

Enhancing Problem-Solving Skills and Self-Regulated Learning Through Guided Project-Based Learning Student Worksheets in Learning Resources Management

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ABSTRACT

Enhance university students' problem-solving skills and self-regulated learning in the Learning Resources Management course. This study employed a Research and Development design using the Borg and Gall model, which was adapted to the instructional product development context. The subjects were 82 sixth-semester students of the Educational Technology Study Program at Universitas Palangka Raya. The implementation results showed that students' problem-solving skills increased from 60.51 to 82.18, with an N-Gain score of 0.55. Students' self-regulated learning increased from 60.45 to 87.20, with an N-Gain score of 0.68. The Wilcoxon test showed significant differences between pretest and posttest scores for both variables, with $p < 0.001$. These findings indicate that Guided Project-Based Learning Student Worksheets are feasible and effective for supporting project-based learning in the Learning Resources Management course.

INTRODUCTION

Higher education in the digital era requires learning systems that develop not only conceptual knowledge but also students' capacity to solve complex problems, regulate their learning, and produce relevant academic products. In educational technology programs, these competencies are particularly important because students must be able to plan, develop, manage, and evaluate learning resources across diverse institutional and technology-supported contexts (Ghanbaripour et al., 2024; Guo et al., 2020; Zhang & Ma, 2023).

The Learning Resources Management course prepares educational technology students to analyze institutional needs and design systems for managing learning resources in schools, libraries, training centers, community learning centers, and other educational organizations. However, preliminary observations indicated that learning activities still emphasized theoretical explanations and general assignments. Students frequently experienced difficulty identifying authentic institutional problems, analyzing needs, organizing project tasks, monitoring progress, and evaluating the feasibility of their proposed solutions.

Problem-solving skills and self-regulated learning are central to this course. Problem-solving requires students to identify problems, examine relevant evidence, formulate alternative solutions, make decisions, and evaluate results (Abtokhi et al., 2021; Hmelo-Silver, 2004). Self-regulated learning enables students to set goals, plan strategies, manage time, monitor performance, seek assistance, and reflect on learning outcomes (Panadero, 2017; Zimmerman, 2002). Both competencies are essential when students complete extended and authentic projects.

Project-Based Learning can connect theoretical knowledge with authentic investigation and product development. Nevertheless, broad project assignments without adequate guidance may create uncertainty and uneven participation. Guided Project-Based Learning addresses this problem by combining authentic projects with structured scaffolding, including project scenarios, guiding questions, planning sheets, progress-monitoring tools, feedback, and reflection activities (Markula & Aksela, 2022; Stefanou et al., 2013; Wijnia et al., 2024). Student worksheets can organize these supports into a systematic sequence of learning activities.

Previous studies have demonstrated the value of project-based learning for active engagement, higher-order thinking, motivation, and applied learning (Guo et al., 2020; Qasem, 2025; Zhang & Ma, 2023). Research on self-regulated learning has also emphasized the importance of planning, monitoring, and reflection in complex learning environments (Panadero, 2017; Schunk & Greene, 2018). However, limited research has integrated Guided Project-Based Learning stages, explicit problem-solving indicators, and self-regulated learning components within student worksheets for a Learning Resources Management course in higher education.

Accordingly, this study aimed to develop Guided Project-Based Learning Student Worksheets and examine their feasibility and preliminary effectiveness in enhancing students' problem-solving skills and self-regulated learning. The

study contributes an instructional product that guides students through a six-meeting project, from problem orientation and needs analysis to product presentation, evaluation, and revision.

THEORETICAL REVIEW

Guided Project-Based Learning and Student Worksheets

Project-Based Learning positions students as active participants who investigate authentic problems and produce meaningful products. Evidence from reviews and meta-analyses indicates that project-based learning can strengthen cognitive achievement, engagement, collaboration, and the application of knowledge when projects are aligned with clear learning objectives and assessment criteria (Bell, 2010; Guo et al., 2020; Wijnia et al., 2024; Zhang & Ma, 2023). Its effectiveness, however, depends on the quality of task design, instructional support, and opportunities for feedback.

