

Innovative Learning Strategies by Embedding Design Thinking-based Project Learning in Textbooks for Edupreneurial Impact

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ABSTRACT

The research aims to develop a textbook that integrates design thinking to optimize project-based learning. The article presents the results of integration feasibility and effectiveness tests design thinking to optimize the project-based learning process. **The research aims** to provide a textbook that supports project-based learning design thinking to fulfill the content, process, and means of learning. R&D was carried out by adopting the Thiagarajan Four-D model for the MKWK for Citizenship Education at Universitas Negeri Medan. **Data was collected** by observation, document study, literature study, questionnaires, and tests. **Development results** in textbook-based design thinking to optimize project-based learning is declared feasible. **This conclusion** was confirmed after validating linguistic, media, and material aspects, and was declared valid because the V index value ($V \geq 0.61$). Textbook-based design thinking is considered practical by lecturers and students, the V index value is greater ($V \geq 0.61$). Implementation of textbook-based design thinking, which has been developed, affects student learning outcomes based on the paired t-test producing a significance value of $p = 0.000$ (sig. $0.000 < 0.05$). This significance value confirms the significant positive (meaningful) influence textbooks on student learning outcomes after intervention or treatment and does not happen by chance.

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1. INTRODUCTION

The Industrial Revolution 4.0, society 5.0, and the demographic bonus bring challenges, opportunities, and new directions to the world of education [1]. RI 4.0 encourages education 4.0. to prepare young citizens to have competencies and learning experiences according to current and future developments [2]. At the higher education level, the government provides learning that meets standards of content, processes, facilities, and assessment to achieve minimum competency standards and expected graduates through the Regulation of the Minister of Education and Culture of the Republic of Indonesia Number 3 of 2020 concerning National Higher Education Standards. The use of project-based learning models is encouraged as a collaborative, participatory and effective learning model [3].

Project-based learning is learning that guides students to provide solutions to problems raised in the form of new ideas, intervention activities or developing products [4]. The steps for implementing project-based learning were adopted from The George Lucas Educational Foundation [5]. The implementation of project-based learning experiences obstacles, the lack of understanding of the problem and research before providing a solution hinders producing the best ideas and designs. Moreover, limited knowledge and skills result in minimal innovation and optimization of learning outcomes. Apart from that, project implementation experiences significant problems in selecting content, linking it to the substance of lectures, monitoring, assessing, and optimizing the achievement of learning objectives [6], [7].

Optimization of project-based learning design thinking not only emphasizing cognitive dimensions, but also affective and psychomotor which are relevant to course learning outcomes [8]. The urgency of implementing project-based learning design thinking for MKWK Civics it needs to be optimized inward textbook (textbook, teach textbook). In addition to process standards, integrating project-based learning design thinking into the textbook provides minimum criteria for learning content and facilities per the Regulation of the Minister of Education and Culture of the Republic of Indonesia Number 3 of 2020 concerning National Higher Education Standards. Utilization textbooks maximize learning outcomes because they contain content, achievements, activities, lecture experiences, and equal assessment of lecture outcomes [9], [10]. The availability of textbooks improves the lecture process more optimally because it provide substance, activity, and experience criteria as a guide for implementing learning [11].

Redesign project-based learning steps by integrating an innovative thinking framework design thinking “double diamond” process model providing support and facilitating more optimal learning based on learning objectives [12]. Additionally, roles design thinking to provide innovative learning experiences and activities, based on selecting appropriate and significant problems and solutions, relevant to the lecture substance, time effective, having measurable monitoring and assessment as well as optimizing the achievement of learning objectives has not received special attention [13]. Weigh the benefits of integrating design thinking into learning through textbook that optimize project-based learning. Design thinking not only emphasizes cognitive dimensions but also affective and psychomotor which are relevant to course learning outcomes.

Availability of textbooks is the fulfillment of standards for content, processes, and learning facilities (Regulation of the Minister of Education and Culture of the Republic of Indonesia Number 3 of 2020 concerning National Higher Education Standards). Not yet available textbooks can provide good guidelines for implementing project-based learning design thinking that guides lecturers and students [14]. Based on this, development is needed textbook that integrates design thinking to optimize project-based learning [15]. Therefore it is important to measure the feasibility and effectiveness of integration design thinking to optimize the project-based learning process [16], [17]. The goal is to provide a textbook that supports project-based learning design thinking to fulfill the content, process and means of learning [18]. Developing textbook-based design thinking to optimize the application of project-based learning is a learning necessity [19].

