Digital Perspectives Journal on Education
Volume 2, Issue 1, pp. 50-64.
e_ISSN: 3124-4815
https://journal.dyoqu.com/index.php/dpj
DOI. https://doi.org/10.64780/dpje.v2i1.235

Development and Preliminary Evaluation of VERINTIS: An Android Application Integrating Islamic Values for Grade 10 Vector Learning

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Article Info

Article history:

Received: April 27, 2026
Revised: Mei 26, 2026
Accepted: June 29, 2026

Keywords:

Android-based learning;
Islamic values;
Mathematics education;
Vector learning

Abstract

Background of study: At one public senior high school, Grade 10 vector learning relied mainly on textbooks and occasional digital materials. Of 42 needs-analysis respondents, 31 regarded mathematics as difficult, 27 identified vectors as difficult, 25 indicated a need for an integrated Android resource, and 35 welcomed and agreed with its development.
Aims and scope of paper: This study developed and preliminarily evaluated VERINTIS, an Android application integrating Islamic values into Grade 10 vector instruction.
Methods: Using ADDIE in a single-school setting, the study involved a 42-student needs survey, one expert in each of mathematical content, media, and Islamic integration, an eight-student pilot, one mathematics teacher, and a 34-student classroom trial using a one-group pretest-posttest design. Data came from validation sheets, teacher and student response questionnaires, and parallel five-item essay tests.
Result: The overall expert-assessed validity score was 94.97%; teacher and classroom-student practicality scores were 94.1% and 80.15%, respectively. The mean score increased from 16.85 to 62.94, and the classical mastery rate increased from 0% to 58.82%.
Conclusion: Expert judgments and user responses support VERINTIS as a valid and practical prototype in the investigated context. The learning-outcome evidence remains preliminary because the study used one group without a comparison condition and did not report questionnaire reliability.

To cite this article: Haq, MMS., & Masrurotullaily. (2026). Development and Preliminary Evaluation of VERINTIS: An Android Application Integrating Islamic Values for Grade 10 Vector Learning. *Digital Perspectives Journal on Education*, *2*(1), 50-64. https://doi.org/10.64780/dpje.v2i1.235

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INTRODUCTION

The relationship between smartphones and schooling remains controversial because devices associated with distraction, entertainment, and fragmented attention are also among the most accessible digital tools available to students. Banning smartphones may reduce off-task behavior, but it can also remove a portable platform for visualization, feedback, and independent learning. Mobile-learning research therefore shifts the question from whether devices should enter classrooms to how their use can be pedagogically structured. Systematic reviews have shown that mobile technologies can support flexible access, situated activity, and multimodal representations when instructional goals guide the technology rather than the reverse (Bano et al., 2018; Crompton & Burke, 2018; Crompton & Burke, 2020; Tang et al., 2023). In mathematics, this distinction is especially important because digital tools may either deepen conceptual representation or merely reproduce static textbook pages on a smaller screen. Evidence from secondary mathematics and science suggests that digital tools are most beneficial when they supplement instruction, provide purposeful representations, and are accompanied by appropriate teacher support (Hillmayr et al., 2020). The central educational issue is therefore not the presence of a smartphone itself, but the quality of the learning design embedded in the device. This tension provides a relevant starting point for developing mobile mathematics resources that respond to actual classroom needs.

The empirical problem underlying this study emerged from mathematics instruction at SMA Negeri 3 Jember. Classroom observations and teacher interviews indicated that instruction relied mainly on mathematics textbooks, with digital media used only occasionally. The school's prior end-of-semester assessment records for the 34 students later involved in the classroom trial showed a mean score of 46.82, providing documentary evidence of weak prior mathematics achievement in the group. The needs questionnaire completed by 42 Grade 10 students added perception-based evidence: 31 students (73.8%) regarded mathematics as difficult, 27 (64.3%) identified vectors as difficult, 25 (59.5%) indicated that they needed an Android mathematics resource integrated with Islamic values, and 35 (83.3%) stated that they were pleased with and agreed to its development. Smartphones were permitted when required for learning, but this available resource was not routinely organized into a structured vector-learning environment. Taken together, these observation, interview, achievement-record, and questionnaire data indicated a local need for a more varied instructional resource, while not establishing that media use alone caused the learning difficulties.

