

Developing Canva-Based Digital Learning Media for Probability in Grade X

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Abstract

Probability is often challenging for students because many of its ideas are abstract and are commonly introduced through symbolic representations. This study developed Canva-based digital learning media for Grade X probability and examined its validity and practicality. The research followed the Plomp Research and Development framework through preliminary investigation, prototype development, and assessment. Material quality was reviewed by two validators, while media and language aspects were evaluated by two other validators. Practicality was measured with an 18-item, five-point Likert questionnaire; 35 of the 40 listed students returned complete responses and were included in the analysis. Numerical data were summarized as percentage scores, whereas validator comments were interpreted descriptively. The mean material-validity score was 86.67% and the media-language validity score was 87.22%, both classified as very valid. Student practicality reached 76.51%, which fell in the practical category. These findings indicate that the developed learning media is feasible for probability instruction in the setting studied. Because pretest-posttest data were not collected, the study did not evaluate effectiveness in improving learning outcomes.

Keywords: Canva; digital learning media; practicality; probability; validity

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INTRODUCTION

Digital technology has broadened the representational options available in mathematics classrooms, allowing explanations to be supported by text, images, animation, audio, and interactive visual elements. Multimedia is useful when these modes are coordinated to organize information and help learners revisit difficult ideas at their own pace (Munir, 2020). In mathematics education, web-based and digital media have also been reported as feasible alternatives for supporting access and learning engagement (Susanti & Suripah, 2021; Suripah & Susanti, 2022). Canva is relevant in this context because its templates, visual assets, animation features, and editing tools can be combined into structured instructional presentations and videos (Sihombing, 2024).

The need for carefully designed visual support is particularly evident in probability. Students must coordinate sample spaces, events, numerical probabilities, and contextual situations, yet they often experience difficulty interpreting questions, representing information mathematically, and selecting an appropriate solution procedure (Fitri & Abadi, 2021; Zainudin et al., 2021). A recent development study that specifically used Canva for probability also indicates that this topic can benefit from visual and animated representations that are organized around learners' needs (Fauzia, 2024). These findings suggest that probability instruction should not rely on symbolic formulas alone, but should also provide representations that make relationships among concepts easier to observe.

Video-based learning media offer one way to provide those representations because narration, text, illustrations, and motion can be arranged in a single instructional sequence. Short videos can support self-paced learning by allowing students to replay explanations when necessary (Sufyadi & Utama, 2024), while mathematics videos can make abstract processes more visible through sequential visualization (Santy et al., 2025). Development studies have likewise reported promising results for animated mathematics videos and other technology-supported media (Firdaus et al., 2023; Astuti et al., 2024). Canva therefore provides a practical environment for designing a probability video in which visual organization and explanation can be developed together.

Previous studies also emphasize that digital learning media should be evaluated beyond visual attractiveness. Canva-based animation has been associated with positive student motivation (Asnawati, 2023), and Canva-supported mathematics videos have been developed to facilitate conceptual understanding (Sitompul, 2024). In other development contexts, expert validation and user-response data have been used to judge whether mathematics learning resources are sufficiently feasible before broader implementation (Widyanti et al., 2021; Shaqila & Zetriuslita, 2023). Zafrullah et al. (2024), whose authors include Zetriuslita and Suripah, similarly positioned expert validation as a central step in the development of interactive multimedia for mathematics learning. Together, this literature supports the use of expert review and student practicality data as complementary evidence.

Despite the growing body of literature on digital and Canva-based media, a clear research gap remains. While previous studies have explored Canva for general student motivation (Asnawati, 2023) or junior high school/Grade VIII probability (Fauzia, 2024), and other video-based media target different mathematical topics or higher grade levels (Astuti et al., 2024; Firdaus et al., 2023), limited research has systematically examined Canva-based learning videos specifically tailored to **Grade X** probability under current curriculum demands. Furthermore, prior development works often treated media design and linguistic validation as separate or secondary components, without anchoring them into an integrated prototype tested directly for end-user practicality in high school classrooms.

The preliminary investigation at SMA Negeri 1 Pekanbaru showed that digital media were still used only to a limited extent in mathematics lessons, whereas probability required more visual and systematically sequenced explanations. This condition motivated the development of a Canva-based learning video for Grade X students. The study differs from prior work in several ways. Alzaber et al. (2021), with Suripah as one of the authors, applied the Plomp model to develop teaching materials that were evaluated for validity and practicality, while Fauzia (2024) developed Canva-assisted media for probability at Grade VIII using the ADDIE model. The present study instead applies the Plomp framework to Grade X probability, integrates language aspects directly into media validation, and examines practicality through student responses in the actual school context. This focus is also consistent with broader development research in mathematics that treats validity and practicality as distinct quality criteria before claims about effectiveness are made (Zetriuslita, 2025).

