measures allow the sample to score on a five-point Likert scale from 1 (strongly disagree) and 5 (strongly agree). The Q-STEAM module validity evaluation will be reviewed by different experts according to their individual competence; thus, the module validity evaluation questionnaire is separated into several parts according to mathematics and STEAM experts, Indonesian language experts, and Islamic education experts.

2.4. Data analysis

The research question was addressed by a descriptive analysis using percentage statistics. The formula for determining the validity level of the module is as follows:

$$\frac{\text{Number of agreed and strongly agreed responses (x)}}{\text{Number of experts (y)}} \times 100\% = \text{Level of validity}$$

If the percentage of answers from the panel of experts who responded agree and strongly agree is equal to 70% or more, then the module has high content validity [37]. The Q-STEAM module's validity level was assessed using Akbar's module validity criteria [38].

After a structural analysis, all interview data were replayed and dialogically transcribed. The results of the interviews are solely utilized to support the descriptively analyzed findings and to get expert emphasis and explanation for each of the responses provided. Interviews serve as a means of connecting and matching perspectives between researchers and experts.

3. Results, discussion, and conclusion

The validity of the Q-STEAM module is assessed by referencing the opinions of ten experts. Every expert received a manual containing a duplicate of the whole Q-STEAM module draft as well as a questionnaire for evaluating the module, which included closed-ended questions. The characteristics to be evaluated include content qualification, presentation qualification, visual qualification, Indonesian language qualification, Q-STEAM qualification, and Islamic education qualification. The evaluation of the Indonesian language and Islamic education qualification dimensions involved the assessment of four separate experts, while the remaining dimensions were evaluated by six other experts. The analysis of the Q-STEAM module validity questionnaire findings on the content qualification dimensions from six experts is shown in Table 1.

According to Table 1, the validity of the content qualifying dimension ranges from 83% to 100%. The experts have provided some crucial feedback for the enhancement of this module. Their remarks are as follows:

P1: The concept of the derivation of algebraic functions needs to be elaborated with contextual problems.

P3: The teaching process in the module still seems to be centered on the teacher, and HOTS (Higher Order Thinking Skills) questions need to be added to each exercise in the module.

P4: The Q-STEAM module needs to be added with a video link to make this module more effective because it will focus more on students.

After discussing with several experts, the adjustments in this section have been modified, some contextual problems have been added to this module, and some issues that are common in the student environment have been addressed. To enhance the student's curiosity, it is enough to add some information related to the concept of two *kullah* water in the form of a video or article, which is provided in the form of a barcode.

According to the above analysis, all constructs and items are accepted by experts, with some adjustments made to some things that have a suitable level of validity; no changes should be made to items with high validity. The experts believe that the Q-STEAM module is designed for independent

learning and focuses on student-centered activities, especially with the application of project and problem-solving skills. As a result, the students will learn actively, and the effect will increase the students' interest in learning mathematics more effectively. After reviewing and adjusting with expert suggestions and comments, the Q-STEAM module prototype in the content qualification dimension was accepted by all experts with a high level of validity.

Table 1. Content validity findings based on expert evaluation.

Construct	Statement item	Percentage	Expert assessment
Suitability of teaching materials with learning objectives	Comprehensiveness of teaching materials.	100%	High validity
	Extent of teaching materials.	100%	High validity
	Depth of teaching material.	83%	Sufficient validity
	Accuracy of ideas and descriptions.	83%	Sufficient validity
Appropriateness of teaching materials	Accuracy of information and evidence.	100%	High validity
	Example and case precision.	100%	High validity
	Accuracy of diagrams and illustrations.	100%	High validity
	Terminology consistency.	100%	High validity
Latest teaching materials	Pictures, diagrams, and illustrations to keep up with the times.	100%	High validity
	The content raised is in accordance with reality.	100%	High validity
	Using examples and cases found in everyday life according to the current situation.	100%	High validity
	Encourages curiosity.	83%	Sufficient validity
Encourage curiosity	Create the ability to ask questions.	100%	High validity
	Create an atmosphere of discussion.	100%	High validity
	Create an investigative environment to complete projects.	100%	High validity

The next dimension in this module evaluation form is the qualification of the module presentation. The analysis of the Q-STEAM module validity questionnaire findings regarding the dimension of presentation qualification from six experts is listed in Table 2.

