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Development of StatistikaSIKK Based on *Design Thinking* to Improve Eighth-Grade Students' Numeracy

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Abstract. This study aimed to develop StatistikaSIKK, a web-based statistics learning application, and to examine its validity, practicality, and effectiveness in improving the numeracy skills of eighth-grade students. The study employed a Research and Development (R&D) method using the Design Thinking approach through five stages: Empathize, Define, Ideate, Prototype, and Test. The needs analysis involved 124 students and interviews with 10 students. Product validation was conducted by three validators, while the practicality test involved 13 students. Effectiveness was examined using a quasi-experimental nonequivalent control group design involving 60 students, consisting of 31 students in the experimental group and 29 in the control group. Data were collected using questionnaires, interview guides, validation sheets, student response questionnaires, and numeracy tests. The results showed content validity of 93.08%, media validity of 94.48%, and practicality of 88.46%. The mean posttest scores were 81.94 for the experimental group and 74.55 for the control group ($p < 0.001$). The N-Gain scores were 0.569 and 0.425, respectively ($p < 0.001$). These findings indicate that StatistikaSIKK is a valid, practical, and effective learning support medium for strengthening students' numeracy skills.

Keywords: Design Thinking; numeracy; statistics

INTRODUCTION

Numeracy is an important component of mathematical competence because it involves the use of concepts, procedures, facts, and reasoning to solve emerging problems. Numeracy is not limited to students' ability to calculate; it also encompasses reading information, selecting problem-solving strategies, interpreting data, and drawing conclusions based on available data. At the same time, strengthening students' numeracy in Indonesia remains a pressing challenge. The results of PISA 2022 show that only about 18% of Indonesian students reached at least Level 2 in mathematics, compared with an OECD average of 69% (OECD,

2023). At this level, students begin to recognize how simple situations can be "mathematized". This condition further underscores the importance of mathematics instruction that gives students room to use mathematics meaningfully rather than merely performing calculations.

Statistics is a strategic topic for developing students' numeracy because the learning activities involved are directly related to data. Students need to learn to read tables and diagrams, process information, use statistical measures, compare results, interpret data, and provide reasons or arguments grounded in data-based evidence. The GAISE II framework (*Guidelines for Assessment and Instruction in Statistics Education*) positions the processes of posing questions, considering data, analyzing, and interpreting results as essential components of statistics learning (Bargagliotti et al., 2020). Consistent with this, Kurnia et al. (2024) showed that students' statistical literacy encompasses the skills of interpreting, communicating, evaluating, and decision-making. These characteristics make statistics highly suitable for training students to apply mathematics in everyday life, particularly in situations involving data.

The use of digital media can broaden students' opportunities to understand mathematical concepts through visualization, practice exercises, and feedback within a single learning environment. Meta-analytic findings in mathematics education indicate that the use of digital media, including web-based media, can contribute positively to learning outcomes when it is designed and used appropriately (Azkia et al., 2023; Samo et al., 2023). Web-based applications also offer advantages in terms of access because students can use them across different devices. Nevertheless, technology selection alone does not guarantee the quality of the learning experience. Therefore, the media developed must remain aligned with the learning objectives, the characteristics of the content, device conditions, and students' needs.

Students' needs deserve careful attention because difficulties in learning mathematics are not always caused by the content alone; they may also stem from prior experiences, study habits, self-confidence, or other barriers. In this context, *Design Thinking* is an appropriate approach for exploring and defining problems

and for designing solutions based on students' needs. Micheli et al. (2019) emphasize user orientation, experimentation, visualization, and iterative processes as key characteristics of *Design Thinking*. Li and Zhan (2022) also show that *Design Thinking* has been used in various K-12 educational contexts through processes of understanding problems, generating ideas, building prototypes, testing, and refining solutions. This approach is well suited to the development of learning media because students' learning needs, rather than the developer's preferences alone, serve as the basis for determining the media and its features.