2. LITERATURE REVIEW

2.1. Optimizing Learning Using Textbooks

Textbook is a book developed by educators that meets the rules and is disseminated for this course [20]. The textbook contains content packaging and lecture guides for developing learning outcomes in the domains of attitudes, knowledge, and skills [21]. Textbooks are deliberately arranged in a systematic, operational, and directed manner intending to help make it easier for students to learn. Availability of textbook lecture resources and guides according to characteristics; curriculum needs and learning outcomes. The availability textbooks helps improve the lecture process more effectively and optimally [22], [23].

Educators plan learning outcomes, learning activities, assessments, and assignments, among other textbooks which has been developed [24]. The availability of textbooks increases students' positive perceptions of learning [25]. Role textbooks guide students in solving learning problems [26]. Textbook provides probabilistic, rather than determinative, opportunities to better explore and interpret material content and study guides optimally [27]. Studies show that there is a relationship between students' difficulties in solving learning problems and their opportunities to study problems optimally provided by textbooks.

2.2. Design Thinking and Improved Learning Outcomes

Design thinking has become part of many industrial and commercial activities [28]. Design thinking are steps and activities to produce innovation in a structured manner based on a sequence of thought processes to

produce solutions that are in harmony with needs [29]. This thinking process framework guides the production of creative and innovative solutions that suit needs (Directorate of Learning and Student Affairs [30], [31]. However, nowadays many research documents present integration design thinking in education [32].

Integration design thinking for student-centered education optimizes relevant cognitive and affective dimensions of human experience [33]. Through the learning process design thinking can foster civic literacy, empathy, cultural awareness, and risk-taking. Therefore, policies and practices for implementing learning must be designed and built with a design thinking process model to provide support to educators to achieve learning goals [34]. Curriculum, assessment, and educational technology are designed to build design thinking (design thinking) to facilitate classroom learning [35].

Design thinking through thinking processes and learning experiences to face dilemma situations and progressively being able to test solutions or prototypes to solve problems [36]. Design thinking can increase learning motivation, critical thinking skills and problem-solving [37]. The thinking process encourages the ability to reflect on learning experiences to solve problems [38, 39]. Because of that, design thinking is very appropriate to be integrated into project-based learning [40]. Because, project-based learning guides students to provide solutions to problems raised in the form of new ideas, intervention activities, or developing products [41].

3. RESEARCH METHOD

3.1. Research Design

This research was carried out through research and development (R&D). R&D is combined or mixed research (mixed methods approach) which combines qualitative and quantitative data methods to produce and test the effectiveness of the products being developed [42], [43]. R&D is carried out by adopting the model Four-D Thiagarajan which consists of 4 main stages, namely:

- Define (Determination)
- Design (Planning)
- Develop (Development)
- Disseminate (Spread)

3.2. Data Collection Technique

Data was collected using several data collection techniques. First, observation (observation) used to observe the need and use of products in learning and other research activities [44]. Second, document study, to review curriculum policies, regulations, and other relevant documents. Third, the literature study, to produce a project-based learning model design thinking that is not only supported by an empirical framework but also uses a logical framework by expert opinion authoritative knowledge [45]. Fourth, interview (interview) in depth (deep interview) to explore data from experts to get input on prototype products [46]. Fifth, a questionnaire (wander) is used to determine the level of feasibility, effectiveness, and response to the product being developed. Sixth, a test (test) is used to collect data through objective and standard measurements related to improving student learning outcomes.

3.3. Location, Population & Sample

The research was conducted at Universitas Negeri Medan with samples selected using techniques purposive sampling because it allows researchers to assess a representative sample themselves for research. Development textbook carried out for the compulsory curriculum course (MKWK) Citizenship Education. The choice was because, in the previous year, the technical implementation unit for general courses (UPT MKU) had developed a project-based learning model design thinking for MKWK within Universitas Negeri Medan through a grant from the Ministry of Education, Culture, Research and Technology of the Republic of Indonesia in 2023. The research sample consisted of 193 Citizenship Education MKWK students, consisting of 6 (six) classes, from 5 (five) study programs, and spread across 3 (three) faculties, Faculty of Social Sciences, Faculty of Languages and Literature and Faculty of Mathematics and Natural Sciences.

3.4. Data Analysis Techniques

The data obtained was analyzed using qualitative and quantitative data analysis techniques. Qualitative data analysis uses an interactive model through steps data collection, data reduction, data display, and conclusion drawing and verification. Meanwhile, quantitative data analysis was carried out using several techniques. First, feasibility analysis (validation) using Aiken's V statistics, with the V value criteria, if the V Value < 0.61 textbooks are considered valid, whereas a V value < 0.61 is declared invalid.

