Al-Ishlah: Jurnal Pendidikan
Vol.17, 1 (March, 2025), pp. 1440-1461
ISSN: 2087-9490 EISSN: 2597-940X, DOI: 10.35445/alishlah.v17i1.6191

Enhancing Critical Thinking Skills Through the TACK Model with Digital Flipbook Integration

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ARTICLE INFO

Keywords:

learning model development;
TACK;
digital flipbook;
critical thinking;
instructional technology

Article history:

Received 2024-10-20
Revised 2024-11-24
Accepted 2025-03-25

ABSTRACT

The rapid advancement of educational technology presents new opportunities to develop learning models that foster essential 21st-century skills, such as critical thinking. This study aims to develop a TACK (Technological, Andragogical, Content Knowledge) learning model utilizing a digital flipbook to enhance the critical thinking abilities of students in the Non-Formal Education (PNF) Department at Universitas Negeri Padang (UNP). This research follows a Research and Development (R&D) design, encompassing five stages: needs analysis, model design, development, implementation, and evaluation. Data were gathered using pretest and posttest instruments to measure students' critical thinking skills, alongside student satisfaction surveys to evaluate the model's reception. The findings indicate a significant improvement in students' critical thinking, with posttest scores (81.6) increasing by 25% from the pretest average (65.3). Additionally, the satisfaction survey revealed a 90% positive response rate, demonstrating strong student engagement and acceptance of the TACK model integrated with digital flipbook content. The TACK learning model, when supported by a digital flipbook, proves effective in enhancing students' critical thinking skills within the context of non-formal education. Its adaptability suggests potential for broader application in both formal and informal educational settings. These results highlight the importance of integrating technological tools with pedagogical strategies to foster innovative and impactful learning experiences.

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1. INTRODUCTION

In the era of the Fourth Industrial Revolution, the rapid advancement of digital technology has transformed various aspects of life, including education. This transformation highlights the urgent need for innovation in technology-based learning, especially in preparing students for the challenges of the 21st century. In the Department of Non-Formal Education at Universitas Negeri Padang (UNP), educators

face increasing demands to integrate technology effectively into the learning process to meet the unique needs of adult learners and ensure relevant, high-quality education in the digital era.

Despite its potential, the adoption of digital technology in learning often encounters challenges. According to Dabbagh and Kitsantas (2012), integrating technology creatively and effectively in higher education is essential to support meaningful learning experiences. However, in nonformal education, where adult learners require flexibility and a learner-centered approach, conventional methods often fall short. Additionally, there are concerns about whether technology alone can optimally develop critical thinking skills if not supported by appropriate pedagogical strategies.

To address these challenges, this study focuses on the TACK learning model (Technological, Andragogical, Content Knowledge). The TACK model integrates three critical components: technological knowledge, andragogical knowledge, and content knowledge, creating a framework that responds to the specific needs of adult learners in nonformal education settings (Koehler and Mishra 2009).By combining these elements, the TACK model not only leverages technology to facilitate interaction and accessibility but also incorporates principles of self-directed learning and ensures relevance to students' fields of study (Hayati, Hayati, and Utama, 2023). This comprehensive approach suits the demands of nonformal education, where flexibility and adult-centred learning are paramount.

Critical thinking skills are essential in today's workforce. As Kamba (2009) noted, that critical thinking forms the foundation of effective decision-making and problem-solving in complex situations. Similarly, Elder and Paul (2020)emphasized that critical thinking involves the persistent and active process of understanding, analyzing, and evaluating information to guide beliefs and actions. While higher education generally recognizes the importance of these skills, strategies to develop them in nonformal education remain underexplored.

Digital flipbooks, with their interactive features and engaging visualizations, offer a promising solution to these challenges. Unlike static digital textbooks, digital flipbooks provide dynamic interactivity and visualization, making it easier for students to grasp complex concepts. These tools also enable flexible access to learning materials, aligning with the learner-centered principles of nonformal education (Ikhwan 2019). While Mandala (2022)highlighted the potential of digital flipbooks in enhancing student motivation, their role in developing critical thinking skills still requires further exploration.

This study is important as it supports efforts to improve the effectiveness of learning in non-formal education at UNP by utilizing information technology. Additionally, focusing on developing critical thinking skills significantly contributes to preparing students to face complex challenges in a rapidly changing society. This research is also expected to guide the development of learning models that are responsive to technological advancements and the needs of students in the current digital era (Cichocka 2019).

Using the Research and Development (R&D) method, this study follows structured stages of needs analysis, design, development, implementation, and evaluation. By addressing the specific challenges of nonformal education and leveraging the strengths of the TACK framework, this study seeks to contribute to the advancement of innovative, technology-integrated learning models that are adaptable to the evolving needs of adult learners in the digital era. The expected outcome of this study is that integrating digital technology into learning models can lead to better and more relevant learning outcomes that meet the demands of the times (Miller 2009).

2. METHODS

2.1. Research Approach

This research was conducted in the Department of Non-Formal Education, Faculty of Education, Universitas Negeri Padang, using the Research and Development (R&D) methodology. R&D is a structured approach aimed at designing, developing, and validating educational products to address specific needs. As stated by Haryati (2012), development research seeks to produce innovations—such as models, patterns, procedures, or systems—with long-term applicability, often involving multi-phase

processes over extended periods. Similarly, Batubara (2020) explains that development research focuses on creating products that can be implemented in educational or other practical settings to evaluate their feasibility, effectiveness, and relevance. In the context of education, development research provides practical solutions to instructional challenges and supports educators in enhancing the learning process.

The primary objectives of development research include: (1) producing and improving products that meet educational needs; (2) integrating various components to create efficient and high-quality solutions; (3) enriching educational media content; and (4) introducing new instructional tools or resources. In this study, the R&D approach is used to develop the TACK (Technological, Andragogical, Content Knowledge) learning model integrated with a digital flipbook. The goal is to evaluate the effectiveness of this model in enhancing critical thinking skills among students in the Non-Formal Education Program at Universitas Negeri Padang. The research follows a systematic process, beginning with problem identification, followed by the design and development of the solution, and concluding with rigorous testing to determine its effectiveness and practical value in the learning environment.

2.2. Research Subjects

The study was conducted with two classes of third-semester students from the 2023 cohort enrolled in the Non-Formal Education Program Planning course at the Department of Non-Formal Education, Faculty of Education, Universitas Negeri Padang (UNP). A convenience sampling technique was employed, as the selected classes were already organized based on course enrollment. While this non-random sampling method may limit the generalizability of findings, it was deemed suitable given the practical constraints of working with pre-assigned groups.

The total sample consisted of 41 students, divided into a control group and an experimental group. The control group included 21 students who received instruction through conventional teaching methods. The experimental group, comprising 20 students, was exposed to the TACK (Technological, Andragogical, Content Knowledge) learning model utilizing a digital flipbook. Both groups completed pre-test and post-test assessments to measure changes in learning outcomes and critical thinking skills following the intervention.

Participants were between 19 and 21 years old, with most aged 20—representing a typical age range for third-semester students in this program. Gender distribution was relatively balanced: the control group consisted of 11 male and 10 female students, while the experimental group included 9 male and 11 female students. These demographics reflect the broader population of the Non-Formal Education department, enhancing the relevance and contextual fit of the research.

The sample size was guided by the availability of participants within the course and is consistent with prior quasi-experimental studies, ensuring sufficient statistical power for detecting differences in critical thinking outcomes between the two groups.

2.3. Research Design

This study utilized a quasi-experimental design involving two groups: an experimental group and a control group. Both groups were assessed using pre-tests and post-tests administered at the beginning and end of the intervention period to measure changes in critical thinking skills. This design enabled a comparative analysis of the effectiveness of different instructional approaches, with the control group receiving traditional instruction and the experimental group experiencing the TACK learning model supported by a digital flipbook.