Accordingly, this study focuses on two quality dimensions: validity and practicality. Validity refers to the appropriateness of mathematical content, presentation, visual design, readability, and language according to expert judgment, whereas practicality reflects students' experience of using the learning media and the ease with which it can be applied. These dimensions are commonly used as initial evidence of feasibility in development studies (Diastuti & Guspatni, 2023). The purpose of this study is therefore to develop Canva-based digital learning media for Grade X probability and to describe its validity and practicality.

METHOD

This study employed a Research and Development (R&D) approach using the Plomp model. The model was selected because it organizes educational development into iterative phases in which needs are examined, a prototype is designed and reviewed, and the resulting learning resource is assessed and revised (Plomp & Nieveen, 2018). A three-phase Plomp structure has also been used in mathematics development studies by Alzaber et al. (2021) and Firdaus et al. (2023), supporting its suitability for producing learning resources that are evaluated progressively. In the present study, the procedure consisted of preliminary research, the prototyping phase, and the assessment phase, while the iterative character of educational design research was maintained through repeated review and refinement (Nieveen & Folmer, 2019).

During preliminary research, the researcher examined learning needs, curriculum requirements, student characteristics, and the scope of probability content. An interview with a mathematics teacher was used to identify classroom conditions, the use of digital resources, and the need for additional learning media. Curriculum and material reviews were then used to determine the learning objectives, content boundaries, and conceptual sequence. Information about student characteristics informed decisions about narration, visual representation, and the level of explanation included in the video.

The prototyping phase translated the preliminary findings into an initial learning video. A storyboard, content sequence, narration, text, illustrations, animation, and audio were prepared and assembled in Canva. The draft was first examined through self-evaluation for conceptual alignment, readability, presentation accuracy, and visual consistency. It was then reviewed by two material validators and two media validators, with language indicators integrated into the media assessment. The use of expert validation at this stage is consistent with other mathematics-development studies in which expert judgment is used to determine whether a learning resource is ready for user testing (Widyanti et al., 2021; Zafrullah et al., 2024). Validator comments were used as the basis for revision before the media was evaluated by students.

The assessment phase focused on practicality after students had used the learning media. The available questionnaire file listed 40 students; 35 completed all 18 items, whereas five forms contained no responses. The blank forms were excluded rather than treated as zero scores, so the practicality analysis used 35 complete responses from Grade X students at SMA Negeri 1 Pekanbaru. Student-response questionnaires are commonly used in development research to capture user acceptance and ease of use (Shaqila & Zetriuslita, 2023). No pretest-posttest data were collected in this study; consequently, the assessment reported in this article is limited to practicality and does not estimate learning-outcome effectiveness.

Research Instruments

Three instruments generated the data analyzed in this article: a material-validation form, a combined media-language validation form, and a student-practicality questionnaire. All instruments used a five-point Likert response format. Expert-validation forms and response questionnaires are widely used in mathematics-development studies to judge feasibility and user acceptance before broader implementation (Widyanti et al., 2021; Zafrullah et al., 2024; Shaqila & Zetriuslita, 2023). Practicality in this study therefore refers to the extent to which students could use and accept the learning media under the intended classroom conditions (Ikhlima et al., 2023). The specific indicators assessed across these instruments are structured as follows:

1. Material-Validation Form (9 items): Assesses core content indicators, including the conceptual accuracy of probability theory, alignment with curriculum learning objectives, suitability and clarity of contextual examples, and logical sequencing of sample space concepts .

2. Media and Language Validation Form (18 items): Assesses visual and linguistic indicators, including visual layout design, color consistency, animation pacing, audio-visual synchronization, legibility of text/fonts, and communicative language suitability and clarity for Grade X students.
3. Student-Practicality Questionnaire (18 items): Assesses user-experience indicators spanning five dimensions: accessibility (ease of opening/accessing the video), visual and audio attractiveness, content clarity, learning experience/self-pacing flexibility, and media operation/ease of use.