Vectors are conceptually demanding because students must coordinate magnitude, direction, notation, graphical representation, components, and algebraic operations. Misunderstanding one representation can disrupt movement between diagrams, coordinates, and symbolic procedures. Mobile multimedia may support these transitions by organizing definitions, illustrations, worked examples, videos, and quizzes within one navigable environment. Across mathematics and science education, digital tools have generally produced favorable but variable outcomes, with benefits depending on task design, teacher orchestration, learner characteristics, and implementation conditions (Al-Khateeb, 2018; Fabian et al., 2018; Fabian & Topping, 2019; Hillmayr et al., 2020; Tang et al., 2023; Wang et al., 2023). Research syntheses covering mobile learning and technology-supported mathematics also emphasize the importance of pedagogical design, learner engagement, teacher knowledge, and implementation context (Borba et al., 2016; Chung et al., 2019; Criollo-C et al., 2021; Hwang et al., 2023; Kholid et al., 2023; Li & Zhu, 2023; Sung et al., 2016). Reviews further identify uneven pedagogical quality, short interventions, adoption barriers, and device constraints (Bano et al., 2018; Crompton et al., 2017; Hidayat & Firmanti, 2024; Sung et al., 2019). These findings are directly relevant to VERINTIS: the product needed coherent representation and navigation, but its evaluation also had to distinguish expert quality, classroom practicality, technical compatibility, and preliminary learning evidence rather than assume that an Android format would automatically improve achievement.

The integration of Islamic values adds a second educational dimension that cannot be reduced to decorative religious symbols. In this study, vector characteristics were analogically connected with intention, effort, and direction, while human life was discussed through ideas of an initial point, a path, and a purposeful destination. This approach positions mathematical structure as a context for ethical reflection without changing the formal definitions and procedures of vector mathematics. Studies on Islamic-integrated mathematics have argued that meaningful integration requires alignment between the mathematical topic and the value being discussed, rather than attaching unrelated verses to a lesson (Mahmudah & Muqowim, 2022; Mutijah, 2019; Nurjanah, 2021). Classroom research has also reported positive responses when Islamic values are connected with realistic mathematical contexts (Jannah et al., 2021). More recent work shows that interactive materials can simultaneously support mathematical communication and knowledge of Islamic values, although gains may differ across school settings and outcomes (Johar et al., 2025). These findings support the educational relevance of integrated materials while also warning against claiming character change unless it is directly measured. Accordingly, the present study evaluated the appropriateness of the Islamic integration through expert validation, but it did not treat spiritual or character development as a measured outcome. The product was intended to make mathematics more meaningful within the learners' educational context, not to substitute religious instruction for mathematical reasoning.

Research on digitally supported mathematics and Islamic-value integration provides several relevant comparison points. Android and iSpring products have been developed for mathematics topics, while Islamic-integrated studies have used teaching devices, contextual models, and interactive worksheets (Handayani & Rahayu, 2020; Jannah et al., 2021; Johar et al., 2025; Winarso & Wahid, 2020). However, these studies differ in platform, topic coverage, value integration, participant setting, and evaluation emphasis. Table 1 summarizes the closest strands of prior work and clarifies that VERINTIS does not introduce Android, iSpring, vectors, or Islamic integration as entirely new elements; its contribution lies in how these elements were combined and evaluated in one Grade 10 public-school development process.

Table 1. Comparison of selected related studies and the present study

Study	Platform/product	Topic and level	Islamic-value integration	Evaluation emphasis
Handayani and Rahayu (2020)	Android application using iSpring and APK Builder	Vector projection, Grade 10	Not integrated	Content, media, and student feasibility/validation
Winarso and Wahid (2020)	Mathematics teaching device	General mathematics learning	Quranic values integrated	Development issues, challenges, and implementation model
Jannah et al. (2021)	Realistic Mathematics Education classroom model	Contextual mathematics learning	Islamic values integrated	Classroom implementation and student responses
Johar et al. (2025)	Interactive worksheets	Mathematical communication in Islamic and regular schools	Islamic values integrated	Mathematical communication and Islamic-value outcomes
Present study	Android application authored in PowerPoint/iSpring and packaged as APK	Broad Grade 10 vector concepts and operations	Integrated and reviewed by an Islamic-integration expert	Expert validity, pilot testing, teacher/student practicality, device constraints, and one-group pretest-posttest description

The most relevant direct comparison is Handayani and Rahayu (2020), who also developed an Android application with iSpring and APK Builder for Grade 10 vector projection. VERINTIS therefore offers incremental rather than technological novelty. It adds five specific contributions to that foundation: broader vector coverage beyond projection; explicit analogical integration of Islamic values; separate expert review of mathematical content, media design, and value alignment; a staged ADDIE evaluation that included an eight-student pilot, one teacher, and a 34-student classroom trial; and reporting of installation constraints together with descriptive pretest-posttest and mastery data. These additions allow the product to be evaluated across disciplinary accuracy, interface quality, religious-context alignment, usability, and preliminary learning outcomes. The instrument structures, rating criteria, and participant roles are reported to the extent documented in the original research record; where reliability, exact exposure duration, or other procedural details were not recorded, the manuscript states those limitations rather than claiming complete methodological transparency.