Guided Project-Based Learning retains student responsibility for investigation and product development while providing structured support across the project cycle. The guidance may include authentic problem scenarios, guiding questions, project-planning formats, monitoring tools, feedback sessions, evaluation rubrics, and reflection prompts. These supports reduce procedural uncertainty without removing students' autonomy. In this study, the Student Worksheets functioned as instructional scaffolds that translated the six Guided Project-Based Learning stages into observable and manageable learning activities.

Problem-Solving Skills

Problem-solving skills involve identifying a problem, analyzing relevant information and constraints, generating possible solutions, selecting an appropriate course of action, and evaluating the outcome. Authentic problem contexts can help students connect conceptual knowledge with evidence-based decision making (Abtokhi et al., 2021; Hmelo-Silver, 2004). In educational technology, these skills are required when students diagnose institutional needs and design feasible systems for managing learning resources.

Project-based activities do not automatically produce systematic problem solving. Students may focus on completing a product without adequately defining the problem or evaluating alternative solutions. Therefore, explicit scaffolding is necessary. The developed worksheets supported problem solving through project scenarios, observation and interview sheets, needs-analysis matrices, priority-setting activities, design alternatives, and feasibility evaluation. These components made the problem-solving process explicit throughout the project.

Self-Regulated Learning

Self-regulated learning refers to learners' active control of goals, strategies, motivation, behavior, and evaluation. Zimmerman (2002) conceptualized self-regulated learning as a cyclical process involving forethought, performance, and self-reflection. Panadero (2017) similarly showed that planning, monitoring,

strategy use, and reflection are central across major self-regulated learning models. These processes are particularly relevant to extended projects because students must organize tasks, manage time, respond to feedback, and evaluate their progress.

Project-based learning can provide opportunities for autonomy, but autonomy without structure may lead to procrastination, unclear task distribution, and dependence on lecturer direction. Structured worksheets can externalize regulatory processes by requiring students to formulate goals, assign responsibilities, establish schedules, record obstacles, monitor milestones, revise products, and reflect on learning strategies. In this study, project-planning sheets, monitoring forms, revision sheets, and reflection prompts were designed to support these regulatory activities (Schunk & Greene, 2018; Stefanou et al., 2013).

Synthesis, Research Gap, and Conceptual Relationship

The previous literature indicates that project-based learning supports authentic and applied learning, while self-regulated learning enables students to manage the cognitive, behavioral, and motivational demands of extended projects. The literature also suggests that scaffolding connects these two processes by organizing problem analysis, project planning, progress monitoring, feedback use, and reflection. Thus, the effectiveness of Guided Project-Based Learning is expected to depend not only on the authenticity of the project but also on the systematic guidance available during each project stage.

The present study addresses a specific gap by integrating Guided Project-Based Learning stages, problem-solving indicators, and self-regulated learning components within a single set of Student Worksheets for the Learning Resources Management course. The conceptual relationship proposed in this study is that structured worksheet guidance supports students' engagement in authentic project tasks, which in turn provides repeated opportunities to practice problem solving and regulate learning. This integration constitutes the principal novelty and practical contribution of the developed product.

METHODOLOGY

Research Design and Setting

This study employed a Research and Development design using an adapted Borg and Gall model (Borg & Gall, 1983; Gall et al., 2003). The study aimed to develop Guided Project-Based Learning Student Worksheets and examine their feasibility and preliminary effectiveness in a real classroom context. The research was conducted during the second semester of 2025 in the Educational Technology Study Program, Faculty of Teacher Training and Education, Universitas Palangka Raya.

The product was designed for the Learning Resources Management course, a three-credit course that focuses on the application of concepts, principles, and procedures for managing learning resources in schools, educational institutions, and other learning organizations.

Participants and Sampling

The population consisted of 82 sixth-semester students enrolled in the Learning Resources Management course. All 82 students participated in the needs-analysis questionnaire and field implementation. Therefore, the study employed saturated sampling, also referred to as census sampling, because the entire accessible population was included.

Five students were selected through purposive sampling for individual interviews during the needs-analysis stage. Selection considered variation in academic achievement, including high, moderate, and low performance, as well as specific difficulties previously experienced in completing project-based assignments. The interviews were conducted face-to-face, and each interview lasted approximately 15 minutes.