Based on Table 2, the items associated with the delivery method construct are in the range of 85% to 100%, which implies that all the experts agree on it, and there are two items that still need improvement. The first item is the very organized flow of concept delivery. The flow of delivery in the initial draft is according to the steps of the EDP. However, the experts propose that the module start with mathematical concepts and further the subsequent improvements to the item. The second is all components are presented correctly. Here are some expert recommendations for completing the Q-STEAM module.

P5: Users do not yet recognize the module as a mathematics learning module, it should start with the concept of differentiation of algebraic functions, followed by EDP steps and other topics.

P1: Introduce mathematical concepts with contextual problems and also explain the use of differentiation concepts in real life.

Table 2. Validity of presentation qualifications based on expert assessment.

Construct	Statement item	Percentage	Expert assessment
Delivery method	The flow of concept delivery is very organized.	83%	Sufficient validity
	All components are properly laid out.	83%	Sufficient validity
	Systematic delivery consistency in teaching activities.	100%	High validity
	Can increase student engagement.	100%	High validity
	There are sample questions in each learning activity.	100%	High validity
Delivery support	There is exercise at the end of each learning activity.	100%	High validity
	There are answer keys for the practice section.	100%	High validity
	There is an introductory section.	83%	Sufficient validity
	There is a glossary section.	0%	Invalid
	There is a summary section.	50%	Validity is less
Coherence and consistent thought patterns	There is a bibliographic section.	100%	High validity
	Delivered regularly and related to learning activities.	83%	Sufficient validity
	Interrelated between one lesson and another lesson.	83%	Sufficient validity
	Integrity of meaning in every learning activity.	83%	Sufficient validity
	In line with the cognitive growth of students.	83%	Sufficient validity

This flow will make it simpler for students to understand and recognize the Q-STEAM module. Students will realize that the project they are working on is an application of the differentiating concept they are learning. This will make it easier for the mathematical issues being studied to become more relevant to the students and can lead to boosting motivation and enthusiasm as well as increasing students' understanding of mathematics.

The next construct is delivery support, where the percentage range is between 0% and 100%. In this construct, there is one item that needs to be removed or added, which is that there is no glossary section in the module. All experts agree that this module should be supplemented with a glossary section. Next, the item that has less validity is that the module already has a summary, as indicated by the comment given

P2: The module needs to add a summary at the end of each Q-STEAM learning step.

The Q-STEAM module's design advises each student to create a summary based on their experiences and the knowledge they picked up along the way. According to the opinion reached after discussing this design with the experts, a summary section is not necessary.

The connections between the materials formed in these modules are not connections of each concept. In order to finish the end project of building a reservoir tank with a capacity of two *kullah*, which is eligible for taking an ablution (the Islamic practice of washing certain areas of the body as a

sort of ritual purification), all the activities in this module adhere to the EDP's instructions. While the procedures that children go through, such as analyzing problems in their environment, looking for pertinent information, and developing and building the final result, can help to shape their mathematical thinking abilities.

The final component of presentational competence is a coherent and consistent pattern of thought. There are three elements, all of which need to be improved because the expert agreement percentage for this construct is 83%. According to the nature of the teaching module, which is self-reliance, it is required to be given a rubric for each feature that will be evaluated. The expert panel agreed that the Q-STEAM module does not yet have a rubric that can be utilized as a guide for students. With the preceding analysis, after analyzing and improving, all the constructs in the Q-STEAM module presentation validity evaluation instrument have been accepted by the experts.

The findings of the Q-STEAM module validity questionnaire for the graphic qualification dimension from six experts are shown in Table 3.

Table 3. Findings of graphic qualification validity based on expert evaluation.

Construct	Statement item	Percentage	Expert assessment
Appearance of the module	Size compatibility with module content material.	83%	Sufficient validity
	The appearance of layout elements on the front cover and the back harmoniously has rhythm, unity, and consistency.	100%	High validity
	The colors of the layout are harmonized and describe the function.	83%	Sufficient validity
	The font size of the module title is more dominating and proportionate.	83%	Sufficient validity
	Doesn't use too many combinations of letters.	100%	High validity
	Consistent arrangement of layout based on patterns.	100%	High validity
	The separation between parts is evident.	83%	Sufficient validity
Module design	Spacing and margins are proportionate.	100%	High validity
	Placing decorations or illustrations as a background does not interfere with titles, text, or page numbers.	100%	High validity
	The positioning of titles, subtitles, graphics, and picture captions does not impede with interpretation.	83%	Sufficient validity
	The majority of letter modifications (bold, italic, all capital, small capital) are not excessive.	100%	High validity
	Heading levels are clear, consistent, and proportionate.	83%	Sufficient validity
	Can reveal the meaning of objects.	83%	Sufficient validity
	Exact shape and proportion according to reality.	100%	High validity
	Creative and dynamic.	83%	Sufficient validity