This study aimed to develop VERINTIS and determine its expert-assessed validity, teacher and student practicality, and preliminary learning-outcome profile for Grade 10 vector learning. The first objective was to establish the appropriateness of the mathematical content, media design, and Islamic-value integration through one expert review in each domain. The second was to examine usability and acceptance through an eight-student pilot, a mathematics-teacher response, and a 34-student classroom trial. The third was to describe changes in students' scores and classical mastery before and after using the application without inferring causality beyond the one-group design. Theoretically, the study provides a contextual example of integrating mobile multimedia and religiously responsive meaning without altering the disciplinary integrity of mathematics. Methodologically, it differentiates expert validity, practicality, technical constraints, and descriptive learning evidence. Practically, it offers teachers a reusable Android resource containing vector content, examples, videos, quizzes, and reflective Islamic analogies.

METHOD

Research Design

This study employed educational research and development using the ADDIE framework: analysis, design, development, implementation, and evaluation. Recent instructional-design and educational-design-research literature supports using systematic analysis, iterative development, implementation, and formative evaluation to produce context-responsive learning solutions (Khalil & Elkhider, 2016; McKenney & Reeves, 2018). ADDIE governed the product-development sequence, whereas the one-group pretest-posttest design was embedded only within the implementation stage to describe classroom scores before and after use. The analysis output was a documented needs and content specification; design produced learning objectives, a storyboard, navigation, item drafts, and instruments; development produced an executable prototype and expert-based revisions; implementation produced pilot and classroom response data plus descriptive pretest-posttest results; and evaluation generated revision or progression decisions at every stage. Thus, learning-outcome measurement was one component of product evaluation and was not treated as a randomized effectiveness experiment. Validity and practicality remained the primary product-quality indicators, while score change was interpreted as preliminary within-group evidence.

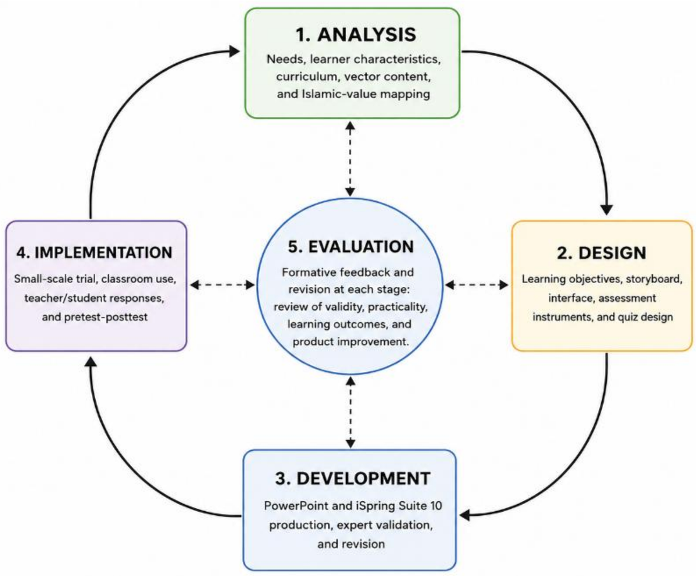


Figure 1. ADDIE development outputs, formative evaluation, and the embedded classroom measurement process

Participant

The participants were involved according to their roles in the development process. They consisted of 42 Grade 10 students who completed the needs-analysis questionnaire; one mathematics-education lecturer who validated the essay-test instrument; one vector-content expert, one media expert, and one Islamic-integration expert who validated the product; eight students from class X.4 who participated in the small-scale trial; 34 Grade 10 students who participated in the classroom trial; and one Grade 10 mathematics teacher who completed the teacher-practicality questionnaire. The eight pilot participants and the 34 classroom-trial participants were different students.

Population and the Methods of Sampling

The target population comprised Grade 10 students at SMA Negeri 3 Jember, East Java, Indonesia. Participants were selected according to the requirements of each ADDIE stage. The 42 needs-analysis respondents were available Grade 10 students who completed an online questionnaire; their identities were not retained in the summarized record, so possible overlap with later groups could not be established. Expert validators were selected purposively based on their disciplinary expertise. The eight-student pilot group was selected purposively by the mathematics teacher to represent four prior-achievement levels, with two students from each level. The classroom trial used one intact available class consisting of 34 students, while the participating mathematics teacher was selected because the teacher taught Grade 10 mathematics at the research school.