TABLE 1. Instruments, Respondents, and Measurement Focus

Instrument	Data source	Number of items	Purpose
Material validation	2 material validators	9	Assess content accuracy and feasibility
Media + language validation	2 media/language validators	18	Assess visual presentation, media aspects, readability, and language
Practicality questionnaire	35 students	18	Assess ease of use and user acceptance of the learning media

Source: Authors' processed research data (2026).

Data Analysis Techniques

Quantitative scores were analyzed descriptively using percentages. For each instrument, the observed score was summed, divided by the maximum possible score, and converted into a percentage. This procedure is consistent with mathematics-development studies that summarize validator judgments and user responses descriptively rather than using inferential tests when the research question concerns feasibility (Widyanti et al., 2021; Alzaber et al., 2021; Zafrullah et al., 2024). Because this study did not test differences between independent groups or associations among variables, normality, homogeneity, correlation, and regression analyses were not part of the analytical design. Qualitative information from validator comments and suggestions was reviewed descriptively and used to identify aspects requiring revision.

For each instrument, the percentage score was obtained using Equation (1).

$$P = \frac{\sum X}{S} = \text{Max} \times 100\%$$

In Equation (1), P denotes the percentage obtained, $\sum X$ represents the sum of observed scores, and Smax is the largest possible score. When more than one validator assessed the same aspect, their percentage scores were combined by calculating the arithmetic mean shown in Equation (2).

$$\bar{P} = \frac{\sum Pi}{n}$$

Interpretation used five percentage bands. Scores of 81-100% were classified as very valid, 61-80% as valid, 41-60% as moderately valid, 21-40% as less valid, and 0-20% as invalid. For practicality, the same intervals were interpreted as very practical, practical, moderately practical, less practical, and impractical. Percentage-based interpretation is consistent with development research in which validity and practicality are treated as separate indicators of feasibility (Diasuti & Guspatni, 2023; Alzaber et al., 2021).

RESULTS AND DISCUSSION

The development results of the Canva-based digital learning media on probability are presented according to the three phases of the Plomp model: the preliminary research phase, the prototyping phase, and the assessment phase. This structure is used to show not only the final validity and

practicality scores, but also how the learning media was developed, evaluated, revised, and tested with students.

Preliminary Research Phase

The development process began with preliminary research to establish an empirical and academic basis for designing the learning media. Activities in this phase included needs analysis, curriculum analysis, analysis of student characteristics, and analysis of probability content. The needs analysis was conducted through an interview with a mathematics teacher and an examination of the learning conditions at SMA Negeri 1 Pekanbaru. The findings indicated that the use of digital learning media in mathematics classes was still limited, while probability required a more visual and systematically organized presentation.

The need for visual representation is particularly important in probability because students have to connect sample spaces, events, probability values, and contextual situations with mathematical representations. Previous studies have also reported difficulties among senior high-school students in interpreting probability problems, constructing sample spaces, translating verbal information into mathematical form, and selecting appropriate solution procedures (Fitri & Abadi, 2021; Zainudin et al., 2021). These findings strengthened the rationale for providing learning media that presents probability concepts gradually through coordinated visual and verbal explanations.

Curriculum analysis was carried out to determine the learning outcomes, learning objectives, content boundaries, and sequence of concepts to be included in the learning media. The analysis of student characteristics was used to guide decisions regarding visual forms, narration, language, and the depth of explanation, whereas the content analysis was used to organize probability material systematically. The combined results of these analyses led to the decision to develop Canva-based digital learning media in the form of a learning video that integrates text, illustrations, animation, audio, and narration.

The work conducted in this phase is consistent with Alzaber, Suripah, and Susanti (2021), who also began Plomp-based development with needs analysis, examination of learning documents and curriculum, and content analysis before proceeding to prototype development. Their study shows that preliminary research functions as a basis for determining the form and characteristics of learning resources that correspond to user needs. In the present study, the preliminary phase therefore served as the foundation for defining the content, structure, visual design, and presentation of the Canva-based learning media.

Prototyping Phase

The results of the preliminary research were then translated into a concrete learning-media design during the prototyping phase. This phase began with the preparation of the content structure and storyboard to determine the sequence of presentation. The prototype incorporated text, illustrations, animation, audio, and narration, which were assembled in Canva to produce an initial learning video. Before external validation, the prototype underwent self-evaluation to examine conceptual alignment, readability, presentation accuracy, and visual consistency.

Expert review was conducted for two groups of assessment aspects. The probability content was evaluated by two material validators using nine assessment items, whereas the media and language aspects were evaluated by two validators using an 18-item instrument. The validators provided quantitative scores as well as comments and suggestions, which were used as the basis for revising the learning media before the student practicality assessment.