Sekolah Indonesia Kota Kinabalu (SIKK; the Indonesian School in Kota Kinabalu) is a school for Indonesian children born in Sabah, Malaysia. In terms of learning needs, SIKK students have diverse needs in learning mathematics. The needs analysis of eighth-grade students showed that some students still feel afraid when learning mathematics and that some are reluctant to ask questions when they do not understand a lesson. On the other hand, some students responded positively to the use of technology in learning. The interviews also revealed needs for explanations accompanied by examples, visualization of the content, tiered practice problems, discussion of solutions and feedback, varied activities, and opportunities for independent learning. These findings indicate that technology can be used to address concrete needs rather than simply increasing the use of digital devices in the classroom.

Previous studies have developed digital media and applications for learning mathematics and statistics. Yuwono et al. (2023) developed web-based mathematics media for statistics content. Zendrato et al. (2025) developed Google Sites–based media for eighth-grade statistics with a numeracy orientation. Asshidiq (2024) developed Android-based media oriented toward numeracy literacy for statistics content in junior high school. Harun et al. (2024) developed a web-based mathematics learning application through needs analysis, expert validation, trials, and learning outcome testing. Akın (2022), Azkia et al. (2023), and Samo et al. (2023) provided synthesized evidence on the potential of web-based and digital media in mathematics learning. In addition, Putri et al. (2024) applied Design Thinking to the design of ULTAPA media to support literacy and numeracy, while

Majid et al. (2022) applied it to the design of the SOL-MATH application. These studies demonstrate the potential of digital media, web media, and Design Thinking, but they have not simultaneously integrated the development of a web-based statistics application grounded in the needs of SIKK students, data exploration and visualization features, and testing of validity, practicality, and effectiveness with respect to numeracy. This study also differs from development studies on other mathematics topics in that it centers its activities on the interpretation and use of statistical data.

Based on these needs, StatistikaSIKK was developed as a web-based statistics learning application for eighth-grade students. The novelty of the development lies in combining a *Design Thinking* approach centered on students' needs; learning features comprising content, tiered practice problems (easy, medium, difficult, and HOTS [higher-order thinking skills]), data simulation, a statistics calculator, and learning progress tracking; and a focus on testing numeracy. This study aims to describe the development process of StatistikaSIKK through the Empathize, Define, Ideate, Prototype, and Test stages; to analyze product validity in terms of content and media; to analyze practicality based on user responses; and to examine its effectiveness in improving the numeracy of eighth-grade students at SIKK.

RESEARCH METHOD

This study employed a Research and Development (R&D) design to produce and test a statistics learning application called StatistikaSIKK. Research and development in education is directed at designing, testing, and refining solutions to meet the needs of instructional practice (Sugiyono, 2023; McKenney & Reeves, 2021). Product development followed a *Design Thinking* approach through five stages, namely *Empathize, Define, Ideate, Prototype,* and *Test.* This approach served as the framework for product development, while the effectiveness test was conducted using a quasi-experimental design.

The *Empathize* stage was used to explore and understand students' experiences, difficulties, and needs in learning mathematics. The *Define* stage aimed to formulate the main problem from the many problems identified. This main

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Page 566-585

problem then served as the basis for the *Ideate* stage, in which alternative solutions were generated. The selected solution was then realized as a product (a learning application) at the *Prototype* stage. The *Test* stage was the final stage, in which the product was tested and assessments and feedback were gathered for improvement. The five stages were not treated as a rigid sequence; validation results and user experiences could be fed back to the design stage to refine the product. The use of these stages draws on the Design Thinking framework described by Stanford d.school (n.d.) and the characteristics of iterative processes discussed by Micheli et al. (2019). The overall product development process is presented in Figure 1 below.



Figure 1. Research and Development Flow of StatistikaSIKK

The initial stage of development was a needs analysis of students' learning. A questionnaire was distributed to 124 eighth-grade students, and the results were explored in greater depth through interviews with 10 randomly selected students. The data obtained were analyzed and used to formulate students' needs in learning mathematics. Subsequently, ideas were gathered as alternative solutions to the problems, until one solution judged to best meet students' needs was selected, namely a learning application. At the next stage, a product prototype was developed. The product was then validated by experts in the relevant fields. Based on the validation results and the trial of the application, the product was revised in

line with the feedback received. After a series of revisions, the final product was obtained and was ready to be used in learning.