Second, test the test instrument. The test instrument was tested using validity and reliability tests. Test the validity of the instrument using the product moment correlation technique by Pearson correlation. Question items on the test instrument are declared valid if they have $r_{\text{count}} > r_{\text{table}}$. To determine r_{table} , the author uses the formula: $df = n - 2$, where: df is (degree of freedom) or degrees of freedom; while n is the number/amount of samples/respondents to the validation test. Meanwhile, the reliability test of the learning outcomes instrument was carried out for internal consistency, namely Cronbach's alpha. If the value of Cronbach's Coefficient Alpha is greater than 0.6, then the questionnaire as a measuring tool is considered reliable. If the value of Cronbach's Coefficient Alpha is smaller than 0.6, then the questionnaire as a measuring tool is considered unreliable. After the validity and reliability tests are carried out, they are interpreted based on the Table 1 below.

Table 1. Interpretation of Validation and Reliability Values

Value Range	Category
0,800-1,000	Very high
0,700-0,899	High
0,400-0,699	Enough
0,200-0,399	Low
0,000-0,199	Very Low

Third, paired t-test analysis. Effectiveness analysis was carried out using a paired t-test, using the Paired Samples T-Test method. The analysis is carried out to compare the means of two related data sets. Decision-making on the results of the t-test can be seen from the significance value being smaller than < 0.05 , so there is a significant influence. Meanwhile, if the significance value is greater than > 0.05 , then there is no significant influence.

4. RESULT AND DISCUSSION

R&D textbook which integrates design thinking to optimize project-based learning carried out for MKWK Citizenship Education. Citizenship Education is a mandatory curriculum subject (MKWK) at every level of undergraduate education in every tertiary institution in Indonesia (UU No. 20 of 2003; Law No. 12 of 2012). At this point, development becomes an urgent textbook that integrates design thinking to optimize project-based learning.

4.1. Design Textbook required

Stages defined conducted for problems, development needs, and product design plans to be developed, the initial analysis of problems and development needs based on the implementation of project-based learning experienced obstacles, lack of guidance and thinking steps for students to develop solutions to the problems raised. Project implementation experiences significant problems in content selection, linkage with lecture substance, monitoring, assessment, and optimizing the achievement of learning objectives because there is not sufficient guidance for lecturers and students. This causes the solutions or interventions carried out not to suit needs (user-based).

Second, the required design must refer to the main material for citizenship education learning materials based on the Decree of the Director General of Higher Education, Ministry of Education and Culture of the Republic of Indonesia Number 84/E/KPT/2020 concerning Guidelines for Implementing Compulsory Courses in the Higher Education Curriculum [47]. Learning materials on textbooks become substance, reference, activity, development of experience and achievements as well as evaluation of learning outcomes [48].

Third, integration of project-based learning steps design thinking in the textbook carried out by adding 1 (one) chapter entitled "Implementation of Citizenship Based Learning Projects Design Thinking "Double Diamond" Process Model" last chapter textbook [49]. Thus, Learning is a project-based design thinking "double diamond" process model through development textbook Citizenship education can be more optimal.

Fourth, develop practice design thinking in the nomenclature "civic practice" at the end of each material. The development of citizenship practice is provided starting from Chapter 1 to Chapter 10 which reflects parts of the thinking process design thinking to train students before carrying out projects based on steps design thinking "double diamond" process model. Specifically for Chapter 10, citizenship practice is aimed at implementing all steps of project-based learning design thinking "double diamond" process model.

4.2. Initial Design Textbook

Stages design (development) involves, the selection and preparation of materials; media, and initial design textbook [50]. Development is carried out by taking into account suggestions and input at the stages defined previously. Stages design (design) is carried out by considering standards and feasibility [51].

Table 2. Eligibility Aspects

Eligibility Aspects	Indicator
Language	Straightforward
	Communicative
	Dialogic and interactive
	Suitability to student development
	Conformity with Indonesian language rules
Media	Consistent use of terms, symbols and icons
	Book size
	Book Cover Design
	Book content design
Material	Material Substance
	Presentation
	Project based Learning Integration Design Thinking "Double Diamond" Process Model
	21st century competency development

Development is carried out with a focus on implementing these insights and refining the textbook design accordingly. Furthermore, the design phase is executed by adhering to established standards and evaluating the overall feasibility of the proposed materials to ensure they align with the required quality benchmarks and educational goals, as outlined in Table 2.