Table 2. Participants and roles in the development process

Stage	Participants	n	Selection/Role
Needs analysis	Grade 10 students	42	Online needs questionnaire
Instrument validation	Mathematics-education lecturer	1	Review of five-item essay test
Product validation	Content, media, and Islamic-integration experts	3	Purposive expert review
Small-scale trial	Class X.4 students	8	Two students from each achievement level
Teacher practicality	Grade 10 mathematics teacher	1	Teacher response questionnaire
Classroom trial	Grade 10 students	34	Intact class; pretest, use, posttest, and response

Instrument

The product developed in this study was VERINTIS, an Android application created with Microsoft PowerPoint and iSpring Suite 10, published in HTML format, and converted into an APK file using Web2APK Builder. The application required approximately 50 MB of storage, was designed for Android 5.0 or later, and contained a cover, opening prayer, learning objectives, user guidance, vector materials, worked examples, Islamic-value integration, learning videos, a ten-item multiple-choice quiz, references, author profiles, and a closing prayer. Data were collected using interview and observation guides, a needs-analysis questionnaire, expert-validation sheets, teacher and student response questionnaires, documentation, and parallel five-item essay pretests and posttests. The content-validation sheet contained 18 statements, the media-validation sheet 13 statements, the Islamic-integration sheet 10 statements, and both the teacher and student questionnaires 17 statements. The essay tests assessed vector representation, magnitude, unit vectors, coordinates, and vector operations. For example, one pretest item asked students to determine the magnitude and unit vector of AB for A(5, 7) and B(9, 4), while the parallel posttest item used A(12, 4) and B(9, 8). Responses were scored using prepared answer keys and solution criteria and converted to a 0-100 scale. A separate validator assessed the content validity of the essay test at 84.6%, categorized as very valid according to the study criteria. Reliability coefficients for the test and questionnaires were not available in the original research documentation and are therefore not claimed.

Procedures and If Relevant, the Time Frame

The research was conducted at SMA Negeri 3 Jember, a public senior high school that implemented the Kurikulum Merdeka in Grade 10. The vector content covered definitions, notation, magnitude, representations, coordinate components, operations, and problem solving. During analysis, the researcher examined learner needs, classroom characteristics, curriculum requirements, vector content, and Islamic concepts that could be meaningfully associated with vectors. During design, the researcher formulated learning objectives, prepared the storyboard, interface, and navigation, gathered illustrations and references, wrote the material, developed the quiz, and prepared the research instruments. During development, the PowerPoint-based media were integrated with iSpring Suite, converted into an Android application, validated by experts, and revised. Revisions included adding a concept map, clarifying the learning sequence, improving vector-direction arrows, embedding video access, improving illustrations and profile information, strengthening the coherence between explanatory sentences and Qur'anic verses or hadith, shortening overly long text, separating scriptural quotations onto dedicated pages, and adding a verse concerning human effort. During implementation, the eight-student pilot was conducted on 12 June 2023. The revised product was then implemented with 34 students on 14 June 2023 in one same-day session: students completed the pretest, learned with VERINTIS, completed the posttest immediately after the activity, and completed the response questionnaire. The teacher-practicality questionnaire was completed on 16 June 2023. The original record did not state the exact number of instructional periods or minutes. Evaluation was formative across all stages and used validator, student, and teacher feedback to determine revisions. The study was conducted after formal permission had been obtained from the school, and only aggregated student results are reported.

Analysis Plan

Qualitative data from interviews, observations, validator comments, and user responses were summarized descriptively and used to guide product revision. Quantitative validity and practicality percentages were calculated by dividing the obtained score by the maximum possible score and multiplying by 100. Validity was classified as very valid (>80%-100%), valid (>60%-80%), moderately valid (>40%-60%), less valid (>20%-40%), or invalid (>0%-20%). Practicality was classified as very practical (>84%-100%), practical (>68%-84%), moderately practical (>52%-68%), less practical (>36%-52%), or impractical (>20%-36%). Learning outcomes were described using the pretest and posttest means and classical mastery. The mastery threshold was 76, and classical mastery was calculated by dividing the number of students scoring at least 76 by the 34 classroom participants and multiplying by 100. No inferential statistical test, normalized gain, or effect-size analysis was added because those analyses were not included in the original research documentation.

Scope and/or Limitations of the Methodology Used

The methodological scope was limited to the development and preliminary evaluation of one Android-based vector-learning product in one public senior high school. The classroom evaluation used one intact group of 34 students without randomization or a comparison class; therefore, the pretest-posttest difference cannot establish that VERINTIS alone caused the observed change. The implementation occurred in one same-day session, but the exact duration in instructional periods or minutes was not documented. Possible overlap between the 42 needs-analysis respondents and later participants could not be determined, although the pilot and classroom-trial groups were distinct. The analysis was limited to descriptive percentages, mean scores, and classical mastery and did not include inferential tests, normalized gain, effect size, retention, or transfer. Reliability coefficients for the test and questionnaires were not reported. In addition, the product was restricted to Grade 10 vectors and depended on Android compatibility and available device storage. A separate institutional ethics-committee approval number and a written-consent protocol were not available in the original documentation. Consequently, the findings support product validity, practicality, and a preliminary within-group learning pattern in the investigated context, but not causal effectiveness or broad generalizability.