The effectiveness test used a quasi-experimental nonequivalent control group design because it was conducted with existing classes (*intact classes*), so randomization was not carried out at the individual level (Creswell & Creswell, 2018). Class VIII A, with 31 students, was assigned as the experimental class and Class VIII C, with 29 students, as the control class, for a total of 60 students. The experimental class received instruction using the developed product, StatistikaSIKK, whereas the control class received instruction without this medium. Both classes were given a pretest before the instruction and a posttest after the series of lessons was completed.

The research instruments included a questionnaire on mathematics learning needs, an interview guide, validation sheets for content experts and media experts, a validation sheet for the test instrument, a student response questionnaire, and a numeracy test.

The content validation sheet covered the alignment of the content with the curriculum, content accuracy, content presentation, and learning evaluation. The media validation covered appearance, ease of use, functionality, interactivity, and technical quality. The student response questionnaire contained 10 Likert-scale items and one open-ended question to obtain feedback. The numeracy test consisted of 25 multiple-choice items measuring the ability to identify information from data, apply statistical concepts, interpret data, compare statistical information, and make decisions based on data.

The needs analysis data were analyzed descriptively using frequencies, percentages, and thematic grouping of the interview results. Content validation scores, media validation scores, and student responses were calculated as percentages. For the research instruments, the range of 86–100% was interpreted as the very valid or very practical category, depending on the type of data. Open-ended suggestions from the validators and students were not treated merely as supplementary information but were actually used to revise the product, for

example by improving the depth of the content, the consistency of symbol use, the variety of practice problems, visualization, navigation, and so forth.

Effectiveness was analyzed through descriptive statistics, a test of initial ability, a comparison of posttest scores, and N-Gain. Normality was examined using the Shapiro–Wilk test, and homogeneity of variance was examined using Levene's test. Because some of the pretest and posttest data were not normally distributed, comparisons between groups were conducted using the Mann–Whitney U test at a significance level of 0.05. N-Gain was used to describe the improvement in scores from pretest to posttest, and the N-Gain values of the two groups were also compared using the Mann–Whitney U test. The interpretation of effectiveness was based not only on differences in posttest scores but also on the equivalence of initial ability and the difference in improvement between groups.

RESULTS AND DISCUSSION

The Development Process of StatistikaSIKK

At the *Empathize* stage, the data showed that students' learning needs were not singular. Of the 124 students analyzed, 71 (57.26%) reported feeling afraid or very afraid when facing mathematics tests. When they did not understand the material, 48 students (38.71%) reported being unwilling or very afraid to ask questions. These findings indicate a need for a learning space in which students can obtain explanations without always having to ask questions in class. On the other hand, 66 students (53.22%) reported enjoying or greatly enjoying learning with devices or technology. In addition, 101 students (81.45%) stated that their teachers had never used an application in mathematics lessons. Taken together, these findings open opportunities for using technology in mathematics learning, positioned as support for students' learning needs.

The interviews with the 10 students further clarified the patterns in the questionnaire data. The summary of the interview results indicated needs for visualization, step-by-step examples, repeated explanations, practice and discussion of solutions, evaluation, games or challenges, and feedback. For statistics content, students specifically mentioned an interest in the presentation of tables, graphs, and

diagrams. For example, in the interview with the student identified as AMB, the student expressed interest in learning statistics through tables, bar charts, and pie charts. Meanwhile, the student identified as FPF considered graphs and diagrams clearer when they could be accessed through a smartphone. Students also raised constraints related to internet connection, data quota, device capability, and storage capacity. Therefore, the application design was directed toward features that directly support conceptual understanding, practice, data visualization, and review of learning outcomes.