Development Procedure

The development procedure consisted of seven adapted stages. The first stage was research and information collecting, which included curriculum analysis, analysis of course learning outcomes, observation of the learning process, administration of a needs-analysis questionnaire to all 82 students, and interviews with five purposively selected students. The second stage was planning, which involved formulating learning objectives, project tasks, worksheet components, problem-solving indicators, and self-regulated learning indicators. The third stage was preliminary product development, which produced the first draft of the Guided Project-Based Learning Student Worksheets.

The fourth stage was expert validation by one material expert, one instructional design expert, and one media expert. The fifth stage was product revision based on the experts' quantitative assessments and qualitative recommendations. The sixth stage was field implementation involving all 82 students. The seventh stage was final product revision based on the validation and implementation results.

Expert Validators

Three expert validators were involved, with one expert representing each field. The material expert held a doctoral degree in Educational Technology, specialized in Learning Resources Management, and had more than 15 years of teaching and research experience. The instructional design expert held a doctoral degree in Educational Technology and had expertise in instructional development models and Project-Based Learning strategies. The media expert held a master's degree in Visual Communication Design and had expertise in graphic design, layout, and the development of printed and digital instructional materials. Each validator independently assessed the product and provided written recommendations before field implementation.

Product Design and Research Instruments

The worksheets were designed for six meetings. The final project required students to design learning resources for an institution, such as a school, library,

course center, community learning center, training institution, learning community, or learning unit within an organization. The project product consisted of an institutional profile and needs analysis, a vision and mission for learning resources, a learning resource design, and a management system.

The Guided Project-Based Learning syntax included six stages: problem and project orientation, project planning, investigation and needs analysis, design development, monitoring and revision, and product presentation and evaluation. Each stage was supported by guiding questions, project-planning sheets, data-collection formats, monitoring forms, reflection prompts, and evaluation rubrics.

Data were collected using a needs-analysis questionnaire, an interview guide, expert validation sheets, problem-solving skills tests, and a self-regulated learning questionnaire. The material validation sheet consisted of 10 statements covering alignment with course learning outcomes, conformity with the Guided Project-Based Learning syntax, and material quality. The instructional design validation sheet consisted of 10 statements covering the systematic learning sequence, conformity with the learning syntax, and active student engagement. The media validation sheet consisted of 15 statements covering graphic feasibility and layout. The validation responses were recorded on a four-point scale and converted into weighted component scores and percentages.

Problem-solving skills were measured using five essay questions based on authentic cases in learning resource management. Each question was scored from 0 to 4 using an analytical rubric addressing problem identification, needs analysis, solution design, and solution evaluation. The maximum raw score was 20. Self-regulated learning was measured using a 20-item questionnaire covering planning, progress monitoring, and self-evaluation.

The expert validation sheets used a four-point scale: 1 = very poor, 2 = poor, 3 = good, and 4 = very good. The self-regulated learning questionnaire used a four-point Likert scale: 1 = strongly disagree, 2 = disagree, 3 = agree, and 4 = strongly agree. The four-point scale was selected to minimize neutral responses and encourage a clear response tendency.

Data Collection Procedures

Data collection was conducted sequentially according to the development stages. During the needs analysis, all 82 students completed a questionnaire concerning their experiences, difficulties, and learning needs in project-based assignments. The questionnaire findings were used to identify the need for structured project guidance, planning tools, monitoring forms, and reflection activities.

Face-to-face interviews were subsequently conducted with five purposively selected students. Each interview lasted approximately 15 minutes and explored difficulties in initiating projects, identifying institutional problems, dividing group responsibilities, managing time, monitoring progress, and evaluating the quality of project outcomes.

The preliminary worksheets were independently evaluated by the three expert validators. Each expert completed the relevant validation sheet and

provided qualitative suggestions. The product was revised on the basis of these assessments before field implementation.

At the beginning of the first meeting, before project orientation and before students used the worksheets, each student individually completed the problem-solving pretest and self-regulated learning pretest. The problem-solving test required approximately 45-60 minutes, while the self-regulated learning questionnaire required approximately 15-20 minutes.

