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Development and Validation of Syllabus-Based Research Workbook for Teacher Education Students

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Abstract: This study examined the effectiveness of a syllabus-based research workbook in enhancing the research literacy of education students. Guided by the ADDIE instructional design framework, the workbook was systematically designed, expert-validated, and implemented using a mixed-methods approach. A total of 68 education students were assigned through statistical matching into an experimental group (n = 34) and a comparison group (n = 34). Research literacy was measured using a reliability-tested, Table of Specifications – based assessment administered during academic year 2024-2025. Results of the independent samples t-test revealed a statistically significant improvement in the research literacy of students exposed to the workbook compared with those in the comparison group, $t(80) = 4.847$, $p < .001$. Qualitative data analyzed through structural coding and thematic analysis supported the quantitative findings. Students perceived the workbook as a comprehensive and well-organized instructional resource that aligned with constructivist learning principles, scaffolded research tasks, and promoted active engagement. The findings underscore value of structured, hands-on instructional materials in strengthening research competencies in teacher education. The study concludes that syllabus-aligned instructional innovations can improve research literacy and recommends that teacher education institutions design and integrate similar resources to foster deeper research skills and enhance the quality of student research outputs.

Keywords: workbook; ADDIE framework; randomized pre-test-post-test control group; research education; teacher education institution

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1. Introduction

Teacher education institutions (TEIs) in the Philippines incorporate research subjects into their curriculum, providing students with the opportunity to engage in various research activities (CMO No. 74, Series of 2017). The research subject aims to provide prospective teachers with skills to conduct applied or action research that will provide empirical bases to improve teaching and learning. However, teaching research is sometimes inconsistent and limited across teacher education program (Darling-Hammond, 2000a) with several studies emphasizing the need for a structured and comprehensive instructional resource to gauge future teachers in acquiring essential research skills (Mills & Butroyd, 2004; Mertler, 2006).

The ability to carry out and evaluate research is an important skill for education students to prepare them for future professional responsibilities as educators. As professional teachers, they must be skilled in using the findings of research to inform teaching practices, strategies, address educational issues, and ultimately contribute to the ongoing conversation in the field of education in the Philippines and across the globe. Although the importance of research skills is highly recognized, there is an existing gap between the theoretical competence of the education students and the practical application of research in the real classroom context (Korthagen, 2010) and this gap can hinder the formation of prospective teachers who are expected to conduct researches, critically analyze and apply findings.

To address this gap, a competency-based resource such as research workbook can offer a structured guide and practical activities to develop research skills. The main objective of this study was to develop and validate a syllabus-based research workbook tailored specifically to the education students with the aim to provide comprehensive and practical learning resource

that guides students throughout the research process including gap identification, formulating research questions, and interpreting data.

Designing and validating the syllabus-based research workbook through field testing, feedback from instructional materials experts, research students and research educators, the researchers aimed to create an effective resource that enhances the research literacy and scaffold the professional development of future educators. The design and validation of the syllabus-based research workbook is in line with the Sustainable Development Goal (SDG) 4 on quality education in many ways: (1) to address inclusive and equitable education through accessible resource to enhance research literacy, (2) contribute to the goal of providing quality education through guided research process that develops essential research skills, (3) equip future teachers with critical thinking and problem-solving skills through practical exercises in the workbook, and (4) promote evidence-based practices by fostering a culture of innovation and inquiry in teaching profession.

Several related studies have provided insights towards the development and validation of syllabus-based research workbook for teacher education students. A study conducted by Evangelista et al. (2015) on the development and evaluation of a Biokit for high school showed the importance of developing instructional materials and resources aligned with the competencies and standards of the recommended curriculum.

This supports the present study's goal of guiding and supporting education students. The improvement in the science performance of students from the Biokit suggests that a well-crafted and developed workbook can enhance learning outcomes. In another study, Rubo (2005) and Gagarin (2003) developed and validated a contextualized modules and workbooks in science and technology aimed to facilitate classroom engagement and active learning among students. The focus on the contextual relevance and constructivist's approach supports the need for a research workbook that specifically caters to the education students' learning needs. A validated worktext in Chemistry 10 developed by Leonen (2016) highlights the significance of assessing effectiveness of instructional materials which is an essential step in designing a research workbook.