RESULTS AND DISCUSSION

Results

Needs Analysis and Product Design

The available evidence indicated a need for more varied support in Grade 10 mathematics rather than a definitive mismatch caused by technology use. Classroom observation and teacher interviews described instruction as mainly textbook-based, with presentations, YouTube, GeoGebra, or Photomath used occasionally. The prior end-of-semester mathematics records for the 34-student classroom group showed a mean of 46.82. Among the 42 needs-analysis respondents, 31 (73.8%) regarded mathematics as difficult, 27 (64.3%) identified vectors as difficult, 25 (59.5%) stated that they needed an Android mathematics resource integrated with Islamic values, and 35 (83.3%) expressed pleasure with and agreement toward its development. These sources triangulate classroom practice, prior achievement documentation, teacher accounts, and student perceptions, while the questionnaire percentages remain descriptive self-reports.

Table 3. Summary of needs-analysis findings

Indicator	Frequency/Percentage	Interpretation
Students who regarded mathematics as difficult	31 of 42 (73.8%)	Reported mathematics difficulty
Students who identified vectors as difficult	27 of 42 (64.3%)	Reported vector difficulty
Students who indicated a need for the proposed application	25 of 42 (59.5%)	Indicated need
Students who welcomed and agreed with development	35 of 42 (83.3%)	Positive acceptance of the proposal

The resulting product was named VERINTIS, an abbreviation of Vektor Integrasi Islami. Its menu structure included objectives, user instructions, vector and scalar concepts, vector types, coordinate-system representations, vector operations, worked examples, videos, Islamic-integration content, a quiz, references, profiles, and opening and closing prayers. The Islamic section presented two principal analogies: vector initial point, magnitude, and direction with intention, effort, and purpose; and vector direction with purposeful life orientation. The product was designed for individual or classroom use on Android devices, with the HTML5 package also accessible on a laptop or computer. Figures 2 and 3 present representative screens from the final application documented in the original report.

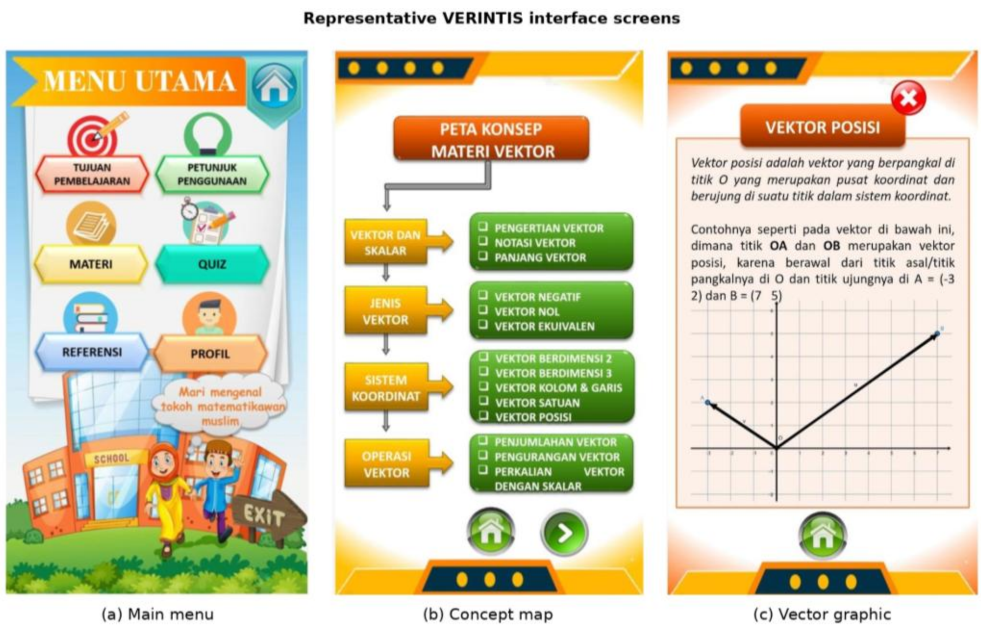
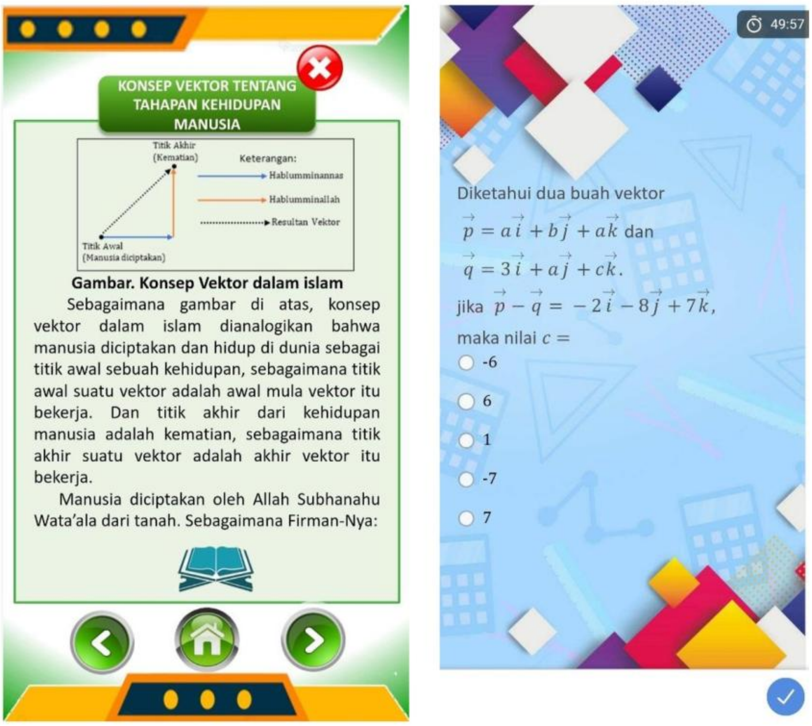