The intervention was conducted over six meetings, with each meeting consisting of three 50-minute instructional periods. Students completed the main project collaboratively in groups, whereas all pretest and posttest instruments were completed individually. Individual administration ensured that the measured scores represented each student's problem-solving skills and self-regulated learning rather than group performance. During implementation, the lecturer clarified project requirements, monitored progress, and provided feedback while students retained responsibility for planning, investigation, product development, and revision.

The posttest was administered individually at the end of the sixth meeting after students had completed all Guided Project-Based Learning stages, presented their final products, received feedback, and revised their projects. The posttest used procedures and time allocations comparable to those of the pretest.

Scoring and Data Analysis

Scores from the expert validation sheets and self-regulated learning questionnaire were converted into percentages by dividing the obtained score by the maximum possible score and multiplying the result by 100. Worksheet feasibility was categorized as very feasible at 85.01%-100.00%, feasible at 70.01%-85.00%, fairly feasible at 50.01%-70.00%, and less feasible at 20.00%-50.00%. Instrument-validation scores were categorized as invalid at 25.00%-<43.75%, less valid at 43.75%-<62.50%, valid at 62.50%-<81.25%, and very valid at 81.25%-100.00%.

Problem-solving responses were scored from 0 to 4 for each of the five essay questions. The raw scores were summed and converted to a 0-100 scale by dividing the obtained score by the maximum raw score of 20 and multiplying by 100. Improvement was calculated using the normalized gain formula, $g = (\text{posttest score} - \text{pretest score}) / (\text{maximum score} - \text{pretest score})$. N-Gain values were categorized as high when $g \geq 0.70$, moderate when $0.30 \leq g < 0.70$, and low when $g < 0.30$.

The data were analyzed using descriptive statistics, including the mean, standard deviation, minimum score, and maximum score. The Kolmogorov-Smirnov test was used to examine normality. Because the data were not normally distributed, the Wilcoxon Signed-Rank Test was used to examine pretest-posttest differences. Statistical significance was determined at $p < 0.05$. Statistical reliability testing was not conducted; this issue is acknowledged as a limitation of the study.

RESULTS

The development process began with a needs analysis involving all 82 students and face-to-face interviews with five purposively selected students. The results showed a consistent need for structured worksheets that could guide authentic project work. Students reported difficulty identifying real institutional problems, analyzing learning-resource needs, organizing group responsibilities, setting weekly targets, monitoring progress, and evaluating product quality. The interviews also indicated that previous worksheets were generally limited to theoretical summaries and low-level questions, while project assignments were communicated through broad instructions without sufficient procedural guidance.

Table 1. Summary of Needs Analysis for Student Worksheet Development

Aspect	Initial Problems	Development Implications
Learning approach	Learning activities still emphasized theory and general assignments	Worksheets should support guided project-based activities
Problem-solving skills	Students had difficulty identifying and analyzing real institutional problems	Worksheets should include problem scenarios, guiding questions, and problem-analysis tables
Self-regulated learning	Students struggled to plan, monitor, and evaluate long-term projects	Worksheets should include planning sheets, monitoring forms, and reflection prompts
Existing worksheets	Worksheets were mostly theoretical and did not guide project completion	Worksheets should function as project scaffolds
Learning resources management task	Students lacked a clear framework for designing learning resources	Worksheets should guide students from needs analysis to final product evaluation

The design of the worksheets was developed based on the results of the needs analysis. The product consisted of six meeting-based worksheets. Each worksheet guided students through a specific project stage, beginning with project orientation and ending with product presentation, evaluation, and revision.

Table 2. Structure of Guided Project-Based Learning Student Worksheets

Meeting	Focus of Activity	Intermediate Product
1	Project orientation and institutional context analysis	Institutional identity, initial problem map, and project plan
2	Needs analysis of learning resources	Needs matrix and problem priority

Meeting Focus of Activity		Intermediate Product
3	Formulation of vision, mission, goals, and basic values	Draft of vision, mission, goals, and service values
4	Design of learning resources	Spatial or digital design, services, media, technology, and service flow
5	Management of learning resources	Management structure, operating procedures, maintenance plan, and evaluation plan
6	Presentation, evaluation, and final product revision	Final document of learning resource design

The worksheet components were arranged to support problem-solving and self-regulated learning. Problem-solving was facilitated through activities such as identifying problems, analyzing needs, determining priorities, generating design alternatives, and evaluating feasibility. Self-regulated learning was facilitated through goal setting, project planning, time management, progress monitoring, feedback use, self-assessment, and reflection.