Based on the descriptive data analysis in Table 3, the range of expert agreement in the graphic qualification dimension is 83% to 100%. The number of items that need to be revised is the same as the number of items that have a high level of validity. The first construct in this dimension is that

visual qualification is at a sufficient level of validity. In this section, the appearance from the outside of the module will be seen, and experts propose some suggestions for improving the Q-STEAM module, such as the addition of a picture of ablution on the module's cover. After modifying and discussing with the experts, all the experts agreed that the validity of the Q-STEAM module in the graphic qualification dimension is valid.

The analysis of the Q-STEAM module validity questionnaire findings on the Q-STEAM qualification dimension from six experts is shown in Table 4.

Table 4. Q-STEAM qualification validity findings based on expert assessment.

Construct	Statement item	Percentage	Expert assessment
Q-STEAM steps	This module has used real problems as initial teaching problems (Identify).	100%	High validity
	This module gives students the opportunity to conduct research.	100%	High validity
	This module gives students the opportunity to fantasize about the completion of the project (Imagine).	83%	Sufficient validity
	This module gives students the opportunity to carry out project solution design (plan).	100%	High validity
	This module gives students the opportunity to carry out a project to solve the given problem (create).	100%	High validity
	This module gives students the opportunity to try the design of the project that has been built (test).	100%	High validity
	This module gives students the opportunity to share problem solving (communicate).	100%	High validity
	This module provides an opportunity for students who have not successfully redesigned (redesign).	100%	High validity
	This module has links between materials from each Q-STEAM component.	100%	High validity
	Each component is perfectly explained.	83%	Sufficient validity
Q-STEAM components	This Q-STEAM module can build Islamic character.	100%	High validity
	This Q-STEAM module promotes inquiry-based teaching methods.	100%	Sufficient validity
	This Q-STEAM module encourages learning based on real-world problems.	100%	Sufficient validity
	This Q-STEM module is able to improve mathematical thinking skills.	100%	High validity
	This Q-STEAM module promotes the understanding of religion in the teaching of mathematics.	83%	Sufficient validity

All of the items in the Q-STEAM qualification have a high level of validity, with a percentage of 100%, according to the descriptive statistics in Table 4. There are three items that have an 83% validity percentage that nevertheless allow pupils to envisage how the assignment will be completed.

This item is called "Imagine." One expert said:

P1: The module has provided a lot of information in detail, so students just follow each step that is already there, until the level of imagination disappears.

Following expert consultations who approved of the module's basic concept, students were asked to conceptualize the project they would design and the approach they would use to solve it. The second issues are each component's perfectly explained items, as one expert has noted below:

P3: The religious, engineering, and artistic components are still not explained in depth. So that the expected understanding of each component will not be obtained, each component of Q-STEAM should be taught in the same proportion.

The last item has a sufficient validity as Q-STEAM module promotes the understanding of religion in the teaching of mathematics. The religious component has already been shown in each step of the EDP. After discussing with other experts, the Q-STEAM module prototype does not require modification; the existing and ideal draft can be maintained.

The validity questionnaire findings of the Q-STEAM module dimension of Indonesian language qualification from two experts are presented in Table 5.

Table 5. Findings on the validity of language qualification based on expert assessment.

Construct	Statement item	Percentage	Expert assessment
Straightforward	Use of correct sentence structure.	100%	High validity
	Sentence effectiveness.	100%	High validity
	The terms used are appropriate.	100%	High validity
Communicative	Language usage can enhance efficiency of communication among students.	100%	High validity
	The use of language that can motivate students.	100%	High validity
	The use of language can encourage critical thinking.	100%	High validity
	The language used is accurate and easy to understand.	100%	High validity
Based on student development	The language used is in accordance with the cognitive development of students.	100%	High validity
	The language used is appropriate to the level of emotional development of the students.	100%	High validity
	The use of symbols and images is appropriate for student development.	100%	High validity
Language method	Grammar accuracy according to enhanced spelling.	100%	High validity
	Spelling accuracy.	100%	High validity
	Consistency of term usage.	100%	High validity
	Consistent in the use of symbols or icons.	100%	High validity

Table 5 shows a descriptive analysis of the language dimension. The expert's opinion suggests that all the items contained in the validity of language qualification have a high degree of validity, which means that the percentage of items within the construct is 100%. Based on this data, it can be implying that all construction and items are accepted by experts and do not require any adjustment.