Both independent t-tests and paired t-tests were employed to analyze the data. The independent t-test was used to compare post-test results between the control and experimental groups, determining whether any observed differences in critical thinking outcomes were statistically significant. The paired t-test, on the other hand, was applied within each group to measure the extent of improvement by comparing pre-test and post-test scores. These statistical methods were selected due to their reliability in

evaluating mean differences and their suitability for assessing the impact of interventions in educational research contexts.

Table 1. Schematic of quasi-experimental design.

Pre-Test	Treatment	Post-Test
T_1	X	T_2

Description:

- T_1: Pre-test conducted before being given treatment
- X: Treatment is given the TACK learning model using a digital flipbook
- T_2: Post-test conducted after treatment

One of the primary limitations of this quasi-experimental design is the lack of randomization. Since students were assigned to control and experimental groups based on pre-existing class enrollments, there is a risk of selection bias. To mitigate this limitation, both groups were matched based on their academic backgrounds and prior achievements, ensuring comparable baseline characteristics.

Additionally, the design may be influenced by extraneous variables such as instructor teaching styles or differences in group dynamics. To address this, the same instructor facilitated both classes using a standardized teaching approach, except for the introduction of the digital flipbook in the experimental group.

2.4. Research Procedure

This study adopts the ADDIE development model, which includes five systematic stages: Analysis, Design, Development, Implementation, and Evaluation. Each phase plays a critical role in guiding the research process, ensuring that the resulting learning model is both effective and relevant to the study's objectives. These stages were carried out sequentially and aligned with the project timeline to support the successful development and testing of the TACK learning model. The detailed breakdown of each stage is presented in the following scheme:

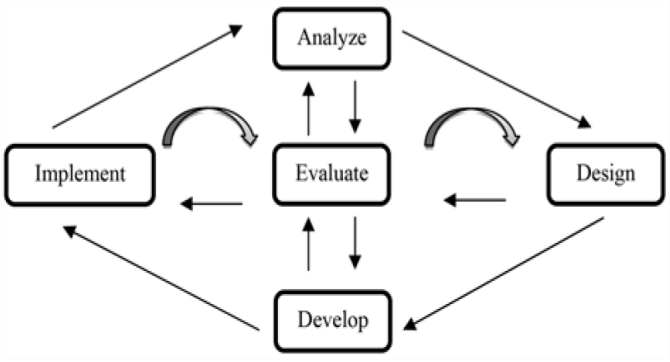

Figure 1. ADDIE Model Stages Schematic.

2.4.1 Analysis (Needs Analysis)

Over two weeks, the research team conducted an in-depth analysis of the needs and characteristics of Non-Formal Education (PNF) students at the Faculty of Education, UNP. This included surveys and interviews to identify students' needs related to critical thinking skills, challenges in digital learning, and preferences for instructional media. Additionally, technological requirements were analyzed to determine how a digital flipbook could support interactive learning. The findings from this stage directly informed the design of the TACK learning model.

2.4.2 Design (Learning Model Design)

The three-week design phase focused on creating the TACK Learning Model, which integrated:

- Technological elements, such as interactive navigation and multimedia content.
- Principles of andragogy, emphasizing self-directed learning and relevance to real-life contexts.

- Content relevance, focusing on concepts, principles, and typologies of nonformal education program planning.

During this stage, the research team developed detailed blueprints for the digital flipbook, including outlines, templates, and interactive features tailored to enhance critical thinking skills. Courage students to analyze, evaluate, and synthesize information, rather than simply memorizing content.

2.4.3 Development (Digital Flipbook Development)

In a four-week development phase, the research team created the digital flipbook using the Heyzine app based on the designed model. The flipbook underwent internal testing to ensure its quality and functionality. The testing assessed the following criteria:

- Usability: Ease of navigation and user interface intuitiveness.
- Interactivity: Effectiveness of multimedia elements (videos, quizzes, hyperlinks).
- Content Relevance: Alignment with course objectives and critical thinking goals.
- Technical Feasibility: Compatibility with various devices (e.g., laptops, tablets).
- Feedback from faculty members and a small group of students during this stage was used to refine and improve the product before implementation.

2.4.4 Implementation (Learning Model Implementation)

The six-week implementation phase involved applying the TACK learning model in the experimental class, while the control class used conventional methods. Training sessions were held for instructors and students before implementation to ensure effective use of the digital flipbook and understanding of the TACK model. Throughout this period, the experimental group actively engaged with the interactive features of the flipbook, while the control group followed traditional teaching methods.

2.4.5 Evaluation (Evaluation and Improvement)

The final stage, lasting two weeks, focused on evaluating the effectiveness of the intervention.

- Quantitative Evaluation: Pre-tests and post-tests were administered to both groups to measure critical thinking improvement, with statistical tests (e.g., independent t-tests) employed to analyze the results.
- Qualitative Evaluation: Feedback from students and instructors was collected through interviews and observations to assess the usability and impact of the digital flipbook and the TACK model.

2.5. Research Instruments

The instruments used in this study include:

1. Pre-test and Post-test

To evaluate students' critical thinking skills before and after the implementation of the learning model, pre-tests and post-tests were administered. These assessments were adapted from established and validated critical thinking instruments, containing items that measured key components such as analysis, evaluation, and synthesis. The adaptation process was carefully conducted to ensure the tests were aligned with the learning objectives of the TACK model and relevant to the context of non-formal education. To further ensure the quality and validity of the instruments, they were reviewed by subject matter experts in instructional design and critical thinking, thereby supporting the content validity of the assessment tools.

2. Questionnaire

To gather data on students' perceptions of the digital flipbook and the effectiveness of the TACK learning model, a structured questionnaire was developed. It consisted of both Likert-scale items, rated from 1 (strongly disagree) to 5 (strongly agree), and open-ended questions to obtain more in-depth qualitative feedback. The questionnaire explored key areas such as usability, student engagement, and the perceived contribution of the digital flipbook to the development of critical thinking skills. Prior to its

full implementation, the questionnaire was piloted with a small sample of students to ensure clarity, reliability, and relevance of the items.

3. Interviews and Observations

Semi-structured interviews were conducted with selected students and instructors to explore their experiences with the TACK model and the digital flipbook. The interview guide included questions about the challenges faced, the benefits of the learning model, and suggestions for improvement. Observations were conducted during the implementation phase to capture real-time interactions and behaviors, such as student engagement and participation.

Qualitative data from interviews and observations were analyzed using thematic coding, a process where recurring themes and patterns were identified to provide deeper insights into the effectiveness of the TACK model. Thematic analysis involved multiple steps: (1) familiarization with the data, (2) generating initial codes, (3) searching for themes, (4) reviewing themes, and (5) defining and naming themes. This systematic approach ensured the credibility and trustworthiness of the findings.

2.6. Data Collection Techniques

Data collection in this study involved multiple methods to ensure comprehensive insights. Critical thinking skills were assessed through pre-tests and post-tests administered at the beginning and end of the study, allowing for a direct measurement of learning outcomes. Additionally, student perceptions of the instructional media and the TACK learning model were gathered through structured questionnaires. To support the quantitative data, qualitative methods—such as interviews and classroom observations—were employed to capture deeper insights into students' experiences and the implementation process in the experimental group.

The pre-test and post-test were specifically developed to evaluate students' critical thinking abilities, focusing on core components such as analysis, evaluation, and synthesis. These assessments provided a basis for comparing student performance before and after exposure to the TACK model. The difference in scores between the two tests served as a direct indicator of the model's effectiveness in enhancing critical thinking skills among students in the Non-Formal Education program.

2.7. Data Analysis Techniques

Quantitative data obtained from the pre-test and post-test assessments were analyzed using statistical methods to determine whether there were significant differences in the improvement of critical thinking skills between the control and experimental groups. These analyses allowed for a clear comparison of the effectiveness of the TACK learning model supported by a digital flipbook against traditional instructional methods.

In parallel, qualitative data gathered through interviews and classroom observations were analyzed thematically to uncover recurring patterns and key themes. This analysis focused on students' learning experiences, their perceptions of the TACK model, and how the digital flipbook contributed to the development of critical thinking skills. Additionally, the thematic analysis helped identify challenges and barriers encountered during the implementation process from both the students' and instructors' perspectives. These insights enriched the quantitative findings and provided a more comprehensive understanding of the model's practical application and impact in an educational setting.