Table 3. Components of the Developed Student Worksheets

Component	Function	Targeted Competency
Project scenario	Provides authentic institutional problems	Problem identification
Guiding questions	Directs students to analyze issues systematically	Problem analysis
Observation and interview sheets	Guides data collection	Evidence-based reasoning
Needs analysis matrix	Helps students identify gaps and priorities	Problem-solving
Project planning sheet	Guides goals, tasks, and schedules	Learning planning
Monitoring sheet	Helps students check progress and obstacles	Self-monitoring
Product revision sheet	Guides improvement based on feedback	Evaluation and revision
Reflection sheet	Supports self-assessment and learning reflection	Self-regulated learning
Final project format	Guides the structure of the final product	Project completion

The first validation was conducted by a material expert. The results showed that all aspects were categorized as very good. The overall score was 92.85%, indicating that the worksheets were highly feasible in terms of content.

Table 4. Material Expert Validation Results

Component	Maximum Score	Obtained Score	Percentage	Category
Alignment with course learning outcomes	15	15	100.00%	Very Good
Alignment with Guided Project-Based Learning syntax	30	27	90.00%	Very Good
Worksheet content quality	35	32	91.43%	Very Good
Display and language feasibility	20	18	90.00%	Very Good
Overall score	100	92.85	92.85%	Very Good

The second validation was conducted by an instructional design expert. The results also showed that the worksheets were very good. The overall validation score was 90.00%.

Table 5. Instructional Design Expert Validation Results

Component	Maximum Score	Obtained Score	Percentage	Category
Alignment with course learning outcomes	15	15	100.00%	Very Good
Alignment with Guided Project-Based Learning syntax	30	26	86.67%	Very Good
Worksheet content quality	35	31	88.57%	Very Good
Display and language feasibility	20	18	90.00%	Very Good
Overall score	100	90	90.00%	Very Good

The media expert validation assessed graphic feasibility and product development. The overall score was 92.50%, indicating that the worksheets were very feasible from the media perspective.

Table 6. Media Expert Validation Results

Component	Maximum Score	Obtained Score	Percentage	Category
Graphic feasibility	56	52	92.86%	Very Feasible
Development	24	22	91.67%	Very Feasible
Overall score	80	74	92.50%	Very Feasible

The assessment instruments were also validated before implementation. The pretest instrument for problem-solving skills obtained 80.05%, which was categorized as valid. The posttest instrument for problem-solving skills obtained 86.10%, while the pretest and posttest instruments for self-regulated learning obtained 82.05% and 85.10%. These three instruments were categorized as very valid.

Table 7. Validation Results of Pretest and Posttest Instruments

Instrument	Percentage	Category
Pretest for problem-solving skills	80.05%	Valid
Posttest for problem-solving skills	86.10%	Very Valid
Pretest for self-regulated learning	82.05%	Very Valid
Posttest for self-regulated learning	85.10%	Very Valid

The worksheets were implemented with 82 students. The descriptive statistics showed an increase in both problem-solving skills and self-regulated learning. The mean score of problem-solving skills increased from 60.51 in the pretest to 82.18 in the posttest. The mean score of self-regulated learning increased from 60.45 to 87.20.

Table 8. Descriptive Statistics and N-Gain Scores

Variable	Test	N	Mean	SD	Minimum	Maximum	N-Gain	Category
Problem-solving skills	Pretest	82	60.51	4.65	48	76	0.55	Moderate
Problem-solving skills	Posttest	82	82.18	4.92	76	97		
Self-regulated learning	Pretest	82	60.45	4.07	57	73	0.68	Moderate
Self-regulated learning	Posttest	82	87.20	1.99	80	95		

The N-Gain score for problem-solving skills was 0.55, which falls into the moderate category. The N-Gain score for self-regulated learning was 0.68, which also falls into the moderate category and approaches the high threshold. These

results indicate meaningful improvement in both outcomes, with a larger normalized gain in self-regulated learning.