The analysis of the Q-STEAM module validity questionnaire related to the qualification dimension of Islamic education by two experts is listed in Table 6.

Table 6. Findings on the validity of Islamic education qualifications based on expert evaluation.

Construct	Statement item	Percentage	Expert assessment
The accuracy of the argument used	The argument used is correct.	100%	High validity
	The arguments used consist of verses from the Quran and hadiths.	100%	High validity
	The argument used is appropriate to the student's development.	100%	High validity
Relevance of the argument to the problem	The argument used is easy to understand.	100%	High validity
	The arguments used are appropriate to the context of the problem.	100%	High validity
	The problem that arises is the religious problem that students experience all the time	100%	High validity
The argument writing	The use of the argument is consistent with the <i>mazhab</i> , which is practiced by many communities around it.	100%	High validity
	Write arguments according to the original source.	100%	High validity
	Proposition writing is precise and easy to read.	100%	High validity
	Writing propositions using the appropriate Arabic writing rules.	100%	High validity

The analysis of descriptive data in Table 6 shows that overall validity is at a high level, with a percentage of 100%. Based on this data, it can be determined that all constructs in the Islamic education qualification validity instrument Q-STEAM module are accepted by experts without alteration.

Building on this finding, an effective module is one that can train students' STEAM skills in accordance with the demands of the workplace and may develop their character. It can also link students' everyday experiences with the learning concept being studied when combined with a student-centered teaching model. If the teaching and learning process is connected to the spiritual needs of humans as a necessary component for everyone, then students can experience remarkable learning. The important thing in forming students' mindsets in learning is realizing that the knowledge they learn can be used in everyday life. For this reason, the materials for the derivatives algebraic function in this module should be rearranged, with the materials being placed at the beginning of the module. The next layout continues with the EDP step to complete the project to be constructed. A good material arrangement will help students recognize the features of a module more easily and clearly [39]. Structured and systematic mathematics learning modules are important as they can help students understand the material more easily and effectively. Structured modules can guide students through the subject in a clear and structured way, making it easier for them to learn and master the topics provided.

Furthermore, the expert panel also agreed that the content of the derivatives algebraic functions material should emphasize the contextual issue. Bringing daily problems into the teaching of mathematics will integrate the mathematics studied in school with the mathematics faced in the real

world. Teachers need to be aware of the student's surroundings and experience to support students' achievements in mathematics [40]. If teaching only focuses on formulas and numbers, then students are not used to developing mathematical thinking. The utilization of contextual issues in mathematics learning will benefit students in developing mathematical thinking skills [41]. Contextual problems can support mathematical thinking by creating a clear connection between the real world and mathematical ideas, developing the higher order thinking skill (HOTS), stimulating mathematical thinking, and encouraging discussion among students [42]. In the Aceh context, religious knowledge is important to students, so some students believe that learning mathematics is not useful because it is not related to religious knowledge. This is also reinforced by the regulations of the Aceh Governor [43], as stated in the Aceh School Curriculum, which requires that all lessons taught in schools must be linked to the understanding of religion and local culture.

Curiosity became an important factor in stimulating learning motivation. The panel agreed to suggest the addition of some catalytic ideas related to the concept of water *dua kullah* in various sources, either in the form of videos or articles, before students start working on the project. The application of the idea of a catalyst in teaching is in line with the application of constructivism theory in teaching mathematics. Catalyst ideas are very important in opening students' way of thinking, building curiosity, increasing interest in learning, increasing creativity, and increasing student participation [44]. The Q-STEAM module is developed with an IT-friendly concept, including the involvement of AI, YouTube, and other information technology platforms. The use of information technology in the teaching process will motivate students who want to continue to build and work together, as well as develop broader ideas [45,46]. Subsequent studies found that the panel of experts agreed to add a glossary in the Q-STEAM module prototype so that any term used in this module would be easily understood by the user. Glossaries in teaching modules play an important role in learning. With the presence of glossaries, students can easily understand the meaning of keywords used in learning [47]. Overall, the glossary plays an important role in improving understanding of subject-specific terms and promoting vocabulary development among students.