The objectives of the study were the following: (1) to design a comprehensive syllabus-based research workbook; (2) to determine the validity of the syllabus-based research workbook; (3) to assess the impact of the syllabus-based research workbook on research literacy. The latter one includes the following tasks: to assess the baseline level of research literacy of education students in the control group; to assess the baseline level of research literacy of education students in the experimental group; to examine the effect of the syllabus-based research workbook on students' research literacy by determining the presence of a statistically significant difference between the pretest and post-test scores of the control and experimental groups; to explore the perceptions and insights of teacher education students regarding the practical value of the syllabus-based research workbook in enhancing their research literacy.

2. Materials and Methods

The study utilized the ADDIE instructional design framework and the development of the syllabus-based research workbook was rooted in the priority agenda of the university where the researchers are presently affiliated. In the analysis phase, the researchers identified the existing knowledge gaps in relation to the level of research literacy of the of the education students. This phase had set the foundation for the design process. In the design phase, a detailed plan was developed, including the competencies indicated in the course syllabus, content outlines, practical activities, and instructional strategies. This phase involved the construction of the blueprint for the syllabus-based research workbook. In the development phase, the actual syllabus-based research workbook was developed based on the design specifications. This involved the actual content, practical tasks and other resources. In the implementation phase, the syllabus-based research workbook was implemented and executed during the first and second semester of the academic year 2024-2025. The last phase, evaluation phase, the effectiveness of the syllabus-based research workbook was assessed. This determined whether significant differences in research literacy existed before and after the utilization of the syllabus-based research workbook between the two groups. The design for this phase is detailed below:

R	O_1	x	O_2
R	O_3		O_4

where R stands for randomly assigned group via statistical matching, x is the receipt of the intervention, O_1 and O_3 are the pretest of the experimental group and control group respectively, O_3 and O_4 are the post-test of the experimental group and control groups respectively. The instruments used included the 50-item competency-based test constructed based on the Table of Specifications with reliability index of .842.

This test measured the pre-intervention and post-intervention research literacy of levels of the education students. The expert validators' instrument is a standardized evaluation tool prescribed by and adopted from the Office of the Director for Instruction of the affiliated university. The last instrument is a semi-structured interview guide validated through field testing. For quantitative data analysis, mean and standard deviation were used to determine the level of research literacy of two groups before and after the intervention, a paired sample test was used to determine differences between the pretest and post-test level of research literacy before and after intervention within groups, independent sample test was used to determine the differences between the pretest and post-test level of research literacy before and after intervention between groups.

The participants of this study included three distinct groups that ensured a comprehensive evaluation of the syllabus-based research workbook's effectiveness and applicability. The first group was composed of 68 education students enrolled during the academic year 2024-2025 under the course Research in Teaching 1. These students were provided with informed consent before their participation. These students were assigned into two groups, the control (n =34) and experimental (n =34) groups through statistical matching. A pretest was conducted to determine their initial level of research literacy which served as the baseline data for evaluating the effectiveness of the syllabus-based research workbook.

The second cohort was composed of five (5) content validators who were experts in the field of instructional materials development. Two (2) were internal experts who currently teach in the professional subjects in the TEI where the re-searchers are affiliated, and the three (3) were external experts from other TEI and Department of Education.

The expert validators were tasked to assess the syllabus-based research workbook using the affiliated university standard for instructional materials development, ensuring its adequacy, coherence, appropriateness, and overall usefulness as a tool for teaching research. The third group comprised forty (40) students who were also taking the same course during the first semester of the same academic year. They utilized the workbook for five (5) months and directly engaged in its practical activities. Their role was to experience the workbook's practical value in enhancing their research literacy. Involving three (3) distinct cohorts with diverse perspectives, the study ensured a multidimensional and rigorous assessment and validation of the syllabus-based research workbook, strengthening its potential to improve the research literacy of prospective teachers.

This study employed a developmental and evaluative research design anchored on the ADDIE instructional design framework. The framework ensured a systematic, iterative, and learner-centered approach to the development and implementation of the syllabus-based research workbook.