The normality test showed that the pretest, posttest, and difference scores were not normally distributed. Therefore, the Wilcoxon Signed-Rank Test was used to determine the significance of the difference between pretest and posttest scores.

Table 9. Wilcoxon Signed-Rank Test Results

Variable	N	Mean Difference	Wilcoxon Statistic	Sig.	Effect Size	Interpretation
Problem-solving skills	82	21.67	0.000	< 0.001	0.87	Significant, large effect
Self-regulated learning	82	26.74	0.000	< 0.001	0.87	Significant, large effect

The Wilcoxon test showed significant differences between the pretest and posttest scores for both problem-solving skills and self-regulated learning. The reported effect size of 0.87 for both variables indicated a large pretest-posttest difference. Within the limitations of the one-group design, these results show that implementation of the Guided Project-Based Learning Student Worksheets was associated with meaningful improvement in both outcomes.

DISCUSSION

This study produced three principal findings. First, the Guided Project-Based Learning Student Worksheets were rated highly feasible by the material, instructional design, and media experts, with validation scores ranging from 90.00% to 92.85%. Second, students' problem-solving scores increased from 60.51 to 82.18, with a moderate N-Gain of 0.55. Third, self-regulated learning scores increased from 60.45 to 87.20, with a moderate N-Gain of 0.68. The Wilcoxon Signed-Rank Test confirmed significant pretest-posttest differences for both outcomes ($p < 0.001$), with a large reported effect size of 0.87. These findings directly address the research objectives concerning product feasibility and preliminary effectiveness.

Feasibility of the Developed Worksheets

The validation results demonstrate that the developed Guided Project-Based Learning Student Worksheets were highly feasible for use in the Learning Resources Management course. The material expert validation showed that the worksheets were aligned with course learning outcomes, relevant to the course content, and suitable for developing students' problem-solving and self-regulated learning. The highest score was obtained in the alignment with course learning outcomes, indicating that the worksheet content was consistent with the expected competencies of the course.

The instructional design expert validation also confirmed the quality of the worksheet design. The worksheets received a high score in the alignment with Guided Project-Based Learning syntax. This result indicates that the sequence of

activities was considered systematic and appropriate for project-based learning. The six stages of Guided Project-Based Learning provided a clear structure for students. Students were guided to identify problems, plan projects, collect data, analyze needs, develop designs, revise products, and present final outcomes. This structure is important because project-based learning requires students to manage complex and long-term tasks.

The media expert validation showed that the worksheets had strong graphic feasibility and product development quality. Clear visual organization, readable tables, structured instructions, and consistent terminology helped students use the worksheets effectively. In project-based learning, product readability and usability are not minor components. They influence how students understand tasks, organize information, and monitor their progress. A worksheet with poor layout may increase cognitive load and reduce task clarity. Therefore, the high media validation score supports the feasibility of the product as an instructional scaffold.

Improvement in Problem-Solving Skills

The results also showed improvement in students' problem-solving skills. The increase from 60.51 to 82.18 indicates that students became more capable of working through problem-oriented tasks after using the worksheets. The N-Gain score of 0.55 represents a moderate improvement. This finding suggests that guided project activities helped students move beyond theoretical understanding toward applied problem analysis and solution design. The worksheet components, such as project scenarios, observation sheets, interview guides, needs-analysis matrices, and feasibility-analysis tables, required students to examine real institutional conditions and propose evidence-based solutions.

This finding is consistent with the principles of Project-Based Learning, which emphasizes active learning through authentic tasks and product development. Project-Based Learning can support students' ability to connect theory with practice because it requires them to produce concrete outcomes based on investigation and decision making. In this study, students did not only answer theoretical questions about learning resources. They designed a learning resource system for an institution. This process trained them to identify actual needs, analyze gaps, prioritize problems, and develop feasible solutions.

Improvement in Self-Regulated Learning

The improvement in self-regulated learning was also substantial. The mean score increased from 60.45 to 87.20, with an N-Gain score of 0.68. This result indicates that the worksheets helped students regulate their learning during the project process. Several worksheet components contributed to this improvement. The project planning sheet encouraged students to set goals, divide tasks, and create schedules. The monitoring sheet helped them check progress and identify obstacles. The reflection sheet encouraged students to evaluate their learning strategies, use feedback, and improve their work.