The *Define* stage was carried out by formulating the main problem underlying the need for learning media, namely media that present content visually and contextually, provide tiered practice problems accompanied by feedback, and give students the opportunity to learn independently and interactively. Statistics was chosen because it supports activities of reading, processing, comparing, and interpreting data. This formulation was then used at the *Ideate* stage to assess several alternative solutions, such as instructional videos, digital teaching materials, digital student worksheets (LKPD), quizzes, infographics, discussion forums, and applications. A learning application was ultimately chosen because it can combine content, practice, simulation, and progress tracking in a single medium and can be accessed through both smartphones and computers.

At the *Prototype* stage, the data obtained from the previous stages were realized as StatistikaSIKK. The structure of the application was designed so that students could move from the content to practice and other supporting activities without a complicated flow. The main features include content, practice problems, a statistics calculator, simulation, learning progress, and a Teacher Dashboard. The content feature presents the main topics, namely data presentation, mean, median, mode, and range. The practice feature offers tiered problems, ranging from Level 1 (easy), Level 2 (medium), and Level 3 (difficult) to HOTS challenge problems. The simulation feature is particularly important because students can enter data and see the results presented visually as bar charts, line charts, or pie charts. In this way, statistical activities are not limited to calculating the mean, median, mode, or range

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Vol. 10, No. 2: November 2026
Page 566-585

but also connect numerical representations with forms of data presentation that can be interpreted. The determination of the features of the StatistikaSIKK application is outlined in the following table 1.

Table 1. Relationship Between User Needs and StatistikaSIKK Features

No	Needs Identified	Realization in the StatistikaSIKK Application
1	Visual, contextual, and easy-to-understand content	Content feature with example problems, tables, graphs, diagrams, and step-by-step presentation.
2	Opportunities to practice gradually	Tiered Practice Problems/Quiz feature and evaluation of learning outcomes.
3	Discussion of solutions and feedback	Feedback after activities and opportunities to review results.
4	More challenging activities	HOTS challenges that guide students to apply concepts to problems.
5	Support for data visualization	Data Simulation feature to show the relationship between numbers and tables, graphs, and diagrams.
6	Independent learning and progress monitoring	Statistics calculator, learning progress, and Teacher Dashboard as supporting features.
7	Device and access limitations	Web-based application accessible through a browser and designed to remain simple.

The following is the *prototype* display of the StatistikaSIKK application:

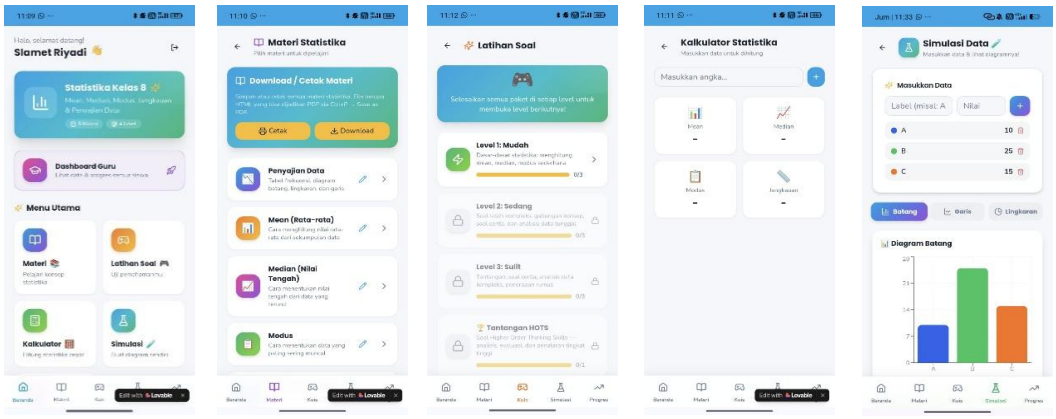

Figure 2. Prototype Display of the StatistikaSIKK Application

The *Test* stage was carried out through validation and user trials. Validation yielded suggestions for improvement that were both substantive and technical. In terms of content, the validators recommended clearer learning objectives, deeper treatment of the content, consistent terminology and mathematical symbols, the