3. FINDINGS AND DISCUSSION

3.1. Development Design of the Learning Model

The development of the TACK learning model in this research integrates digital book-based learning media, specifically a digital flipbook created using the Heyzine app. The content of this flipbook emphasizes the concepts, principles, and typology of program planning in nonformal education, which aligns with the core material of the course Nonformal Education Program Planning. This course is a compulsory subject for third-semester students in the Department of Nonformal

Education, Faculty of Education, Universitas Negeri Padang, carrying 3 credits. It aims to enhance students' knowledge, understanding, and skills in designing nonformal education programs while fostering creative and critical thinking abilities.

The experimental group, session class 202410050049, showed a significant improvement in critical thinking skills, with an average post-test score increase of 16.75 points compared to the control group (session class 202410050047). This improvement underscores the effectiveness of the TACK learning model. The specific features of the TACK model that contributed to this enhancement include:

1. Interactive Content in Digital Flipbooks: The interactive design of the flipbook facilitated better engagement with the learning material, enabling students to explore and analyze concepts in-depth.
2. Integration of Andragogical Principles: The self-directed learning approach encouraged by the TACK model empowered students to take ownership of their learning process, a key factor in developing critical thinking skills.
3. Technological Accessibility: The use of a digital format provided flexibility and convenience, allowing students to access materials anytime, and fostering a more continuous and reflective learning process.

In addition to quantitative results, qualitative feedback from students and instructors indicated that the TACK model was particularly effective in promoting active learning. Students appreciated the interactive features of the flipbook and the structured guidance provided, which they felt encouraged deeper engagement with the course material.

The developed TACK model and its digital flipbook were validated by a panel of experts in instructional design, technology integration, and nonformal education. Validators highlighted several strengths of the model:

1. Content Alignment: The flipbook effectively aligned with the course objectives and addressed the core competencies required in nonformal education program planning.
2. Ease of Use: The user-friendly design of the Heyzine flipbook was praised for its accessibility and intuitive navigation.
3. Engagement Potential: The multimedia elements of the flipbook were noted to enhance student engagement and motivation.

Areas for improvement identified by validators included minor adjustments to the layout for better readability and the inclusion of additional examples to contextualize complex concepts. These suggestions were incorporated into the final product to ensure optimal usability and relevance.

The 16.75-point improvement in critical thinking skills is not just statistically significant but also practically meaningful. This improvement suggests that the TACK learning model addresses gaps in conventional instructional methods by offering a more holistic and integrated approach to learning. For educators, this highlights the potential of combining technological tools with andragogical principles to create meaningful and impactful learning experiences. In practice, this model can be adapted to other courses or educational settings to enhance learning outcomes and critical thinking development.

3.2. Learning Media Design Display

The appearance of the flipbook learning media design consists of 3 types, namely: Cover, content, and cover. In the cover design, use the Canva application in A4 portrait size format. The content of the flipbook consists of several menus, namely: table of contents, material in the form of concepts, principles, procedures, methods, and techniques of Nonformal Education program planning, YouTube video links to Nonformal Education Program Planning concepts, links, and barcodes to access quizzes, website wheel of names for assessment, and bibliography.

Flipbook learning media can be accessed by clicking the link https://heyzine.com/flip-book/a252a4938a.html, by entering the password ridhapnffipunp. The following is a flipbook media design:

3.2.1 Cover Display

The flipbook cover is designed using a black, white, and gray color scheme, enhanced with animated illustrations to create a modern and engaging visual appeal. The layout was developed using Canva to ensure a clean and professional appearance. The front cover features the title *"E-Module for Program Planning in Nonformal Education"*, along with the official logos of the Faculty of Education and Universitas Negeri Padang. Additionally, the developer's name is clearly displayed, providing proper authorship and academic attribution.

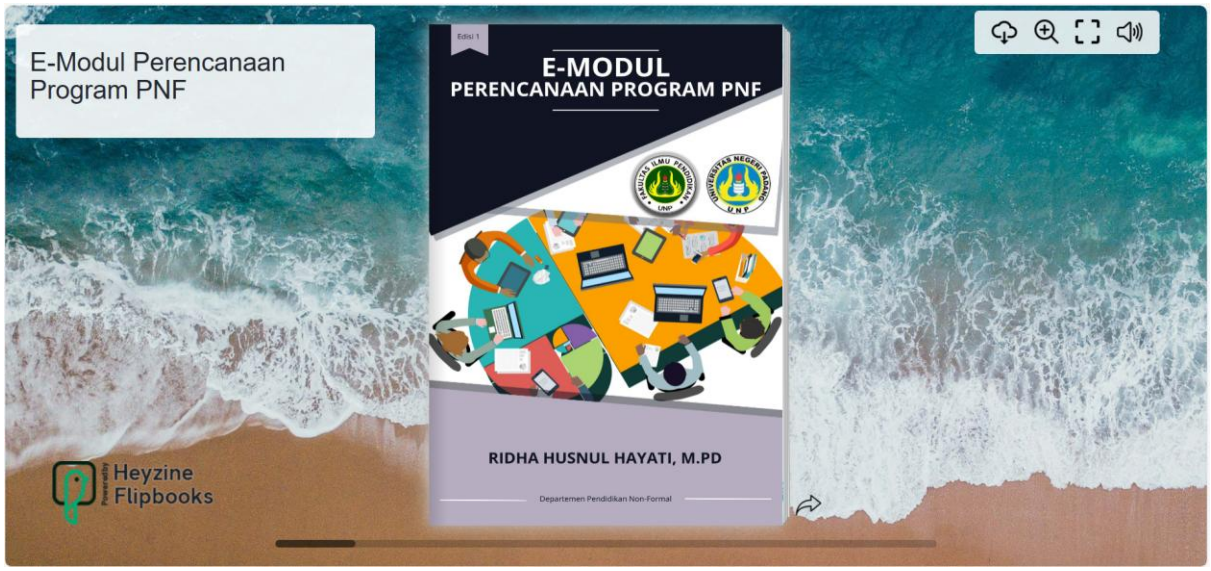

Figure 2. Flipbook Front Cover.

3.2.2 Table of Contents Display

The table of contents page includes all the features of the flipbook learning media, from the cover to the bibliography.

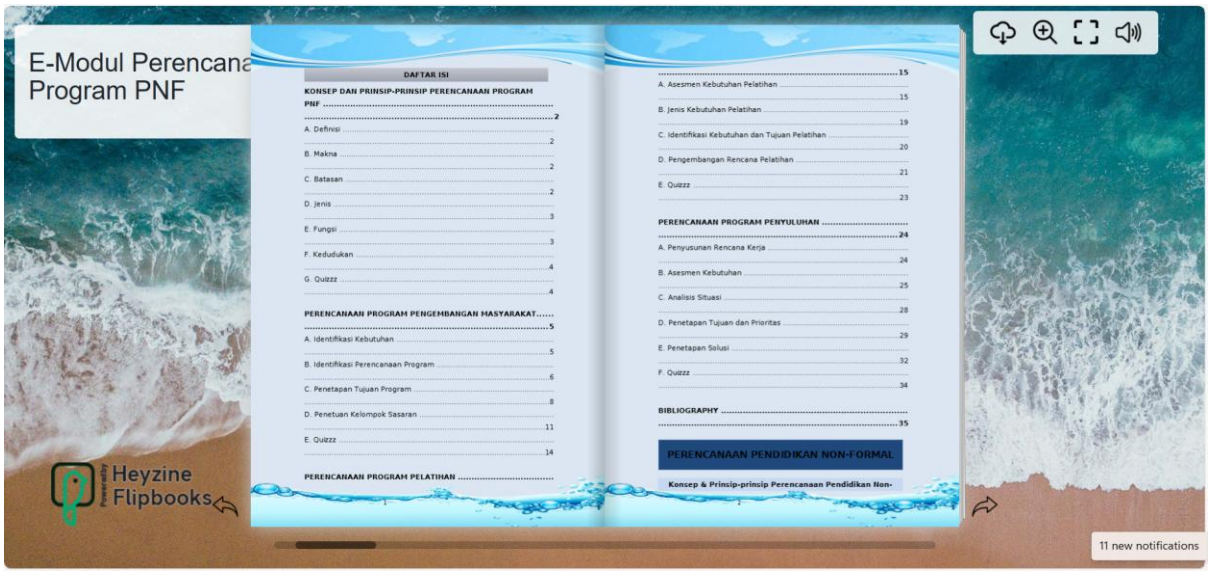

Figure 3. Table of Contents.