4.3. Initial Design Development Textbook

After providing the initial design textbook, the preparation of the instrument was carried out with the aim of collecting data on the feasibility and practicality of textbook carried out in stages develop (development). Stages develop (development) is carried out by repeatedly testing the validity of the product to product specifications, namely: suitability and practicality. Feasibility is tested on 3 (three) aspects, namely, language, media and material. Based on language feasibility tests by relevant experts and analyzed using Aiken's, the language feasibility of the product is presented in the Table 3.

Table 3. Product Qualification

Eligibility Aspects	V Indicator	Information
Language	0.87	Valid
Media	0.85	Valid
Material	0.86	Valid

The validation test results (feasibility) of the contents of the initial product design textbook show the value of the Aiken index (index V) for all aspects, language, media, and the material is greater than the provisions ($V \geq 0.61$). In the product development process, media and material aspects underwent several revisions before finally being declared feasible by the validator. Meanwhile, the language feasibility aspect goes through a feasibility test process and is declared feasible. This shows that the initial design of the product textbook was declared valid and suitable to be continued at the next research stage.

After the feasibility test, the researcher continued the development stage by conducting a practicality test by asking for an assessment of the practicality of the textbook (textbook) by lecturers and students. The results of the practicality test can be seen in the Table 4.

Table 4. Textbook Practicality Test

Aspect	Supporting Lecturer		Student	
	In Aspect	Information	In Aspect	Information
Language	0.73	Valid	0.73	Valid
Media	0.79	Valid	0.74	Valid
Material	0.78	Valid	0.78	Valid

The results of the practicality test data analysis in the table above show all aspects of practical textbooks (feasible/valid). The Aiken index value (index V) for all aspects shows a value greater than or equal to (≥ 0.61). In addition to the practical aspects in detail, the Aiken index value (index V) is averaged based on the results of the practicality test textbook by the teaching lecturer, which is 0.77 or valid.

This refers to the average value of the Aiken index (index V) for all aspects greater than or equal to (≥ 0.61). This conclusion shows that the textbook (textbook) that integrates project-based citizenship learning design thinking “double diamond” process model is practical for use in lectures according to students who have undergone MKWK Citizenship Education for one semester using textbooks (textbook).

4.4. Effectiveness Textbook based

The effectiveness test began by carrying out instrument validation tests with a sample size of 29 people. When referring to the formula for determining df (degree of freedom) and the number of respondents, then:

$$df = 29 - 2, \quad \text{so} \quad df = 27. \quad (1)$$

The validity test results show that the r table with a significance level of 0.05 is 0.367. After determining the critical value in the correlation table, the analysis results show the score of Pearson correlation (r_{count}) for each question item in the test instrument is greater ($>$) than the r table, namely: 0.367, where the correlation of question items can be said to be valid. Analysis of Pearson correlation (r_{count}) provides information that each item in the instrument has a fairly high positive contribution to the effectiveness to be measured. The validity test confirms the reliability of the instrument in the context of this research.

Next, a reliability test was carried out to measure the consistency of the research instrument when used repeatedly using the technique Cronbach's alpha. When the value of Cronbach's Coefficient Alpha is greater than 0.6, then the questionnaire as a measuring tool is considered reliable. If the value of Cronbach's Coefficient Alpha is smaller ($<$) than 0.6, then the questionnaire as a measuring tool is considered unreliable. The results of reliability testing show that the value of Cronbach's alpha is 0.966. So, all the questions in the research variables are reliable. The value of Cronbach's alpha, namely 0.966, indicates that the instrument used is very reliable.

Test effectiveness textbook based design thinking “double diamond” process model carried out on 193 students who were taking MKWK Citizenship Education, consisting of 6 (six) classes, from 5 (five) study programs, and spread across 3 (three) faculties. The effectiveness test is carried out by assessing abilities at the beginning of the semester (pretest) and at the end of the semester (posttest). The data from the assessment using test instruments was then analyzed. From the results of descriptive statistical analysis of pretest and posttest data, it can be seen that the average score from the pretest was 31.56 and the average score on the posttest was 34.34, which in detail can be seen Table 5.

Table 5. Descriptive Statistical Analysis

Group	N	Min	Max	Mean	Std. Deviation
Pretest	193	7	50	31.56	9.493
Posttest	193	10	50	34.34	8.365

Furthermore, to determine whether the samples taken from the population are normally distributed or not, it is necessary to carry out a normality test. Basen on Table 6, The normality test of data was conducted using the Kolmogorov-Smirnov technique, and the results show that both the pretest and posttest scores

are normally distributed. This conclusion was drawn because the p-value (significance value) > 0.05 . The significance values (p-values) for the pretest and posttest were 0.076 and 0.200, respectively.