Figure 2. Main menu, concept map, and vector-graphic screens in VERINTIS

Representative instructional features



(a) Islamic-value integration (b) Quiz interface

Figure 3. Islamic-value integration and quiz screens in VERINTIS

Expert Validation and Product Revision

The instrument validator rated the five-item essay test at 84.6%, which met the stated criterion for very valid instruments. Product validation was then conducted independently for mathematical content, media quality, and Islamic-value integration. As shown in Table 4, all three expert scores exceeded 90%, producing an overall mean validity of 94.97%. The mathematical-content expert did not require substantive content revision, while the media and Islamic-integration experts recommended targeted improvements to navigation, visual clarity, presentation, and the relationship between mathematical explanations and religious sources. These revisions were completed before the classroom implementation.

The media revisions included adding a concept map before the main material, clarifying whether the menu sequence should be followed from top to bottom, improving the visibility of vector directions, enabling video access without forcing users to leave the application interface, and adding the developer's photograph to the profile page. The Islamic-integration revisions included adding illustrations, improving sentence-to-verse coherence, expanding explanations without becoming verbose, placing Qur'anic verses or hadith on separate pages, and adding a verse concerning the importance of human effort. These changes show that the validation process addressed both technical presentation and conceptual appropriateness rather than functioning as a numerical approval exercise only.

Table 4. Validation results

Validation component	Score (%)	Category
Test instrument	84.60	Very valid
Mathematical content	96.60	Very valid
Media design	92.30	Very valid
Islamic-value integration	96.00	Very valid
Overall product validity	94.97	Very valid

Small-Scale Trial and Practicality

The small-scale trial involved eight students representing high, moderate, moderately low, and low prior achievement. Students were asked to install or access the application, explore its menus and content, ask questions when necessary, and complete a response questionnaire. The mean practicality score was 77.2%, which fell within the practical category. No additional student-requested revision was documented after this stage, so the revised application proceeded to the larger classroom implementation.

The teacher response reached 94.1%, categorized as very practical. The teacher rated the material, objectives, instructions, sequence, interface, readability, examples, support for independent learning, and usefulness for classroom explanation positively. The 34-student response produced a mean score of 80.15%, categorized as practical. Student responses addressed the progression of material, communicative language, readability, visual clarity, ease of use, attractiveness, examples, quizzes, videos, enjoyment, and perceived support for understanding vectors. The difference between the teacher and student percentages suggests that professional appreciation of the instructional structure was stronger than the uniformity of students' user experience. The implementation records showed that some students could not install the application because their devices were incompatible or had insufficient storage, providing a plausible contextual explanation for the lower student score.

Table 5. Practicality results

Evaluator	n	Score (%)	Category
Small-scale students	8	77.20	Practical
Mathematics teacher	1	94.10	Very practical
Classroom students	34	80.15	Practical

Preliminary Learning Outcomes

All 34 students completed the parallel five-item essay pretest and posttest. The mean score increased from 16.85 before implementation to 62.94 after the same-session learning activity with VERINTIS. No student reached the operational mastery threshold of 76 on the pretest. On the posttest, 20 students reached the threshold and 14 did not, yielding a classical mastery rate of 58.82% according to the study's criterion. These results describe a within-group score increase and partial mastery; without a comparison group, they do not isolate VERINTIS as the cause of the change.