3.2.3 Nonformal Education Program Planning Material Display

The course material in the *Nonformal Education Program Planning* flipbook covers essential concepts, principles, and the typology of program planning within the context of nonformal education.

Each subtopic is supported by practice quizzes designed to reinforce the material, which can be accessed via embedded links or by scanning the corresponding QR codes. To enhance understanding, the flipbook also includes instructional videos related to the content. These videos are easily accessible by clicking on the video icons integrated within the digital pages, offering a more interactive and engaging learning experience.

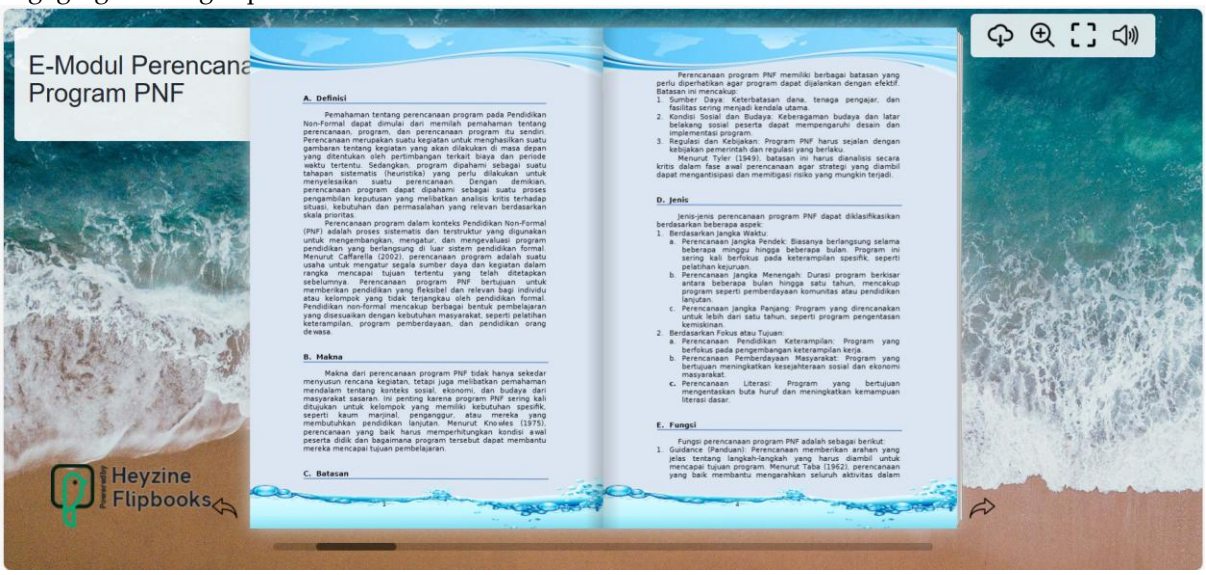

Figure 4. Non-formal Education Program Planning Materials.

3.2.4 YouTube Video Link Display of Non-Formal Education Program Planning Material

This page contains YouTube video links about *Non Formal Education Program Planning* material to help students understand the material more easily.

Figure 5. YouTube Video Link about Non-Formal Education Program Planning Material.

3.2.5 Assessment Display

Students can access the practice questions by clicking on the link or barcode provided at the end of each material explanation. The link or barcode for the practice questions is automatically connected to the Quizizz application. Additionally, there is a "wheelofnames" feature designed for a question-and-answer session between the lecturer and the students. When this feature is clicked, one student's

name will be randomly selected to answer a question posed by the lecturer. This aims to enhance students' interest, enthusiasm, and motivation in the learning process.

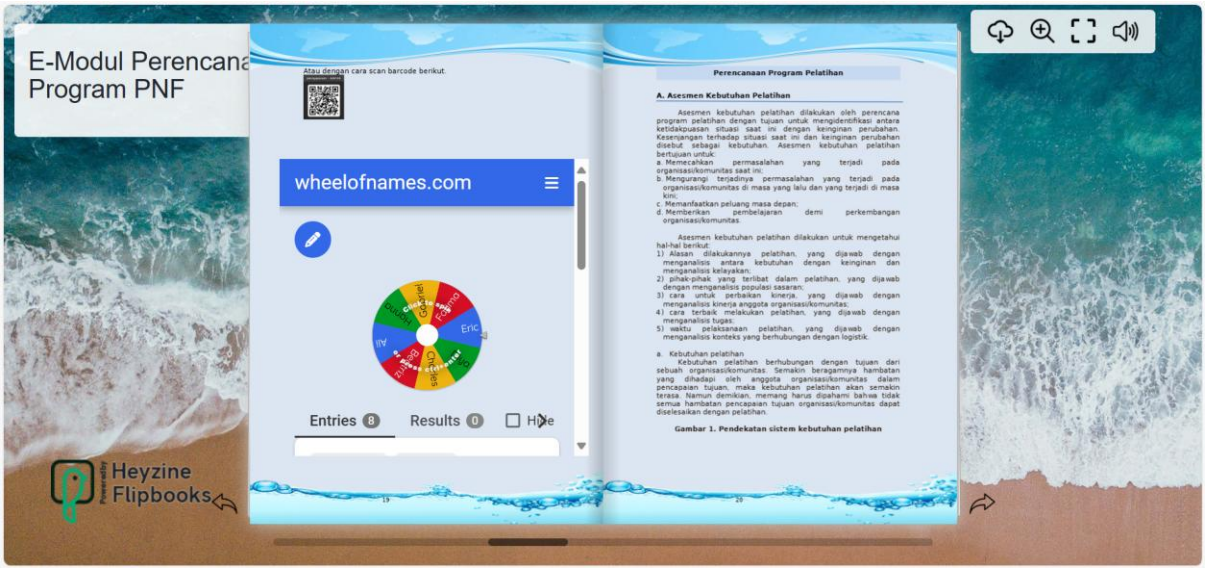

Figure 6. Link or Barcode for Assessment and Wheel of Names Feature

3.2.6 Bibliography Display

The bibliography in the flipbook serves as a reference source, providing readers with information to validate that the flipbook contains accurate and reliable data. It ensures that the information presented is credible and can be verified.

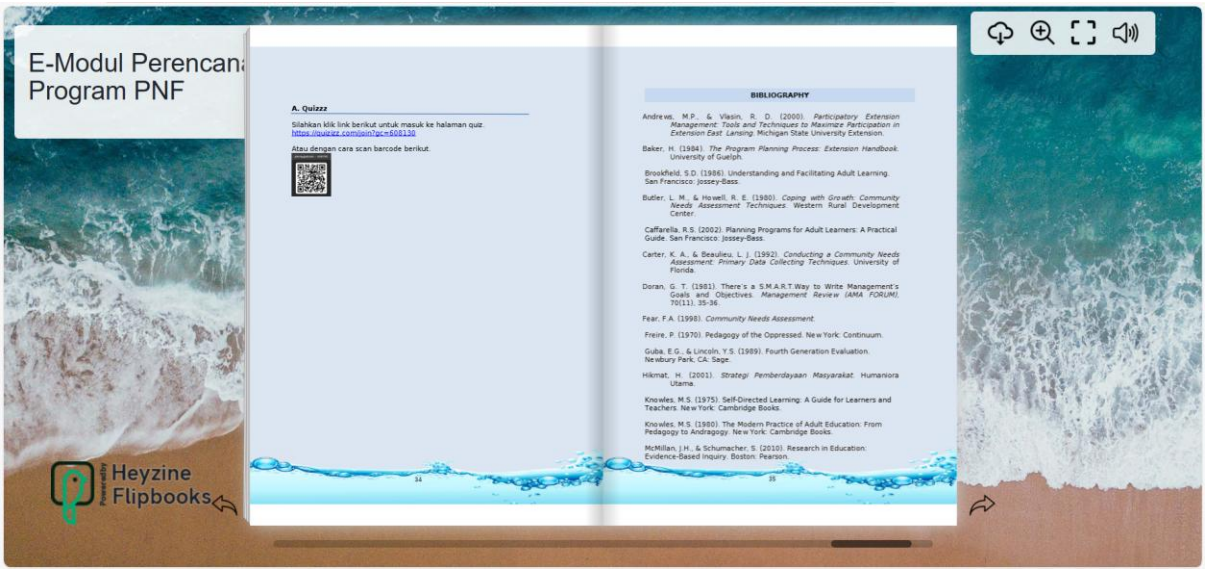

Figure 7. Bibliography.