TABLE 2. Material Expert Validation Results

Validator	Obtained score	Maximum score	Percentage	Category
Validator 1	40	45	88.89%	Very valid
Validator 2	38	45	84.44%	Very valid
Mean	-	-	86.67%	Very valid

Source: Authors' processed research data (2026).

As shown in Table 2, Validator 1 awarded 40 points out of a maximum of 45, corresponding to 88.89%, while Validator 2 awarded 38 points, corresponding to 84.44%. The average material-validity percentage was therefore 86.67%, which falls within the very valid category. This result indicates that the probability content was considered highly appropriate in terms of conceptual accuracy, suitability of presentation, examples, and alignment with the intended learning objectives.

An indicator-level examination of the material validation instrument reveals that the highest scores were achieved in *curriculum objective alignment* and *mathematical concept accuracy* (such as the definition of sample spaces and event probability formulas), where both validators gave near-maximum scores. Slightly lower evaluations were recorded in the indicator concerning *contextual word-problem complexity*, where validators suggested simplifying real-life scenarios so that Grade X students could parse the conditions without getting lost in lengthy text descriptions. This level of material validity is especially important for probability because inaccuracies in the representation of sample spaces, events, or calculation procedures may reinforce misconceptions. The difficulties reported by Fitri and Abadi (2021) and Zainudin et al. (2021) support the need for careful sequencing and precise mathematical representation. The validation result therefore provided sufficient evidence for continuing the revised media to the next stage of development.

TABLE 3. Media and Language Expert Validation Results

Validator	Obtained score	Maximum score	Percentage	Category
Validator 1	76	90	84.44%	Very valid
Validator 2	81	90	90.00%	Very valid
Mean	-	-	87.22%	Very valid

Source: Authors' processed research data (2026).

Table 3 shows that Validator 1 awarded 76 points out of a maximum of 90, equivalent to 84.44%, while Validator 2 awarded 81 points, equivalent to 90.00%. The mean media-and-language validity percentage was 87.22%, which was categorized as very valid. This result indicates that the visual arrangement, readability, presentation, use of media elements, and language were generally considered highly feasible by the validators.

A closer look at the sub-indicators within the 18-item media-and-language instrument shows that *visual layout design*, *color contrast*, and *graphic consistency* received the strongest praise from validators. Conversely, constructive notes were directed toward *animation pacing* and *audio-visual synchronization* in specific transition frames, as well as the need to ensure standard Indonesian mathematical terminology (Bahasa baku) in the voiceover script. Canva facilitates the integration of text, illustrations, animation, and audio in a single learning medium; however, instructional quality still depends on clarity of communication and coherent organization of these elements. Multimedia components should support understanding rather than serve merely as decoration (Munir, 2020). The result is also consistent with studies indicating the potential of Canva and video-based media to support mathematics learning through visual representation and sequential explanation (Sihombing, 2024; Sitompul, 2024; Santy et al., 2025).

Although both validation aspects reached the very valid category, the validators' comments and suggestions were still used as the basis for refinement. Revisions were directed toward adjusting text font size on dense sample-space trees, refining audio narration speed, and tightening language expressions. This process reflects the formative-evaluation principle of the Plomp model, in which an initial prototype is revised on the basis of expert review before being used by learners. A comparable sequence was reported by Alzaber et al. (2021), where expert validation of content, media, and language was followed by revision before the assessment phase.

Assessment Phase

After validation and revision, the learning media proceeded to the assessment phase. In this study, the assessment phase focused on practicality through students' responses after using the learning media. The raw questionnaire dataset listed 40 students. Of these, 35 students completed all 18 questionnaire items, whereas five questionnaires were entirely blank. The blank questionnaires were

excluded from the calculation rather than being treated as zero scores. Accordingly, practicality was analyzed using 35 complete responses.

TABLE 4. Student Practicality Analysis Results

Summary indicator	Value
Number of students listed in the raw data	40
Fully completed questionnaires	35
Blank questionnaires	5
Number of questionnaire items	18
Total obtained score	2,410
Maximum score	3,150
Practicality percentage	76.51%
Category	Practical

Source: Authors' processed research data (2026).

Table 4 shows that the total score obtained from the 35 respondents was 2,410 out of a maximum possible score of 3,150. The resulting practicality percentage was 76.51%, placing the learning media in the practical category. This finding indicates that students were generally able to use the media and responded positively to its presentation and operation, although the score had not yet reached the very practical category.