Self-regulated learning is particularly important in project-based learning because students must manage their own learning process across multiple stages.

Without structured guidance, students may delay work, rely too heavily on peers, or wait for direct instructions from lecturers. The initial needs analysis showed that students often used last-minute strategies and lacked clear milestones. After using the guided worksheets, students had more explicit learning targets for each meeting. This structure helped them understand what should be completed, how progress should be monitored, and how revisions should be made.

The significant results of the Wilcoxon Signed-Rank Test strengthen the descriptive findings. Both problem-solving skills and self-regulated learning showed statistically significant improvement. The effect size for both variables was large, indicating that the observed improvement was not only statistically significant but also meaningful in practical terms. This result suggests that the combination of Guided Project-Based Learning and structured Student Worksheets can support cognitive and metacognitive development simultaneously.

Theoretical and Practical Contributions

Theoretically, this study strengthens the relationship between guided project-based learning, scaffolding, problem-solving, and self-regulated learning. The worksheets functioned as scaffolds that helped students complete complex project tasks. Scaffolding was visible in the use of guiding questions, structured tables, progress monitoring, peer feedback, and reflection prompts. These supports helped students internalize systematic procedures for solving problems and managing learning. From a constructivist perspective, students built understanding through active engagement with authentic problems, collaboration, and reflection.

Practically, this study provides a learning product that lecturers can use in the Learning Resources Management course. The worksheets can help lecturers organize project-based learning more systematically and reduce students' confusion in completing long-term assignments. The product can also be adapted for other educational technology courses that require students to analyze institutional needs, design learning systems, or develop instructional products.

Limitations and Directions for Future Research

Despite these positive findings, the study has several limitations. First, field implementation was conducted in one study program and one course, so the findings should be generalized cautiously. Second, the one-group pretest-posttest design did not include a comparison group; therefore, the observed improvement cannot be attributed exclusively to the worksheets. Third, self-regulated learning was measured through self-report data, which may be influenced by students' perceptions and response tendencies. Fourth, statistical reliability testing was not conducted for the instruments, although they were reviewed through expert validation. Fifth, the study examined short-term improvement and did not assess retention or transfer to other courses. Future studies should involve multiple institutions, comparison groups, larger samples, digital or interactive worksheet formats, longitudinal measurement, internal-consistency analysis, and multiple raters for essay-test scoring.

CONCLUSIONS AND RECOMMENDATIONS

This study developed Guided Project-Based Learning Student Worksheets for the Learning Resources Management course using an adapted Borg and Gall model. The product guided students through six project stages, from problem orientation and needs analysis to product presentation, evaluation, and revision. Expert assessments indicated high feasibility, with scores of 92.85% from the material expert, 90.00% from the instructional design expert, and 92.50% from the media expert.

Following implementation, students' problem-solving scores increased from 60.51 to 82.18, with an N-Gain of 0.55, while self-regulated learning scores increased from 60.45 to 87.20, with an N-Gain of 0.68. The Wilcoxon Signed-Rank Test identified significant pretest-posttest differences for both variables ($p < 0.001$). Within the limitations of the one-group design, these findings indicate that the developed worksheets were feasible and showed preliminary effectiveness in supporting problem-solving skills and self-regulated learning.

Lecturers may use the developed worksheets to organize structured project-based learning in educational technology courses. Future research should test the worksheets across multiple institutions and comparison groups, examine instrument reliability, involve multiple raters for essay-test scoring, develop digital or interactive versions, and investigate long-term retention, transfer, collaboration, and instructional design competence.

FURTHER STUDY

Further research could explore the implementation of guided project-based learning student worksheets across different educational levels, subject areas, and learning environments to examine their broader effectiveness in enhancing students' problem-solving skills and self-regulated learning. Future studies may also investigate the integration of digital and interactive worksheets, compare guided project-based learning with other innovative learning models, and examine additional variables such as motivation, creativity, collaboration, and digital literacy. Longitudinal and experimental studies involving larger and more diverse samples are also recommended to provide stronger evidence regarding the sustainability and generalizability of the findings.

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