3.3. Presentation of Trial Data

This development research aims to produce a digital flipbook for the course on Nonformal Education Program Planning. The developed product must go through several validation stages to ensure it is suitable and appropriate for use, including validation by content experts, design experts, learning experts, field trials with learners, and effectiveness testing of the product. The results of these validations are as follows:

3.3.1 Results of Material Expert Validation

The material expert involved in validating the digital flipbook-based learning media for the Nonformal Education Program Planning course is Mr. Muhamad Fahrur Rozi, M.Pd., a lecturer in the Department of Nonformal Education, Faculty of Education, Universitas Negeri Padang. With a professional background in Nonformal Education Program Management and direct teaching experience in the same course, he brings subject-matter expertise essential for evaluating content relevance and academic accuracy. The primary objective of this validation process is to assess whether the content presented in the digital flipbook aligns with the learning outcomes and curriculum requirements of the Nonformal Education Program Planning course.

The validation process utilized a structured questionnaire as the evaluation instrument. This approach yielded both qualitative and quantitative data. Qualitative insights were gathered through detailed feedback and comments provided by the expert validator, while quantitative data were obtained from the numerical scores assigned to each item in the questionnaire. The following section presents the results and analysis of the material validation conducted by the expert.

Table 2. Results of the Material Expert Validation Questionnaire.

No	Aspects Evaluated	Score
1	Learning Objectives by Core Competencies and Basic Competencies	3
2	The material is presented in a systematic manner	4
3	The material presented is easily understandable for students	4
4	Illustrations are presented by the content of the material in the media	3
5	The language used in the media is easily understood by students	4
6	Alignment of the Material in the Flipbook with Core Competencies and Basic Competencies	3
7	The competencies presented in the material include core competency units and basic competencies	3
8	The material in the Flipbook can be studied without the assistance of other media	4
9	The material in the Flipbook is by the developments in science and technology	4
10	The material in the Flipbook can be studied anytime and anywhere	4
	Total Score	36

Each point on the questionnaire above is scored from 1 to 4; if there are 10 points, the highest possible score is 40. The analysis of the questionnaire results can be calculated using the following formula:

$$\mathrm{P} = \frac{\sum X}{\sum Xi} \text{ x } 100\%$$

Explanation:

- P: Percentage of feasibility
- ∑X: Total score of the validator's answers (actual score)
- ∑Xi: Maximum score
- 100%: Constant number

$$P = \frac{36}{40} \times 100\% = 90\%$$

3.3.2 Results of Design Expert Validation

The design expert responsible for validating the digital flipbook media for the Program Planning in Nonformal Education course is Miss Fitri Dwi Arini, M.Pd., a faculty member in the Department of Nonformal Education, Faculty of Education, Universitas Negeri Padang. With her expertise in teaching

the Information and Communication Technology course and her frequent involvement as a design validator in student research projects, she brings valuable experience to the evaluation process. The primary objective of the design validation is to assess whether the media is visually and functionally appropriate for university-level students. Additionally, the validation seeks to gather recommendations for improving the layout, visual appeal, and overall user experience of the flipbook to enhance its effectiveness as a learning tool.

The validation process was conducted using a questionnaire, which, like the material validation, produced both qualitative and quantitative data. The qualitative data were drawn from the expert's written feedback and suggestions, while the quantitative data were based on scores given to specific design elements. The following section presents the results of the design expert's evaluation.

Table 3. Results of the Design Expert Validation Questionnaire.

No	Aspects Evaluated	Score
1	The arrangement of layout elements on the front cover is appropriate/harmonious, giving a good sense of rhythm	4
2	Displays the correct focal point (point center)	4
3	The composition of layout elements (title, author, illustration, logo, etc.) is proportional to the layout of the content	3
4	The size and layout elements of the writing are proportional to the size of the Flipbook media	4
5	The color elements have a harmonious layout, enhancing clarity and emphasizing the function of the content	3
6	Displays good contrast	3
7	The title font size is more dominant compared to the author's name and logo	4
8	The title color contrasts well with the background color	3
9	The font size is proportional to the size of the flipbook	4
10	Do not use too many font type combinations	4
11	Do not use decorative fonts	4
12	The font type used is appropriate for the content/material	4
13	Illustrations effectively represent the content/material	3
14	Illustrations reveal the character of the objects	3
15	The placement of layout elements is consistent based on writing patterns	3
16	The placement of chapter titles or equivalent sections (e.g., preface, table of contents) is uniform/consistent	3
17	The spacing between text and illustrations is appropriate	3
18	Title	4
19	Subtitles (Slides)	4
20	Illustrations	3
21	The use of font variations (bold, italic, capital, small capital) is not excessive	4
22	The font size is appropriate for the educational level of higher education students	4
23	The font type is suitable for the content/material	4
24	The line spacing of the text is normal	4
25	It effectively conveys the meaning/essence of the objects	3
26	The shapes are realistic and true to life	4
27	All illustrations are harmonious	3
28	There are various complementary features/variations in the flipbook media	4
	Total Score	100

Each point on the questionnaire above is scored from 1 to 4, with a total of 29 items, making the maximum score 116 points. The analysis of the questionnaire results can be calculated using the following formula:

$$P = \frac{\sum X}{\sum Xi} \text{ x } 100\%$$

Explanation:

- P: Percentage of feasibility
- ∑X: Total score of the validator's answers (actual score)
- ∑Xi: Maximum score
- 100%: Constant number

$$P = \frac{100}{116} \times 100\% = 86{,}21\%$$

3.3.3 Results of the Learning Expert Validation

The learning expert validation was conducted by Mrs. Rila Rahma Mulyani, M.Psi, Psikolog. She is a lecturer in the Guidance and Counseling Study Program at Universitas PGRI Sumatera Barat. With over 11 years of teaching experience and being certified, she is qualified to serve as a learning expert validator. The purpose of the learning expert validation is to assess the suitability of the media and its alignment with the characteristics of students and the curriculum being taught. Additionally, it aims to strengthen the validation data for the development of the flipbook learning media, which can be used as an alternative for the course on Nonformal Education Program Planning in higher education. The results of the learning expert validation are as follows:

Table 4. Results of the Learning Expert Validation Questionnaire.