The workbook was specifically developed for education students enrolled in the Research in Teaching course. Its content and activities were deliberately aligned with the course competencies to ensure curricular relevance and instructional coherence.

The syllabus-based research workbook underwent a rigorous expert validation process following the standard instructional materials development protocol established by the researchers' affiliated university. Validation focused on content alignment, instructional clarity, and pedagogical appropriateness.

To ensure intellectual protection and proper attribution, the developed workbook was copyrighted and formally deposited at the National Library in compliance with the policies of the university's Intellectual Property and Management Office. This process safeguarded the originality and ethical use of the instructional material. Descriptive and inferential statistics were utilized in the quantitative data while structural coding was used in the qualitative data.

3. Results

3.1. Determination of the validity of the syllabus-based research workbook

Establishing the validity of instructional materials is essential to ensure their alignment with curricular standards and pedagogical objectives. Prior to implementation, the syllabus-based research workbook underwent expert validation to determine its level of acceptability as a learning resource for the Research in Teaching course. A standardized evaluation tool

adopted from the Iloilo Science and Technology University Office of the Director of Instruction was used to ensure rigor and consistency in the assessment process. Both internal and external experts evaluated the workbook across key domains, including adequacy, coherence, appropriateness, and usefulness. Table 1 presents the results of the expert validation, reflecting the overall validity of the syllabus-based research workbook.

Table 1. Validity level of the syllabus-based research workbook.

Expert validators	Overall rating	Description/Interpretation
Internal Validator 1	4.0	Very acceptable
Internal Validator 2	4.0	Very acceptable
External Validator 3	4.0	Very acceptable
External Validator 4	4.0	Very acceptable
External Validator 5	4.0	Very acceptable
Overall rating	4.0	Very acceptable

Note[1]: 4 - Very acceptable, 3 -Acceptable, 2 - Fairly acceptable, 1 - Not acceptable
Note[2]: Adopted from the Iloilo Science and Technology University Office of the Director of Instruction

Table 1 shows the level of acceptability of the syllabus-based research workbook based on the expert validators' standardized evaluation tool. Based on the evaluation result, the syllabus-based research workbook received an overall rating of 4.0, indicating a high level of acceptability across all essential domains. This implies that the syllabus-based research workbook has effectively met the university's expected standards in terms of adequacy, coherence, appropriateness, and usefulness.

3.2. Assessment of the impact of the workbook on research literacy

This section presents the level of research literacy of education students in the control and experimental groups before and after the intervention. Descriptive statistics were used to examine changes in mean scores, variability, and standard error following conventional instruction and intervention. Table 2-5 summarize the pre-test and post-test research literacy scores of the control and experimental groups and the differences in the test scores. The results provide an indication of baseline and endline learning gains achieved with and without exposure to the syllabus-based research workbook.

Table 2 shows the level of research literacy of the control group. Results show an increase in the mean score (M = 19.4412 to 22.4118) of the control group (n = 34), suggesting an improvement in the level of research literacy, with a small reduction in score variability after conventional teaching (SD = 4.29 to 4.03). The standard error of the mean (pre-test = .73515 and post-test = .69132) suggest that the sample means are relatively stable estimates of the population means.

Table 2. Level of research literacy of the control group.

Control	Mean	n	SD	Std. error mean
Pre-test	19.4412	34	4.28663	.73515
Post-test	22.4118	34	4.03107	.69132

Table 3 shows the level of research literacy of the experimental group. Results show an increase in the mean score (M = 20.4375 to 26.6667) of the experimental group (n = 34), suggesting an improvement in the level of research literacy, with a small reduction in score variability after the intervention (SD = 4.48 to 3.83). The standard error of the mean (pre-test = .64612 and post-test = .55331) suggest that the sample means are reliable estimates of the population means.

Table 3. Level of research literacy of the experimental group.