Table 6. Pretest and posttest summary

Measure	Pretest	Posttest	Change/Interpretation
Mean score	16.85	62.94	Increase of 46.09 points
Students reaching mastery (≥76)	0 of 34	20 of 34	58.82% classical mastery
Students below mastery	34 of 34	14 of 34	Partial, not universal, mastery

Discussion

The first major finding is that VERINTIS achieved consistently high expert-validation scores across mathematical content, media design, and Islamic-value integration. This pattern indicates that the product was not considered strong in only one dimension; rather, experts judged its disciplinary accuracy, interface, and contextual value integration to be mutually compatible. Within educational design research, such multidimensional review is essential because a visually attractive application can still fail if the content sequence or value claims are inaccurate. The result is consistent with development studies reporting high validation for Android mathematics media and Islamic-integrated materials (Handayani & Rahayu, 2020; Hakim et al., 2025). It also aligns with instructional-design and educational-design-research principles that development should include formative evaluation and revision before broader implementation (Khalil & Elkhider, 2016; McKenney & Reeves, 2018). The contribution of the present finding is therefore not the percentage alone, but the evidence that revisions addressed concept mapping, navigation, vector-direction clarity, scriptural alignment, and text economy. This strengthens the product's internal coherence and supports its use as a classroom prototype.

The second finding concerns practicality, with the teacher rating the application as very practical and students rating it as practical. The higher teacher score may reflect the application's usefulness as an organized teaching aid, because it brought objectives, explanations, examples, videos, quizzes, and value integration into one resource. Student experience was more heterogeneous, as some devices could not install the application or lacked adequate storage. This difference supports mobile-learning research showing that perceived usefulness and ease of use are distinct and that adoption depends on technical as well as pedagogical conditions (Al-Emran et al., 2018; Scherer et al., 2019). It also corresponds with Indonesian technology-integration reviews that identify device limitations and infrastructure as persistent barriers (Hidayat & Firmanti, 2024). Therefore, the practical value of VERINTIS lies in its instructional organization, but its accessibility cannot be separated from compatibility, storage, and installation requirements. The finding implies that future versions should preserve the instructional structure while reducing technical friction.

The pretest-posttest pattern provides promising but incomplete learning evidence. The mean increased by 46.09 points, yet only 58.82% of students reached the mastery threshold after implementation, leaving 14 students below the criterion. The mastery percentage is reported descriptively and is not labeled effective or ineffective because the design did not include a comparison class. Meta-analytic research suggests that digital tools can support mathematics and science learning, but outcomes vary with tool type, instructional support, and implementation quality (Hillmayr et al., 2020). Reviews of mobile learning likewise note that positive findings often coexist with short interventions and design weaknesses (Bano et al., 2018; Sung et al., 2019). The most defensible interpretation is therefore that VERINTIS has preliminary instructional potential that requires controlled, longer-duration evaluation.

The positive user responses can be interpreted through multimedia-learning theory, but this interpretation remains a theoretical possibility rather than a measured mechanism. VERINTIS combined text, diagrams, worked examples, videos, navigation, and quizzes, while revisions added a concept map, clarified sequence, and improved vector-direction cues. Coordinated words and graphics may support selection and organization of information when they are not redundant (Mayer, 2020), and such design features are relevant to a topic requiring movement among symbolic and visual representations. Similar studies have reported favorable engagement and achievement with purposeful mobile mathematics tasks (Fabian et al., 2018; Fabian & Topping, 2019). However, the present study did not administer validated motivation, engagement, or cognitive-load instruments; it therefore cannot conclude that VERINTIS changed those constructs.

The integration of Islamic values gave VERINTIS a contextual meaning that extends beyond generic mobile mathematics media. The analogies of initial point, magnitude, and direction with intention, effort, and purpose offered a way to connect vector structure with ethical reflection. This finding supports literature arguing that Islamic integration is most meaningful when the value is conceptually related to the mathematical topic and expressed through relevant contexts (Mutijah, 2019; Mahmudah & Muqowim, 2022). Recent interactive-material research also indicates that mathematics and Islamic-value outcomes can be addressed together, although the effects may differ by school type and measured construct (Johar et al., 2025). The present study extends that literature to vector learning and a public senior high school context. However, expert validation of value alignment is not equivalent to evidence of changes in students' religiosity, character, or moral behavior. The conceptual contribution is therefore a validated integration design, not a demonstrated character-formation effect.

The product architecture also illustrates the opportunities and limits of using PowerPoint, iSpring Suite, and APK packaging for school-based innovation. These tools lowered the technical barrier to producing an interactive application without conventional programming, enabling the researcher to combine menus, multimedia, and quizzes. This is consistent with the broader finding that general-purpose software remains prominent in mathematics-technology integration because it is familiar and accessible to teachers (Hidayat & Firmanti, 2024). At the same time, the study identified limitations associated with beginner-level hyperlink structures, restricted quiz formats, video dependence, device compatibility, and installation storage. Mobile-learning literature describes similar tensions between accessibility, usability, and rapidly changing device ecosystems (Grant, 2019; Tang et al., 2023). Consequently, the application should be viewed as a functional prototype rather than a finished platform independent of technological change. Its practical value is highest when the school provides installation support and the teacher integrates the application with explanation and discussion rather than treating it as a complete replacement for instruction.