addition of contextual examples, and greater variety of problems. In terms of media, improvements were suggested for navigation, menu consistency, visualization, and media optimization so that the application would remain usable when internet connectivity is limited. This feedback is consistent with the principle of educational product development that treats evaluation and refinement as iterative processes (Burkhardt & Schoenfeld, 2021; McKenney & Reeves, 2021). After the improvements were made, the user trial generated feedback mainly concerning the ease of finding menus, access to the application, variety of practice, appearance, and feature development. This feedback was again used to refine the product before it was finally put into use.

This workflow demonstrates the function of *Design Thinking* as a decision-making framework rather than merely a sequence of five stages. The needs identified at the *Empathize* stage were translated into a problem formulation at the *Define* stage and then into feature decisions at the *Ideate* and *Prototype* stages. The *Test* stage subsequently fed user experiences back into the revision process. This pattern is consistent with the characteristics of *Design Thinking*, which positions users, experimentation, and iteration as essential elements (Micheli et al., 2019). In K-12 education, similar processes have also been found in a variety of *Design Thinking* models aimed at bringing learning problems together with solutions that can be tested and refined (Li & Zhan, 2022).

Validity and Practicality of StatistikaSIKK

The validity of StatistikaSIKK was assessed by three validators in terms of both content and media. The content validation obtained a combined score of 363 out of 390, or 93.08%, in the very valid category. By aspect, alignment of the content with the curriculum reached 92.00%, content accuracy 92.50%, content presentation 93.33%, and learning evaluation 94.44%. All aspects were rated highly; nevertheless, the validators still provided suggestions to deepen certain parts of the content, clarify the objectives, add contextual examples, and improve the consistency of terminology, symbols, and mathematical formulas. This is important

because validation scores serve both as a basis for determining feasibility and as a basis for product revision.

The media validation obtained a combined score of 411 out of 435, or 94.48%, in the very valid category. In detail, functionality received the highest percentage at 96.00%, appearance and technical quality each received 95.56%, interactivity 93.33%, and ease of use 92.22%. This indicates that, technically, the application performs its learning functions well. The detailed results of the content expert and media expert validation are presented in the following tables.

Table 2. Results of Content Expert Validation

Aspect	Score Obtained	Maximum Score	Percentage
Alignment of content with the curriculum	69	75	92.00%
Content accuracy	111	120	92.50%
Content presentation	98	105	93.33%
Learning evaluation	85	90	94.44%
Total	363	390	93.08%

Table 3. Results of Media Expert Validation

Aspect	Score Obtained	Maximum Score	Percentage
Appearance	86	90	95.56%
Ease of use	83	90	92.22%
Functionality	72	75	96.00%
Interactivity	84	90	93.33%
Technical quality	86	90	95.56%
Total	411	435	94.48%

The practicality aspect was examined through the responses of Class VIII B students after using the application. The score obtained was 575 out of 650, or 88.46%, in the very practical category. In detail, the highest response was for the statement that the application is easy to use, at 92.31%, followed by ease of understanding the information/content, at 90.77%. The lowest score was for ease of finding menus and features, at 84.62%. Although the responses were generally good, the gap between aspects provides concrete information that navigation needs

more attention than merely improving the appearance. The validity and practicality of StatistikaSIKK are briefly summarized in the following table.

Table 4. Summary of the Validity and Practicality of StatistikaSIKK

Assessment Aspect	Result	Category	Notes
Content Validity	93.08%	Very Valid	All aspects > 90%; revisions focused on objectives, content depth, examples, and notation consistency.
Media Validity	94.48%	Very Valid	Functionality 96.00%; navigation and access optimization continue to be refined.
Practicality	88.46%	Very Practical	Ease of use 92.31%; ease of finding menus/features 84.62%.