Exp.	Mean	n	SD	Std. error mean
Pre-test	20.4375	34	4.4765	.64612
Post-test	26.6667	34	3.83341	.55331

Table 4 shows the paired sample test results for the pre-test and post-test of the control and experimental groups. In the control group, result indicates a significant difference between the pre-test and post-test scores with mean difference of -2.97 (t =-3.087 (33), p =

.004, < 0.05), implying a statistically significant improvement. This suggests that the post-test score is higher on average. The 95% confidence interval does not include zero, further confirming that the increase in scores is unlikely due to the random chance (-4.93 to -1.01) while the effect size of -0.529 suggests a moderate effect of conventional teaching on the research literacy of the control group. In the experimental group, the mean difference of -6.23 shows that the post-test score is higher on average. The t value is -7.878 (df = 47) and p-value = .000 < 0.05, indicating a statistically significant improvement. The 95% confidence interval does not include zero, further confirming that the increase in scores in unlikely due to the random chance (-7.82 to -4.64) while the effect size of -1.137 suggests a substantial improvement in the research literacy of the experimental group. This implies that the syllabus-based research workbook had a meaningful effect on the research literacy of the pre-service education students.

Table 4. Paired sample test result.

Control	***t***	***df***	***p***	**Effect size**
Pre-test Post-test	-3.087	33	.004	-.529
Experimental	***t***	***df***	***p***	**Effect size**
Pre-test Post-test	-7.878	47	.000	-1.137

Table 5 shows the independent sample test results for the pre-test and post-test scores of the control and experimental groups. Result indicates that there is no significant difference between the pre-test scores of the control and the experimental groups, t (80) = 1.010, p = .315 > 0.05. The mean difference of 0.996 which falls within 95% confidence interval (-0.97 to 2.96), including zero, further confirms that the significant difference does not exist. This means that the control and experimental groups started with a statistically comparable baseline scores in research literacy. This implies that the improvement observed in the post-test scores are likely due to the syllabus-based research workbook rather than the initial differences between the control and experimental groups.

Table 5. Independent sample test result.

Pre-test	***t***	***df***	***p***
Control Experimental	1.010	80	.315
Note[1]*:* Equal variance assumed (F =.301, p =.585)			
Note[2]*:* Equal variance assumed (F =.275, p =.602)			
Post-test	***t***	***df***	***p***
Control Experimental	4.847	80	.000

In the post-test, result indicates that there is a statistically significant difference between the post-intervention scores of the control and the experimental groups, t (80) = 4.847, p = .000 < 0.05 and a mean difference of 4.25 which falls within 95% confidence interval (2.51 to 6.00), excluding zero, further confirming that the significant difference exists. This implies that the experimental group performed significantly better than the control group in the post-intervention measure, indicating that the syllabus-based research workbook provided a meaningful effect on the research literacy of pre-service education students.

3.3. Insights of the teacher education students gained regarding the practical value of the research workbook in enhancing their research literacy

This section presents the insights of teacher education students regarding the practical value of the syllabus-based research workbook in enhancing their research literacy. Qualitative data were analyzed using structural coding to identify recurring patterns and meanings in students' responses. The analysis focused on how the workbook supported learning processes, research understanding, and skill development. Table 6 summarizes the resulting structural codes, categories, and emergent themes. These themes provide deeper explanations of how the workbook functioned as a learning support and a constructivist instructional tool.

Table 6. Structural codes and themes.

No	Structural codes	Categories	Themes
1.	Structural guide	Learning support and resource	Workbook as comprehensive and learning support for enhanced understanding
2.	Practical exercises		
3.	Invaluable resources		
4.	Integration of examples		
5.	Facilitating immediate feedback		
1.	Demystification of research	Enhanced understanding and application	
2.	Benefits in understanding		
3.	Reinforcement		
4.	Deepening comprehensions		
5.	Expansions of understanding		
1.	Active learning	Active learning and skills development	Workbook as support to constructivist pedagogy
2.	Aid in development		
3.	Guide through stages		
4.	Facilitating active roles		
1.	Sharpening critical thinking skills	Critical thinking and competence	
2.	Enhancing competence		
3.	Application of theoretical concepts		