Within the literature reviewed in this study, VERINTIS occupies a modest and contextually distinctive position. The closest prior product used Android, iSpring, APK Builder, and vector projection (Handayani & Rahayu, 2020), while other studies addressed Islamic-integrated mathematics through teaching devices, contextual models, or interactive worksheets (Jannah et al., 2021; Johar et al., 2025; Winarso & Wahid, 2020). VERINTIS extends this work through broader vector coverage, separate Islamic-integration validation, staged pilot and classroom practicality evidence, device-compatibility reporting, and descriptive pretest-posttest data. The contribution is therefore an evaluated contextual design configuration, not a universally new technology or theory. Separating expert validity, practicality, and preliminary learning outcomes also prevents one favorable indicator from substituting for all dimensions of product quality.

Implications

For mathematics teachers, VERINTIS can function as a structured supplement for introducing and reviewing vector concepts, particularly when students need coordinated symbolic and visual representations. The application should be used alongside teacher explanation, questioning, and written problem solving, because the posttest results show that digital access alone did not ensure mastery for all students. Schools intending to use similar applications should check Android compatibility, storage capacity, and installation procedures before instruction. They should also provide a browser-based or lightweight alternative for students whose devices cannot run the APK.

For curriculum and media developers, the study demonstrates that Islamic integration should be mapped during the analysis and design stages and evaluated by a relevant expert. The religious content should remain conceptually connected to the mathematics, while mathematical accuracy should not be displaced by moral commentary. The revision process also highlights the importance of concept maps, visible direction cues, concise text, and in-application multimedia access for topics such as vectors.

Research Contribution

This study contributes an empirically evaluated prototype that unites mobile multimedia, vector learning, and Islamic-value integration within a documented ADDIE sequence. Its theoretical contribution lies in framing value integration as contextual meaning-making that must be aligned with mathematical structure. Its methodological contribution is the differentiated evaluation of content validity, media validity, Islamic-integration validity, teacher practicality, student practicality, and preliminary learning outcomes. Its practical contribution is a reusable Android resource developed from an actual needs analysis in a public senior high school.

Limitations

The study has several limitations. The implementation used one intact group without randomization or a comparison class, so score improvement cannot be attributed solely to VERINTIS. The classroom sample comprised 34 students from one school, and the original record did not specify the exact duration in instructional periods or minutes. The pilot and classroom groups were distinct, but overlap between the 42 needs-analysis respondents and later participants could not be determined. Learning-outcome analysis relied on means and classical mastery and did not include inferential statistics, normalized gain, effect size, retention, or transfer. The product was restricted to Grade 10 vectors, used a PowerPoint/iSpring hyperlink architecture, included a multiple-choice quiz, and depended on Android compatibility and available storage. Islamic values were assessed for expert appropriateness, but students' spiritual, ethical, or character outcomes were not measured. Questionnaire and test reliability coefficients, a formal ethics-committee approval number, and a written-consent protocol were not reported in the source documentation.

Suggestions

Future studies should compare VERINTIS with conventional instruction or another digital resource using larger multi-school samples and a longer implementation period. Researchers should report effect sizes, retention tests, and analyses of which vector representations remain difficult after instruction. Product development should prioritize a lightweight cross-platform or progressive-web version, offline video access, broader device compatibility, more varied formative assessment, and accessibility features. Further evaluation may also measure motivation, usability, mathematical representation, and students' understanding of Islamic values with validated instruments. Any claim regarding character development should be supported by direct longitudinal evidence rather than inferred from the presence of religious content.

CONCLUSION

VERINTIS was developed as an Android-based Grade 10 vector-learning application combining mathematical content, multimedia, quizzes, and contextually aligned Islamic values. One expert in each domain rated the product, producing an overall expert-assessed validity score of 94.97%; the teacher rated it very practical, and students rated it practical under the study-specific criteria. Mean scores increased within the 34-student group, but classical posttest mastery reached 58.82%, so the result constitutes preliminary descriptive evidence rather than causal effectiveness. The study demonstrates that the product was appropriate and usable in the investigated setting while identifying installation, device, content-scope, session-documentation, and research-design limitations. Its main contribution is an incrementally extended and transparently bounded model for developing religiously responsive mobile mathematics media without claiming outcomes that were not directly measured.

ACKNOWLEDGMENT

The authors gratefully acknowledge SMA Negeri 3 Jember, the participating mathematics teacher and students, and the expert validators who supported the development and evaluation of VERINTIS.

AUTHOR CONTRIBUTION STATEMENT

MH conceptualized the study, conducted the needs analysis, developed the Android-based learning application, collected and analyzed the data, revised the application, and prepared the initial draft of the manuscript. ML supervised the research, provided methodological and substantive guidance, reviewed the research process and manuscript, and contributed to the revision of the final manuscript. Both authors read and approved the final version of the manuscript.

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