These validity and practicality results are consistent with the findings of previous research on web-based statistics learning media. Yuwono et al. (2023) showed that web-based media for statistics content can be developed to meet feasibility criteria. Likewise, Zendrato et al. (2025) reported positive results for website-based media for eighth-grade statistics with a numeracy orientation. Asshidiq (2024) showed that the development of Android-based media can be directed specifically at numeracy literacy in statistics content. More broadly, the meta-analyses by Akın (2022), Azkia et al. (2023), and Samo et al. (2023) support the potential of digital media and web-based learning in mathematics education. The contribution of StatistikaSIKK lies in the use of Design Thinking to translate user needs into features that can be tested, not merely in the choice of a digital format.

Web-based applications provide flexibility of access through devices that students already own, but the user experience is still affected by connection quality and device capability. Therefore, the practicality results should not be interpreted only as “easy to use” in a general sense. Item-level scores and open-ended comments are more useful for locating the core of the problems students face. In this study, navigation was the aspect most in need of attention. This finding reinforces the importance of continuous evaluation and improvement of the

interface, especially because problems of access to and use of digital media still arise in learning practice (Rahma et al., 2023).

Effectiveness of StatistikaSIKK on Numeracy Skills

The effectiveness test involved 60 students, consisting of 31 students in the experimental class and 29 students in the control class. The mean pretest score of the experimental class was 56.58 (SD = 12.38), while that of the control class was 55.59 (SD = 8.90). After the instruction, the mean posttest score of the experimental group increased to 81.94 (SD = 4.83), while that of the control class reached 74.55 (SD = 6.12). Descriptively, both groups improved, but the class that used the StatistikaSIKK application obtained a higher final mean and a greater improvement. These results are summarized in the following table.

Table 5. Descriptive Statistics of Pretest, Posttest, and N-Gain

Group	n	Pretest Mean (SD)	Posttest Mean (SD)	N-Gain
Experimental	31	56.58 (12.38)	81.94 (4.83)	0.569 / 56.88%
Control	29	55.59 (8.90)	74.55 (6.12)	0.425 / 42.49%

The Shapiro–Wilk test indicated that some of the data were not normally distributed, so comparisons between groups were conducted using the Mann–Whitney U test. For the pretest, the result was $U = 491.00$ with $p = 0.540$. This value indicates that there was no significant difference in initial numeracy between the experimental group and the control group.

For the posttest, the result was $U = 750.50$ with $p < 0.001$. This difference indicates that the post-instruction outcomes of the experimental group differed significantly from those of the control group.

The N-Gain analysis reinforced this pattern. The experimental class obtained a mean N-Gain of 0.569, or 56.88%, while the control class obtained 0.425, or 42.49%. The Mann–Whitney test on N-Gain yielded $U = 782.00$ with $p < 0.001$, indicating a significant difference in the improvement of numeracy between the two groups.

Table 6. Results of the Mann–Whitney Test Between Groups

Comparison	Mann–Whitney U	p	Interpretation
Pretest	491.00	0.540	No significant initial difference.
Posttest	750.50	< 0.001	There is a significant difference in final outcomes.
N-Gain	782.00	< 0.001	There is a significant difference in improvement.

The improvement in the experimental group can be understood by examining the alignment between the activities in StatistikaSIKK and the numeracy indicators measured. The content and step-by-step examples help students recognize relevant information and apply statistical concepts. Tiered practice gives students opportunities to repeat both the computation and interpretation processes at increasing levels of difficulty. HOTS challenges encourage students to use data to solve problems, while data simulation helps connect numbers with tables, graphs, and diagrams. These activities relate directly to the abilities to identify information from data, apply statistical concepts, interpret results, compare information, and make decisions based on data. This alignment is consistent with the Mathematics Learning Outcomes for Phase D (BSKAP, 2025) and with the numeracy framework that emphasizes the use of mathematics in context (Tim Substansi Asesmen Akademik, 2023).