An indicator-by-indicator analysis of the 18 student practicality items which spanned five operational dimensions demonstrates distinct performance patterns:

1. *Accessibility and Device Compatibility*: Scored relatively high; students reported that the digital video format was easy to open and stream on standard mobile or desktop screens.
2. *Visual and Audio Attractiveness*: Received strong endorsement from students, who appreciated the colorful Canva illustrations, animated characters, and engaging layout.
3. *Content Clarity*: Scored moderately high, though a subset of students indicated that certain multi-step probability tree diagrams required replaying the video to fully grasp how branches connect to sample spaces.
4. *Learning Experience and Self-Pacing Flexibility*: Demonstrated that the ability to pause and rewind the video helped reduce cognitive load during abstract calculations.
5. *Media Operation and Ease of Use*: Recorded lower relative ratings compared to aesthetic items, largely stemming from minor device buffering, audio volume variations across slides, or density of text appearing simultaneously with spoken narration.

In development research, practicality concerns ease of use, readability, manageability, and the suitability of learning media for actual user conditions (Ikhlima et al., 2023). Student responses are therefore important because expert validation does not fully represent users' direct experience when using the learning media. This interpretation is consistent with previous studies that use learner responses as evidence of practicality and usability in the assessment phase (Alzaber et al., 2021; Shaqila & Zetriuslita, 2023).

Critical Interpretation: Why Validity is "Very Valid" while Practicality is "Practical"

A critical synthesis of the findings explains why the media achieved a "very valid" rating from experts (86.67%–87.22%) yet scored in the "practical" band (76.51%) from students. Expert validators evaluate learning media under ideal, low-pressure analytical conditions, focusing on structural coherence, curriculum compliance, and theoretical soundness without the distraction of live classroom dynamics. In contrast, student practicality reflects real-time cognitive and operational engagement inside an active learning environment. While students found the Canva video visually appealing and conceptually helpful, real-world friction points such as cognitive pacing during fast animated derivations, simultaneous reading and listening demands (split-attention effect), and individual hardware/earphone limitations moderated their ease-of-use scores. This divergence highlights that high expert endorsement does not automatically equate to frictionless end-user experience, thereby reinforcing the necessity of dual-layer evaluation (expert plus user) in educational design research.

The assessment phase in this study was limited to practicality. Pretest and posttest data were not collected; therefore, learning gains, N-Gain, and the effectiveness of the learning media in improving achievement were not analyzed. Consequently, the findings should not be interpreted as evidence that the learning media improves student learning outcomes. This limitation remains consistent with development studies that stop at the valid-and-practical stage when broader effectiveness testing has not yet been conducted, as also reported by Alzaber et al. (2021).

TABLE 5. Summary of Learning Media Validity and Practicality

Aspect	Percentage	Category
Material validity	86.67%	Very valid
Media + language validity	87.22%	Very valid
Student practicality	76.51%	Practical

Source: Authors' processed research data (2026).

Overall, the three development phases produced a consistent pattern. Expert evaluation placed material validity at 86.67% and media-and-language validity at 87.22%, both in the very valid category, while student practicality reached 76.51% and was categorized as practical. These results indicate that the learning media passed a sequence of needs identification, design, expert validation, revision, and practicality assessment before being considered feasible for use in the context of the study.

Limitations of the Study

Several limitations should be considered when interpreting these findings. First, the study provides evidence only for validity and practicality and does not establish the effectiveness of the learning media in improving achievement. Second, five questionnaires were entirely blank and could not be included in the practicality analysis. Third, student responses were obtained in a single school context (SMA Negeri 1 Pekanbaru), which limits broader generalization. Further studies may conduct broader field trials and use an appropriate pretest-posttest or experimental design to examine learning effectiveness.

CONCLUSION

Conclusion

The Canva-based digital learning media developed for Grade X probability achieved an average material validity of 86.67% and media-language validity of 87.22% (both classified as very valid), alongside a student practicality score of 76.51% (classified as practical). These results demonstrate that the media is valid and usable for Grade X probability instruction within the tested school environment. In accordance with the development scope, no claims are made regarding student learning achievement or effectiveness, as pretest-posttest data were not gathered.

Suggestions

Subsequent revisions should focus on enhancing specific sub-indicators identified as lower in student practicality (such as video pacing and textual density). Future research is recommended to expand field testing and incorporate experimental or pre-post designs to evaluate the media's impact on learning outcomes.

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