Number	Aspects Evaluated	Score
1	The learning materials in the Flipbook learning media include learning outcomes	3
2	The Flipbook learning media contains exercises that align with the material	3
3	The clarity of the presentation of material, images, audio, video, and colors motivates students to learn	3
4	The Flipbook learning media is easy to operate	4
5	The Flipbook learning media is enjoyable	4
6	The Flipbook learning media helps you capture students' attention when explaining the material	4
7	The Fun Learning activities in the Flipbook learning media align with the student's environment and characteristics	3
8	The video content in the Flipbook learning media can help students understand the material	3
9	The Flipbook learning media assists you in developing students' critical thinking skills	4
10	The Flipbook learning media encourages students to be active in discussions and exploration	3
11	The colors, images, and font sizes are appropriate for the characteristics of the students	3
12	The Flipbook learning media makes it easy for you to identify differences in students' learning pattern	3
	Total Score	40

Each point on the questionnaire above is scored from 1 to 4, with a total of 12 items, resulting in a maximum score of 48. The analysis of the questionnaire results can be calculated using the following formula:

$$P = \frac{\sum X}{\sum Xi} \text{ x } 100\%$$

Explanation:

- P: Percentage of feasibility
- ∑X: Total score of the validator's answers (actual score)
- ∑Xi: Maximum score
- 100%: Constant number

$$P = \frac{40}{48} \times 100\% = 83{,}33\%$$

3.4. Effectiveness Test Data Analysis

3.4.1 Results of the Experimental Class

Table 5. Experimental Class Test Results Before Treatment (Pre-test).

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Pretest	20	45	85	60.75	11.502
Valid N (listwise)	20				

The analysis of pre-test data for the experimental group, conducted using SPSS version 20.00 with a sample of 20 students, revealed a mean score of 60.75 and a standard deviation of 11.502. The lowest score recorded was 45, while the highest reached 85. These results reflect the students' initial critical thinking abilities prior to the implementation of the TACK learning model. The detailed frequency distribution of the experimental group's pre-test scores is presented in the following table.

Table 6. Pre-test Frequency Distribution of the Experimental Class.

Number	Interval	Frequency	%
1	45-52	7	35%
2	53-60	4	20%
3	61-68	3	15%
4	69-76	4	20%
5	77-85	2	10%
Total		20	100%

Based on the pre-test frequency distribution table of the experimental class, it can be illustrated in the histogram below:

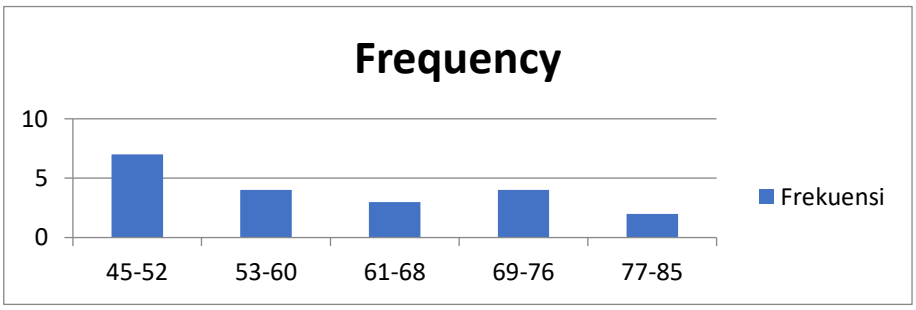

Figure 8. Frequency Distribution of Experimental Class Test Results Before Treatment (Pre-Test).

Based on the table and histogram above, the majority of pre-test frequencies for the experimental class are found in the interval of 45-52, with a total of 7 students (35%).

Table 7. Test Results of the Experimental Class After Treatment (Post-Test).

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Posttest	20	60	95	77.50	11.413
Valid N (listwise)	20				

The post-test results for the experimental group, analyzed using SPSS version 20.00 with a sample of 20 students, indicate an average score of 77.50 and a standard deviation of 11.413. The lowest score achieved was 60, while the highest was 95. These results reflect an overall improvement in students' critical thinking skills following the implementation of the TACK learning model. The detailed frequency distribution of the experimental group's post-test scores is presented in the table below.

Table 8. Post-Test Frequency Distribution of the Experimental Class.

Number	Interval	Frequency	%
1	60-66	5	25%
2	67-73	3	15%
3	74-80	5	25%
4	81-87	1	5%
5	88-95	6	30%
Total		20	100%

Based on the frequency distribution table of the experimental class post-test, it can be illustrated in the histogram below:

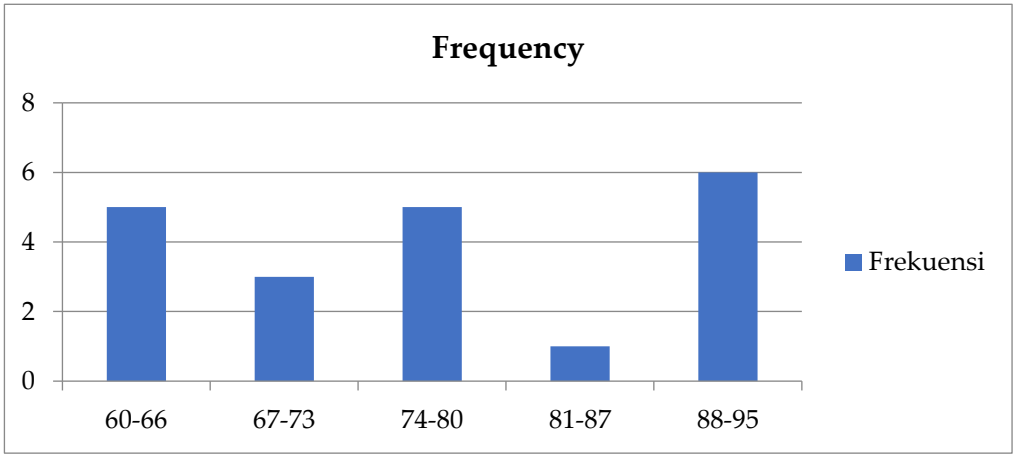

Figure 9. Frequency Distribution of the Experimental Class Test Results After Treatment (Post-Test).

Based on the table and histogram above, the majority of post-test frequencies for the experimental class are found in the interval of 88-95, with a total of 6 students (30%).

3.4.2 Results of the Control Class

Table 9. Control Class Test Results Before Treatment (Pre-test).

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Pretes	21	40	75	57.62	12.808
Valid N (listwise)	21				

Based on the SPSS 20.00 analysis of the pre-test data for the control group, which included 21 students, the average score was 57.62 with a standard deviation of 12.808. The lowest recorded score was 40, while the highest was 75. These figures represent the baseline critical thinking abilities of the control group prior to receiving conventional instruction. The frequency distribution of the control group's pre-test scores is presented in the table below.

Table 10. Pre-test Frequency Distribution of the Control Class.

Number	Interval	Frequency	%
1	40-46	7	33%
2	47-53	2	10%
3	54-60	3	14%
4	61-67	4	19%
5	68-75	15	24%
Total		21	100%

Based on the pre-test frequency distribution table of the control class, it can be illustrated in the histogram below:

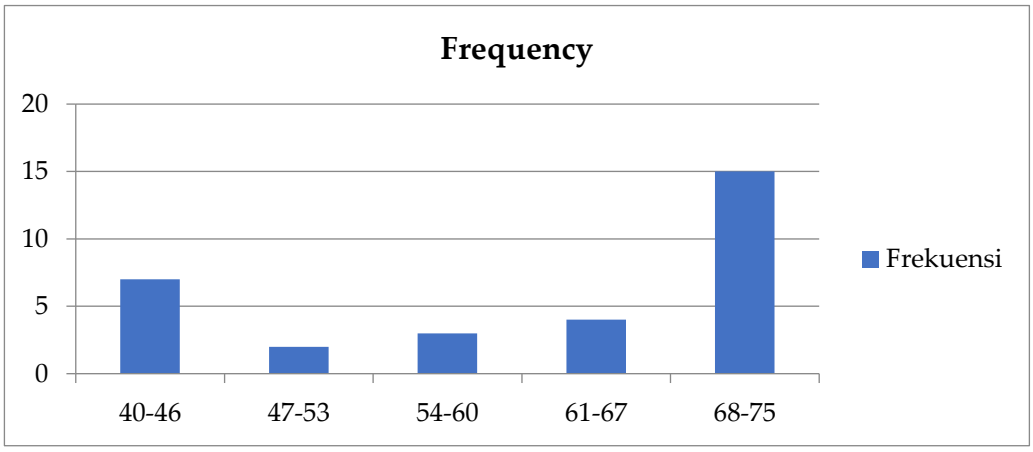

Figure 10. Frequency Distribution of Control Class Test Results Before Treatment (Pre-Test).