The relationship between learning activities and these indicators is relevant to the view of statistical literacy that does not limit learning to the calculation of measures of central tendency. Kurnia et al. (2024) emphasize the skills of *interpreting*, *communicating*, *evaluating*, and *decision-making* as part of the development of statistical literacy. GAISE II likewise places data analysis and interpretation within an investigative cycle rather than treating them as separate procedures (Bargagliotti et al., 2020). In StatistikaSIKK, visualization and simulation are not positioned as interface decoration but as means of helping students see patterns and meaning in data before drawing a conclusion.

This effectiveness finding is in line with the studies by Yuwono et al. (2023) and Zendrato et al. (2025), which showed that web-based media for statistics

content can support learning outcomes. Harun et al. (2024) also showed that a web-based mathematics learning application developed through needs analysis, validation, and trials can produce better learning outcomes after use. In this study, the particular contribution lies in integrating a user-centered development process with the measurement of numeracy through a two-group comparison. Thus, the results show not only that the application is liked or feasible, but also that its use in the research context is associated with a greater improvement in numeracy than learning without the application.

Nevertheless, the effectiveness findings need to be read in light of the limitations of the research design. This study used existing classes, so students were not randomized individually. The test was also conducted at one school, and the content was limited to eighth-grade statistics. In addition, the practicality test involved a small group of 13 students, so its results mainly reflect users' initial experience with the product. Therefore, although the results provide strong evidence for the context of implementation at SIKK, further testing is needed for other schools, other devices, different network conditions, or different student characteristics.

Implications for Development

Practically, StatistikaSIKK can be used as a supporting medium, not as a replacement for the teacher's role. The needs data show that direct explanations from teachers remain an important preference for students, while technology serves as a variation and an additional space for learning and practice. Therefore, the use of the application is better combined with teacher explanation, discussion, and guidance. Teachers can use the content and simulations to clarify concepts, tiered practice to differentiate practice opportunities, and progress results as additional information for monitoring the learning process.

In terms of development, this study shows that feature decisions become more focused when they begin with users' problems. The need for visualization was translated into data simulation; the need for gradual practice was translated into tiered quizzes; the need for challenge was translated into HOTS activities; and the

need for independent learning was supported by feedback, a calculator, and learning progress. This explicit link between needs and features is important so that digital innovation does not turn into the addition of functions unrelated to learning objectives.

Further development can be directed at improving navigation, practice variety, access efficiency on slow connections, and extending the coverage to other mathematics topics. Subsequent testing could also involve schools with different characteristics, larger numbers of users, and longer periods of use. In this way, practicality can be assessed under more varied device and network conditions, while effectiveness can be tested in broader contexts and on different numeracy indicators.

CONCLUSION

StatistikaSIKK was successfully developed as a web-based statistics learning application through a Design Thinking approach consisting of the Empathize, Define, Ideate, Prototype, and Test stages. The development began with mapping students' experiences and needs, followed by problem formulation, development of alternative solutions, prototyping, validation, trials, and revision. Students' main needs—visual and contextual presentation, gradual practice, feedback, interactive activities, and opportunities for independent learning—were translated into the content, tiered practice, HOTS challenge, data simulation, statistics calculator, learning progress, and Teacher Dashboard features.

In terms of product quality, StatistikaSIKK obtained a content validity of 93.08% and a media validity of 94.48%, both in the very valid category. The practicality test yielded 88.46%, in the very practical category. In the effectiveness test, the initial ability of the experimental and control groups did not differ significantly ($p = 0.540$). After the instruction, the mean posttest score of the experimental group was 81.94 and that of the control group was 74.55, with a significant difference ($p < 0.001$). The mean N-Gain of the experimental group was 0.569, or 56.88%, higher than that of the control group at 0.425, or 42.49%, and the difference was also significant ($p < 0.001$). These findings indicate that

StatistikaSIKK is valid, practical, and effective as a supporting medium for numeracy-oriented statistics learning in the research context at SIKK.

The use of the application still needs to be combined with teacher explanation, discussion, and guidance. Because the study was conducted at one school with existing classes and the practicality test involved a small group, further testing with more varied populations, schools, devices, networks, and durations of use is needed to obtain a broader picture of its implementation.

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