Table 6. Normality Test Results

Group	Statistic	Sig.	Law	Information
Pretest	0.061	0.076	> 0.05	Normal
Posttest	0.045	0.200	> 0.05	Normal

Temporary data variations are declared homogeneous through homogeneity test results. The homogeneity test in this study used the Levene Statistics test method, with a significance value of 0.054 (sig. = 0.054 > 0.05), which means that the data variance in this study is homogeneous. The homogeneity results show that the data is accurate and unbiased, so the researcher has a strong basis for continuing further analysis with the paired t-test, which requires this assumption. This means that comparisons between groups can be made without worrying that the results will be biased due to differences in variance.

Textbook based design thinking “double diamond” process model appears to have high significance after the data was subjected to a paired T-Test using the Paired Samples T-Test method. This T-Test compares averages pretest and posttest of the same subject. The results of the Paired Samples T-Test are presented in the Table 7 below.

Table 7. Paired Samples T-Test Results

Group	Mean	Std. Deviation	Sig.
Pretest	31.56	9.493	0.000
Posttest	34.34	8.365	0.000

From the results of the paired samples t-test (paired t-test), the p-value is 0.000 (sig. = 0.000 < 0.05) indicating that there is a statistically significant difference between the averages of the pretest and posttest. In this case, the Paired Samples T-Test produces strong evidence that the average posttest score (34.34) is higher than the average pretest score (31.56). The results of this analysis show that there is a positive and significant increase (influence) after the intervention or treatment is carried out. Therefore, there are real changes and influences on student learning outcomes after the textbook based on the design thinking double diamond process model is implemented, which did not occur by chance or as the result of randomness.

5. MANAGERIAL IMPLICATION

Integrating design thinking-based project learning into textbooks provides strategic advantages for educational managers and curriculum developers aiming to cultivate edupreneurial mindsets among students. By embedding real-world problem-solving approaches directly into learning materials, institutions can enhance student engagement, creativity, and innovation skills, which are critical for entrepreneurial success. Managers should prioritize textbook development that aligns with contemporary industry needs and entrepreneurial challenges, ensuring that instructional content fosters autonomy, critical thinking, and experimentation. Additionally, teacher training programs must be redesigned to equip educators with facilitation techniques that support design thinking pedagogy. From a policy perspective, educational leaders must consider long-term investments in instructional innovation to create scalable and sustainable edupreneurial ecosystems within academic institutions.

6. CONCLUSION

Integration of design thinking in textbooks to optimize project-based learning for MKWK, Citizenship Education, is carried out by adopting the steps of the “double diamond” process model. The integration of project-based learning steps through design thinking in the textbook is accomplished by adding one (1) chapter (Chapter 10), which is strengthened by developing “civic practice” exercises for each chapter to train and prepare students to understand the design thinking process, particularly the “double diamond” process model, before carrying out a civics learning project.

The development of the textbook based on design thinking to optimize project-based learning is declared feasible after the language, media, and material aspects are declared valid because the V index value

(≥ 0.61). The textbook based on design thinking is considered practical by both lecturers and students, as the V index value is greater than or equal to 0.61. The textbook based on the design thinking “double diamond” process model appears to have high significance after the data was subjected to a paired t-test. This resulted in a significance value of 0.000 (sig. = 0.000 < 0.05), which means that there was a positive and significant increase (influence) after the intervention or treatment was carried out through the application of the textbook based on the design thinking double diamond process model, and it did not happen by chance.

7. DECLARATIONS

7.1. About Authors

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7.2. Author Contributions

Conceptualization: SY, AG, WL, FR and SB; Methodology: SY, AG and WL; Software: FR, AG and SB; Validation: SY, AG, WL; Formal Analysis: WL, FR and SB; Investigation: SY, AG and WL; Resources: SY, AG, and SB; Data Curation: AG, WL and SB; Writing Original Draft Preparation: SY; Writing Review and Editing: AG, WL, and FR; Visualization: SY, AG, WL, and FR; All authors, SY, AG, WL, FR and SB, have read and agreed to the published version of the manuscript.

7.3. Data Availability Statement

The datasets used to support the findings of this study are available from the direct link in the dataset citation.

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7.5. Declaration of Conflicting Interest

The authors declare that they have no conflicts of interest, known competing financial interests, or personal relationships that could have influenced the work reported in this paper.

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