Referring to the table and histogram presented above, the highest concentration of pre-test scores in the control group falls within the 68–75 range, with 15 students (24%) achieving scores in this interval.

Table 11. Test Results of the Control Class After Treatment (Post-Test).

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Posttes	21	45	80	60.71	10.036
Valid N (listwise)	21				

The post-test analysis for the control group, conducted using SPSS version 20.00 with a sample of 21 students, revealed a mean score of 60.71 and a standard deviation of 10.036. The lowest score recorded was 45, while the highest reached 80. These results reflect the students' critical thinking performance following conventional instruction. The detailed frequency distribution of the control group's post-test scores is provided in the table below.

Table 12. Post-Test Frequency Distribution of the Control Class.

Number	Interval	Frequency	%
1	45-51	6	29%
2	52-58	2	10%
3	59-65	7	33%
4	66-72	4	19%
5	73-80	2	10%
Total		21	100%

Based on the frequency distribution table of the control class post-test, it can be illustrated in the histogram below:

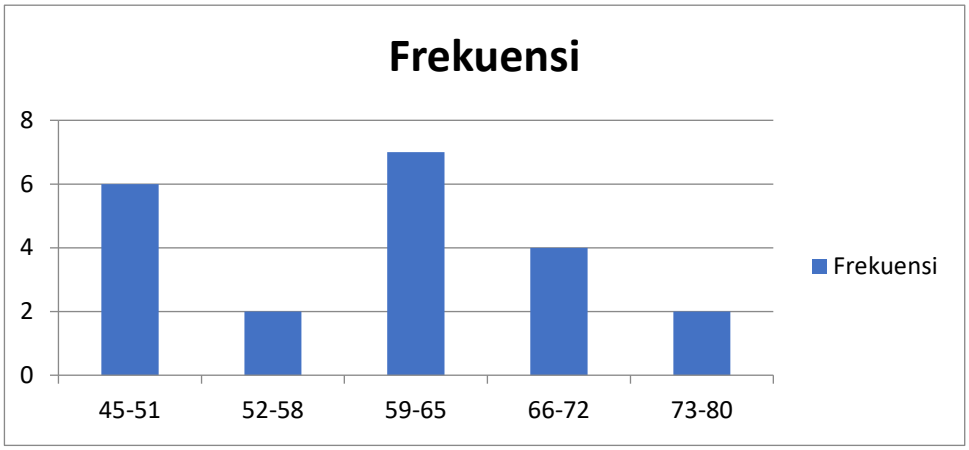

Figure 11. Frequency Distribution of the Control Class Test Results After Treatment (Post-Test).

Based on the table and histogram above, the highest concentration of post-test scores in the control group falls within the 59–65 range, with 7 students (33%) achieving scores in this interval.

3.5. Analysis Prerequisite Testing

Prerequisite testing was conducted before performing data analysis. The prerequisites used in this research are normality tests and homogeneity tests. The results of the prerequisite analysis are presented as follows:

3.5.1 Normality Test

The normality test is used to assess whether the data for all variables follow a normal distribution. This test was conducted using the Kolmogorov-Smirnov method and processed through SPSS version 20.00. A variable is considered to be normally distributed if the significance value (sig.) exceeds 0.05; conversely, if the value is below 0.05, the data are considered not normally distributed. The results of the normality test are presented as follows:

Table 13. Normality Test Summary.

Number	Groups	*Sig*	Summary
1	Experimental Class Pre-test	0.053	Normal
2	Experimental Class Post-test	0.200	Normal
3	Control Class Pre-test	0.110	Normal
4	Control Class Post-test	0.200	Normal

Referring to the table above, the significance values (sig.) for both the pre-test and post-test data on students' critical thinking skills in the experimental and control groups are all above 0.05. This indicates that the data meet the criteria for normal distribution, allowing for the use of parametric statistical analyses in further testing.

3.5.2 Homogeneity Test

Following the normality test, a homogeneity test was conducted to examine whether the variances between the experimental and control groups are statistically similar. This test is essential to determine whether both groups can be compared using parametric methods. The decision to accept or reject the hypothesis is based on the significance value obtained from Levene's Statistic. If the significance (sig.) value is greater than 0.05, the data are considered to have homogeneous variances. The results of the homogeneity test are presented in the following table:

Table 14. Homogeneity Test Summary.

Classes	*Sig*	Description
Pretest	0.400	Homogeneous
Posttest	0.326	Homogeneous

The results of the homogeneity test for the research variables show a significance value of 0.400 for the pre-test and 0.326 for the post-test. Since the significance values for both the pre-test and post-test are greater than 0.05 (sig > 0.05), it can be concluded that the data in this study have homogeneous variances.

3.6. Hypothesis Testing

The hypotheses in this study were tested using the paired t-test and independent t-test with the help of SPSS 20. The hypotheses proposed in this research are as follows:
Ha: There has been an improvement in the critical thinking skills of non-formal education students.
Ho: There has been no improvement in the critical thinking skills of non-formal education students.

The results of the hypothesis testing are as follows:

3.6.1 Pre-test and Post-test of the Experimental Class

The pre-test and post-test in the experimental group were conducted to assess whether there was a measurable improvement in student scores following the intervention. A significant increase is indicated when the calculated t-value exceeds the critical t-value from the t-distribution table at the 5% significance level, and when the p-value is less than 0.05. A summary of the t-test results for the experimental group's pre-test and post-test scores is presented in the following table:

Table 15. Results of the t-Test for the Pre-Test and Post-Test of the Experimental Class.

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean	Sig.
Pair 1	Pretest_Experiment	60.75	20	11.502	2.572	.000
	Posttest_Experiment	77.75	20	11.639	2.603	

Based on the table above, the average pre-test score of the experimental class was 60.75, and the average post-test score was 77.75, showing an increase of 17.00. It was also found that the t-calculated value was greater than the t-table value at a 5% significance level (9.688 > 2.093) and had a p-value less than 0.05. This indicates that there was a significant improvement in the critical thinking skills of the Non-formal Education students in the experimental group.

3.6.2 Pre-test and Post-test of the Control Class

The pre-test and post-test of the control class were conducted to determine whether there was an increase in scores. The conclusion is considered significant if the t-calculated value is greater than the t-table value at a 5% significance level, and the p-value is less than 0.05. The summary of the t-test for the pre-test and post-test of the control class is shown in the following table:

Table 16. Results of the t-Test for the Pre-Test and Post-Test of the Control Class.

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean	Sig.
Pair 1	Pretest_Kontrol	57.62	20	12.808	2.572	.000
	Posttest_Kontrol	60.71	20	10.036	2.603	

Based on the data presented in the table above, the control group's average pre-test score was 57.62, while the post-test average increased slightly to 60.71, resulting in a modest gain of 3.09 points. However, the statistical analysis showed that the t-calculated value (1.599) was lower than the t-table value (2.085) at the 5% significance level, and the p-value exceeded 0.05. These results suggest that the observed improvement in the critical thinking skills of Non-Formal Education students in the control group was not statistically significant.

3.6.3 Post-test of the Experimental Class and Post-test of the Control Class

An independent-sample t-test was conducted to compare the post-test scores of the experimental and control groups, aiming to determine whether a statistically significant difference existed between the two. The result is deemed significant if the calculated t-value exceeds the critical t-value at the 5% significance level and the p-value is less than 0.05. The summary of the independent t-test comparing the post-test scores of both groups is presented in the following table:

Table 17. Results of the t-Test for the Post-Test of the Experimental and Control Classes.

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean	Sig
Pair 1	*Posttest*_Eksperimen	77.75	20	11.639	2.603	.683
	*Posttest*_Kontrol	61.00	20	10.208	2.283	

The results of the t-test revealed that the average post-test score for critical thinking in the experimental group was 77.75, compared to 61.00 in the control group—indicating a difference of 16.75 points in favor of the experimental class. Statistical analysis showed a t-calculated value of 5.091 and a significance (p-value) of 0.000. Given that the t-calculated value exceeds the critical t-table value of 2.085 at the 5% significance level (5.091 > 2.085), and the p-value is below 0.05 (0.000 < 0.05), it can be concluded that the difference in critical thinking skills between the two groups is statistically significant.