3.3.1. Workbook as Comprehensive and Learning Support for Enhanced Understanding

The syllabus-based research workbook has provided a clear and organized framework for learning the research process, assisting education students in understanding every stage of research. Students engaged in the hands-on activities that reinforced theoretical concepts, facilitating a deeper comprehension of research methodologies. Students experienced the workbook as an essential learning resource that offers guidance, clarity and practical activities for doing research projects. Real-life examples integrated into the workbook helped students contextualize theoretical concepts, improving their understanding of the principles of research methodology. The immediate feedback on the exercises allows students to gauge their comprehension and progress, contributing to their enhanced understanding. Creswell (2014), Saunders et al. (2019), and Bryman (2016) emphasized the importance of providing a structured guidance and resource in learning research among students. This aligns with the findings of this study where the workbook developed has served as a structured guide and offering valuable support to students as they journey in the research process. The following represents the overall perception of the students regarding the workbook as a comprehensive and learning support for enhanced understanding:

"The workbook is a guide that led us through each stage for successful conduct of research. It has exercises that provided us hands-on practice that made us understood the concepts better. The feedback allowed us to reflect on our understanding of the research principles" (Student 1)

Through this workbook, the research process has been broken down into manageable steps, making them understandable and accessible to students. They recognized the workbook as highly beneficial for understanding research methodology, indicating its effectiveness in clarifying conceptual understanding of the research process. Practical activities and examples in the workbook reinforced the students' understanding of the key concepts. Students reported that the learning material deepen their understanding especially on the areas of formulating the research questions and data analysis. The value of practical exercises reinforced theoretical concepts (Neuman, 2014; Cohen et al., 2017; Silverman, 2000), which correlates with the positive effect of this workbook in students' understanding of research methodologies.

"The workbook provided us with step-by-step process, simplifying the complexities of research methodology. It is important self-assessment tool for independent work. It is highly beneficial for our understanding of the research process and expanded our understanding on some challenging areas of research such as identifying researchable topics, writing the research questions, and analysis of the data" (Student 2)

This theme supports the findings of the study showing significant difference in the research literacy of the education students between the control and experimental groups, with post-test scores significantly higher in the experimental group, suggesting that the workbook provided a comprehensive learning support to students to enhance their understanding of the research process.

3.3.2. Workbook as Support to Constructivist Pedagogy

Education students have engaged in active learning through practical exercises and tasks, helping them retain information better and developed their confidence in conducting research projects. This provided them with skills and proficiency in research methodology and contributed to their competence in the course. They were guided in every step of the way with pragmatic-based tasks, giving them active role in the learning process. This, way, they were empowered to take ownership of their research activity. McMillan and Schumacher (2018), Fraenkel et al. (2019), and Gall et al. (2007) emphasize the role of active learning and skill development in research, underscoring the importance of engaging students in practical activities. This supports the finding that the workbook facilitated active learning and aids in the development of research literacy.

"We are engaged in active learning through practical activities given after every lecture. It guided us through stages of the research process. Since we are guided through different stages, it helped us developed essential skills and proficiency in research methodology" (Student 3)

The workbook has helped sharpen their critical thinking skills, enabling them to analyze the research process effectively. It has enhanced the students' competence in doing research by providing practical tools, guidance, and opportunities for development of essential research skills. Students are able to apply theoretical concepts learned from the workbook in a hands-on manner, enhancing their understanding and application of the principles of research. Cultivating critical thinking skills is important enhancing competence in the conduct of rigorous and meaningful research (Lincoln & Guba, 2018; Kothari, 2008; Patton, 2014). This supports the findings of this research the workbook helped sharpen the critical thinking skills and enhanced the students' competence in conducting research.

"The workbook served as a resource in sharpening our critical thinking skills and development of a systematic approach to research. The practical activities allowed our application of theory in real life context, and we believed it enhanced our learning experience" (Student 4)

These findings show significant difference in the research literacy of the education students between the control and experimental groups, with post-test scores significantly higher in the experimental group, suggesting that the workbook served as a support to the constructivist pedagogy as an effective approach to teaching research among education students.