Referring to the principle of the self-instruction module, the assessment rubric is required in the Q-STEAM module manuscript. The rubric will be used as a reference to evaluate the activities contained in the module. The expert panel agreed that the Q-STEAM module should add a rubric as a reference for teachers and students. The rubric in the learning module provides a clear set of criteria for evaluating student work, which helps ensure consistency and objectivity in analytical and holistic grading, and it can be used for self-assessment and peer assessment. Rubrics have an important role in self-assessment by students and help students maximize each activity they will carry out [48].

The fundamental aspect of the development of the Q-STEAM module was the concept of merging each subject in an integrated way. This model was chosen because school project learning is centered on the topics and subjects contained in the curriculum rather than current projects and existing science concepts. Integrated teaching in project-based learning is important because it allows students to integrate various knowledge and skills from various subjects and apply them in a relevant project context [49]. This approach enables meaningful and comprehensive learning, as well as fostering critical thinking, creativity, and communication skills [50]. In addition, integrated teaching also allows students to see the relationship between various concepts and topics, as well as understand how the knowledge learned can be used in real life. This gives students a holistic learning experience and allows them to develop a deep understanding of the subject being studied.

The integration in the Q-STEAM module is to integrate the understanding of the Quran into the

STEAM approach for project solutions in the teaching and learning of the derivative's algebraic functions topics. Q-STEAM module was designed utilizing the engineering design process (EDP) model developed by the Massachusetts Department of Education. The EDP not only produces abstract concepts but also applies design skills to students through problem-solving approaches and basic concepts. EDP-based learning will enhance students' experience with design knowledge [51]. However, the construction of a product is not the primary goal of EDP, its primary objective is to develop decision-making competence that helps students research solutions to critical issues, thereby creating students who have engineering literacy [52].

Students learned in this module that determining the idea of two *kulllaks*—the foundation of ablution for every Muslim, is one of the practical applications of learning the concepts of derivative algebraic functions. The integration of Quran verses into this module is carried out using mathematics to deliver the Quran. Mathematics teaching is carried out at the same time as conveying Quran verses related to the concept of *thaharah*. This module also uses the concept of mathematics with the Quran, namely instilling the character values contained in the verses of the Quran in each EDP step in completing the final project. The project completion step that refers to the EDP step in the Q-STEAM module always starts with a study of the Quran verse that is appropriate to the content to be learned or according to the activity to be carried out. This integration is designed to remind students about their comprehension of the Quran and the morals inherent in it, so that it will be effective and can be practiced in their daily lives outside of school. By getting used to reading the Quran, it will have a positive impact on morals, the skill of reading the Quran in accordance with the knowledge of *tajwid* and being able to read the Quran repeatedly and can instill an attitude of *istiqamah* [53]. The teaching process that integrates the understanding of the Quran will have a positive impact on spiritual intelligence. According to the *Mufti* of the Kuala Lumpur Territory [54], the reading of the Quran is rather special than any reading of a human creation because it has a variety of beneficial qualities. Those who make it a primary source of reading will surely experience well-being and excellence.

As previously mentioned, a descriptive analysis based on the agreement of the expert panel, the draft Q-STEAM module has high validity. Some elements are valid enough and have already been evaluated and modified in accordance with the experts' recommendations. The Q-STEAM module seeks to integrate the project's ability with knowledge of science, technology, engineering, art, and mathematics, as well as an understanding of the Quran. This integration process is carried out to ensure that mathematics teaching in schools achieves the objectives of national education goals while also meeting the demands of the world of work in the industrial revolution 4.5 and society 5.0. This module can be fully used by mathematics teachers who teach the concept of algebraic functional derivatives and utilize it as a model when developing new modules. Furthermore, this module can be used as a reference in professional development training for teachers in courses for mathematics education students. However, it needs to be emphasized that this module is only suitable for use in schools with Muslim students.

4. Suggestions for future research

Based on the most essential factors that have been identified in this study, future research can evaluate the Q-STEAM module among secondary school students. In addition to that, subsequent research can also investigate the effectiveness of the Q-STEAM modules in learning mathematics or other subjects outside of mathematics.

Author contributions

Muzakkir: conceptualization, data collection and analysis, writing the original draft, reviewing, and editing; Rose Amnah Abd Rauf: conceptualization, reviewing and supervision; Hutkemri Zulnaidi: conceptualization, reviewing and supervision. All authors have approved the final version of the manuscript for publication.

Use of AI tools declaration

The creation of this article did not involve the utilization of any Artificial Intelligence (AI) tools.

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Conflict of interest

The author asserts that there are no conflicts of interest to disclose in this article.

Ethics declaration

All the ethical principles for conducting research in the field of education were meticulously followed in this study.

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