Therefore, the research hypothesis (Ha), which states that "There is an improvement in the critical thinking ability of Non-Formal Education students," is accepted. This confirms that the implementation of the TACK learning model had a positive and measurable impact on enhancing students' critical thinking skills compared to traditional instructional methods.

Discussion

This study revealed a significant improvement in the critical thinking skills of students in the experimental group who engaged with the TACK-based learning model and digital flipbook media. These results are consistent with the foundational principles of nonformal education, which emphasize flexibility, accessibility, and learner-centered instruction (Lippitt, Knowles, & Knowles, 1984). The integration of digital tools into learning design proves particularly effective in addressing the self-directed learning needs of adult learners, who often seek practical, applicable knowledge to navigate real-world challenges (Brookfield, 1986).

The findings also contribute to broader discussions on the role of instructional technology in nonformal education, highlighting its value in cultivating critical thinking. This skill is essential for adult learners, empowering them to assess, evaluate, and respond effectively to complex problems (Paul & Elder, 2013). The TACK model's emphasis on the fusion of technology, pedagogy, and content makes it especially suitable for diverse learning contexts. Its adaptability aligns well with the unique needs of adult learners, many of whom juggle work, education, and family responsibilities. These findings align with Mishra and Koehler's (2006) TPACK framework, which stresses the importance of harmonizing technology, pedagogy, and content to design impactful, context-sensitive learning experiences.

However, several limitations must be considered when interpreting the results. The small sample size of 20 students per group may not adequately represent the wider student population, suggesting a need for studies with larger, more diverse samples to validate the outcomes (Creswell & Creswell, 2017). Furthermore, all participants were drawn from a single institution, limiting the generalizability of the findings across different demographic or cultural contexts.

In terms of implementation challenges, initial technical issues emerged related to access to and familiarity with digital flipbook tools. These were addressed through preparatory sessions to ensure students could navigate the platform confidently—an approach supported by Salas et al. (2012), who emphasize the importance of readiness in technology adoption. Additionally, some students expressed hesitation in adopting the new learning model. This resistance, a common reaction when introducing innovative instructional strategies (Rogers, Singhal, & Quinlan, 2014), was mitigated through clear communication and demonstration of the model's benefits via pilot activities.

The study's findings suggest that incorporating digital tools like flipbooks into nonformal education can significantly support the development of critical thinking. For such integration to be successful, however, thorough planning is essential. Educators and learners alike must receive adequate training to use digital tools effectively, and institutions must ensure equitable access to the required technology to avoid excluding any participants.

Future research should explore the application of the TACK model in a variety of educational settings and examine its long-term effects on learners' cognitive skills and professional outcomes. Studies investigating the model's use in hybrid or blended learning formats may also offer valuable insights into optimizing teaching strategies in nonformal education environments.

4. CONCLUSION

This study aimed to develop and evaluate the effectiveness of digital flipbook-based learning media for the *Nonformal Education Program Planning* course, utilizing the ADDIE model within a Research and Development (R&D) framework. The development and expert validation confirmed that the flipbook aligns with curriculum standards, pedagogical principles, and student learning needs. Experts in content, instructional design, and educational media rated the material positively in terms of relevance, visual appeal, and user-friendliness. Empirical findings revealed that the digital flipbook significantly enhanced students' critical thinking skills, as shown by a marked improvement in the experimental group's scores—from 60.75 to 77.50—compared to the control group's modest increase from 57.62 to 60.71. Hypothesis testing confirmed a statistically significant difference, with the

experimental group outperforming the control group by 16.75 points. Despite these promising results, the study is limited by its relatively small sample size and focus on a single course within one institution, which may affect the generalizability of the findings. Future research is encouraged to explore the application of digital flipbook media in broader and more diverse nonformal education contexts, including interdisciplinary courses and collaborative learning environments. Further investigation into the integration of advanced technologies—such as augmented reality (AR) or gamification—could also enhance interactivity and learner engagement. Overall, this research highlights the potential of the TACK learning model combined with digital flipbooks as an effective, scalable, and engaging instructional tool for promoting critical thinking in higher education.

Acknowledgments: The authors would like to thank Lembaga Penelitian dan Pengabdian Masyarakat Universitas Negeri Padang for funding this work with contract number: 1569/UN35.15/LT/2024. The authors also express their gratitude to all parties who have provided support for this research, especially to the team of material, design, and learning validators who have offered valuable input. In addition, thanks are extended to the students who participated in the field trials, as well as to those who provided technical and administrative assistance.

Conflicts of Interest: The authors declare no conflict of interest in this research.

REFERENCES

Batubara, Hamdan Husein. 2020. "Media Pembelajaran Efektif." *Semarang: Fatawa Publishing* 3.

Brookfield, Stephen. 1986. *Understanding and Facilitating Adult Learning: A Comprehensive Analysis of Principles and Effective Practices*. McGraw-Hill Education (UK).

Cichocka, A. ,. &. Hidayat, N. ,. &. Khalika, M. 2019. "Narasi Nasionalisme Dalam Perspektif Psikologi Sosial." *Journal of Social Psychology* 55(3):205–2015.

Creswell, John W., and J. David Creswell. 2017. *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. Sage publications.

Dabbagh, Nada, and Anastasia Kitsantas. 2012. "Personal Learning Environments, Social Media, and Self-Regulated Learning: A Natural Formula for Connecting Formal and Informal Learning." *The Internet and Higher Education* 15(1):3–8.

Elder, Linda, and Richard Paul. 2020. *Critical Thinking: Tools for Taking Charge of Your Learning and Your Life*. Foundation for Critical Thinking.

Haryati, Sri. 2012. "Research and Development (R&D) Sebagai Salah Satu Model Penelitian Dalam Bidang Pendidikan." *Majalah Ilmiah Dinamika* 37(1):15.

Hayati, Ridha Husnul, Nikmah Hayati, and Hendri Budi Utama. 2023. "The Effectiveness of The Tack Learning Model Using Logic Model Analysis To Enhance Self-Directed Learning." *KOLOKIUM Jurnal Pendidikan Luar Sekolah* 11(3):27–36.

Ikhwan, M. 2019. "Pengembangan Model Pembelajaran Berbasis Teknologi Informasi." Universitas Terbuka.

Kamba, Manir Abdullahi. 2009. "Access to Information: The Dilemma for Rural Community Development in Africa."

Koehler, Matthew, and Punya Mishra. 2009. "What Is Technological Pedagogical Content Knowledge (TPACK)?" *Contemporary Issues in Technology and Teacher Education* 9(1):60–70.

Lippitt, Gordon L., Malcolm Shepherd Knowles, and Malcolm S Knowles. 1984. "Andragogy in Action: Applying Modern Principles of Adult Learning."

Mandala, W. 2022. "Efektivitas Pembelajaran Berbasis Teknologi Digital Dalam Pendidikan Era 4.0." *Journal of Educational Technology*.

Miller, R. ,. &. Josephs, I. 2009. *Critical Pedagogy in the Modern Classroom*. University Press.

Mishra, Punya, and Matthew J. Koehler. 2006. "Technological Pedagogical Content Knowledge: A Framework for Teacher Knowledge." *Teachers College Record* 108(6):1017–54.

Paul, Richard, and Linda Elder. 2013. *Critical Thinking: Tools for Taking Charge of Your Professional and Personal Life*. Pearson Education.

Rogers, Everett M., Arvind Singhal, and Margaret M. Quinlan. 2014. "Diffusion of Innovations." Pp. 432–48 in *An integrated approach to communication theory and research*. Routledge.

Salas, Eduardo, Scott I. Tannenbaum, Kurt Kraiger, and Kimberly A. Smith-Jentsch. 2012. "The Science of Training and Development in Organizations: What Matters in Practice." *Psychological Science in the Public Interest* 13(2):74–101.