4. Discussion

The findings of this study underscore the significant effect of structured instructional materials, specifically a syllabus-based research workbook, in enhancing research literacy among pre-service teachers in a TEI. Quantitative results indicated a statistically significant improvement in the post-test scores of students in the experimental group compared to the control group, highlighting the effectiveness of the workbook as a pedagogical intervention in research education. These results provide empirical support for the view that teacher education programs should adopt more structured and consistent approaches to re-search training to ensure that pre-service teachers acquire the essential competencies necessary for conducting, interpreting, and applying research (Darling-Hammond, 2000b).

Existing literature emphasizes the pedagogical value of workbooks in facilitating active and guided learning, particularly in complex domains such as research education. Workbooks offer scaffolded instruction, structured exercises, and opportunities for self-paced learning, which help demystify research processes and make abstract concepts more accessible (Mertler, 2006). Prior studies have demonstrated that well-designed workbooks increase students' engagement, comprehension, and practical application of research skills by providing stepwise guidance, illustrative examples, and iterative practice opportunities (Hutchinson & Torres, 1994; Hyland, 2006). The present study's findings align with this evidence, showing that students who utilized the syllabus-based research workbook developed not only greater knowledge of research concepts but also improved confidence and competence in conducting research tasks.

Furthermore, the qualitative insights gathered through structural coding revealed that students perceived the workbook as a comprehensive learning support tool. The workbook facilitated active learning, strengthened critical thinking, and reinforced the application of theoretical concepts in practical research scenarios. These findings suggest that the workbook functioned not merely as a repository of exercises, but as a constructivist pedagogical scaffold that actively engaged students in the learning process, allowing them to internalize research principles and progressively build competencies. This addresses a persistent gap noted in

previous studies regarding the lack of accessible, structured, and contextually relevant instructional resources for teacher candidates (Mills & Butroyd, 2004).

Given that research literacy constitutes a foundational skill for educators (Dewey, 1933; Shulman, 1986), integrating structured workbooks into teacher education curricula can provide an organized framework for developing research capabilities. Such materials enable students to navigate research processes systematically, rein-force conceptual understanding, and engage in iterative practice, thereby supporting evidence-based teaching and lifelong learning.

In light of these findings, teacher education pro-grams are encouraged to adopt workbook-based interventions as part of their research courses. Beyond enhancing research literacy, these interventions can promote independent learning, scaffold skill development, and ultimately contribute to the preparation of teacher candidates capable of conducting high-quality research and applying evidence in educational practice. This study demonstrates that syllabus-based workbooks represent an effective instructional strategy that bridges theoretical knowledge and practical application, fostering both competence and confidence in pre-service teachers' research abilities.

Future research could explore the adaptation of such workbooks across different contexts and disciplines to examine their broader impact on teacher preparation and professional practice.

5. Conclusions

This study developed and validated a syllabus-based research workbook and examined its effect on the research literacy of education students. The workbook was designed following the ADDIE framework, ensuring a systematic, learner-centered, and competency-aligned approach, and it underwent rigorous expert validation to confirm its adequacy, coherence, and pedagogical relevance. Quantitative results demonstrated a significant improvement in the research literacy of students who used the workbook compared to those in the control group, indicating that structured, hands-on instructional materials can effectively enhance students' understanding, application, and confidence in research. The findings also revealed a reduction in score variability, suggesting that the workbook supported more consistent learning outcomes across the experimental group. Qualitative insights further highlighted the practical value of the workbook. Students perceived it as a comprehensive learning resource that facilitated active engagement, scaffolded research tasks, reinforced theoretical concepts, and promoted critical thinking. These perceptions suggest that the workbook functioned not only as a guide but also as a constructivist pedagogical tool, supporting independent learning while ensuring alignment with course objectives. The study's outcomes have important implications for TEIs. First, the positive effect of the workbook on research literacy underscores the need for TEI educators to integrate structured, innovative instructional resources into research courses. Such interventions can scaffold research skill development, foster higher-order thinking, and promote evidence-based practice among pre-service teachers. Second, the study highlights the value of combining quantitative assessment with qualitative feedback to ensure that instructional materials meet both academic standards and learner needs. In conclusion, the findings support the adoption of syllabus-based workbooks as a strategy to enhance research competence, improve learning outcomes, and prepare pre-service teachers to produce meaningful, high-quality research outputs.

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