Article Situmorang

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Action Research with Projects to Facilitate Students to Study Research and Prepare Research Proposals During the Covid-19 Pandemic

Abstract

Knowledge and skills in the field of research are key requirements for the successful completion of studies for students, including prospective teachers. However, the outbreak of the Covid-19 coronavirus has made it difficult for students to conduct research in the usual ways. This study aims to apply project-based learning through action research to teach students educational research methods and to help them prepare research plans that are adaptive to classroom situations. This is achieved through the provision of learning resources to teach research theory, followed by the implementation of action research to write research proposals and evaluations of learning outcomes. Learning resources were systematically arranged to support online learning to teach research methods, and effective action research led students to learn actively and develop educational research plans. Competence in the field of research was achieved. Student learning outcomes sequentially for assignment scores (M=88.38±3.00), final project scores (M=88.20±3.55), and posttest (M=92.06±2.17) were all high. Project-based learning is shown to be effective in guiding students to learn actively by utilizing available learning resources. It motivates students to learn independently and can be applied to achieve competency targets in both normal and abnormal learning situations, such as those experienced during the Covid-19 pandemic.

Keywords: Educational research, Project-based learning, Action research, Active learning, Research proposal

INTRODUCTION

Educational research, including action research, is very important for students who are preparing to become teacher to equip them to carry out research for continuous learning improvement (Avgitidou, 2020). Students must understand the principles of research methods

In order to be able to assess and evaluate research proposals before applying them in the classroom (Simmons, McDermott, Eaton, Brown & Jacobsen, 2021; de Oliveira, Buckeridge & Dos Santos, 2017). In addition, research skills must be possessed by professional educators in order to adapt learning to the development of students and the progress of science and teaching (Elliott, 2015; Jakhelln & Pörn, 2019). Classroom action research is a practical intervention to improve learning through educational orientation to solve educational problems that occur in the classroom (Cunningham, 2011; Norton, 2009). Action research is oriented towards reflective problem solving, which is carried out in stages including planning, action, findings, reflection, and improvement plans for the next stage in the form of a continuous cycle (Situmorang, 2019), and aims to create new situations based on pedagogical practices relevant to classroom situations to achieve the desired goals (McNiff, 2013). Action research conducted in the classroom is used to find learning problems and apply appropriate forms of action in solving problems that occur until continuous improvement is created (Jacobsen, Eaton, Brown, B., Simmons & McDermott, 2018). The characteristics of classroom action research are generally situational, practical, direct, and relevant to real situations in the world of education. Classroom action is problem-solving, flexible, adaptive, participatory, and self-evaluative for improving educational practice (Mertler, 2019; Hui & Grossman, 2008). Thus, classroom action research can be used to overcome educational problems in both normal times and abnormal situations, such as those arising due to the Covid-19 pandemic.

Action research using participatory and collaborative approaches as the application of practical knowledge has been widely used to intervene in the education sector, especially for the improvement and enhancement of learning (Pearson, 2021; Rauch, Zehetmeier & Posch, 2019; Townsend, 2013). Action research has also been implemented in professional development because it combines research, action, and work-related practice, including the educational profession (Dogan & Kirkgoz, 2022; Situmorang, et al., 2022; Stern, Townsend, Rauch &

Schuster, 2014). Action research through project-based learning is very relevant to use in intervening student learning activities and to overcome learning difficulties (Rauch, Schuster, Stern, Pribila, & Townsend, 2014). The project assignment is the direct practice of writing research proposals through lecture assignments to accelerate the completion of their studies.

Action research is very well used in solving educational problems for continuous improvement (Jove, 2011; Roulston, Legette, Deloach & Pitman, 2005). Classroom action research specifically has been integrated into the educational curriculum to prepare educators to understand research skills including designing, researching and reporting research results for learning improvement (Moch, Vandenbark, Pehler & Stombaugh, 2016; Situmorang, Gultom, Hamid, Panjaitan & Ritonga, 2018; Davis, Clayton & Broome, 2018). Knowledge and skills in the field of educational research have become one of the indicators in accelerating the completion of the studies for students, including prospective teachers. Research methods must be mastered to support students in planning and carrying out research in the field of education for the completion of the final project. Thus, students must have sufficient knowledge of educational research to enable them to focus on planning and conducting research to obtain the data needed in writing their thesis (Balakumar, Inamdar & Jagadeesh, 2013; Van Lacum, Ossevoort & Goedhart, 2014; McClendon, et al., 2015).

The spread of the Covid-19 coronavirus, which started in 2020, created significant challenges for educational institutions, including universities in Indonesia (König, Jäger-Biela & Glutsch, 2020). The outbreak disrupted learning, restricting face-to-face lectures on campus and replacing them with online learning in an effort to break the chain of virus transmission (Dincher & Wagner, 2021; Piccolo, Livers & Tipton, 2021). In some universities, face-to-face learning was limited only to laboratory activities that followed strict health protocols. While blended learning, a combination of online and offline learning, had been used in higher education for some time (Sáiz-Manzanares, Escolar-Llamazares & Arnaiz González, 2020; Viljoen, Millar,

Manning & Burch, 2020), this became dominated by online learning during the pandemic. Online lectures are more meaningful if accompanied by learning resources that motivate students to study actively, so it is necessary to develop strategies to involve students in learning actively through learning innovations (Sinaga, Situmorang & Hutabarat, 2019; Purba, Situmorang & Silaban, 2019). Innovations through assignments and projects were typically most suitable for teaching during the Covid-19 pandemic (Situmorang, Purba & Situmorang, 2020), and these facts indicated that project-based learning would be successful when integrated into action research.

The difficulty of conducting research as part of the final project is a problem faced by students globally. In general, students find it difficult to carry out research because they have no experience in preparing research plans. Limited access for students to conduct research caused by Covid-19 restrictions and the lack of student experience in adapting research topics to classroom situations, adds to the difficulties for students. To overcome these problems, a strategy is needed to support students in preparing research proposals through the application of action research with projects. This study aims to implement project-based learning through action research to facilitate students' active learning about educational research methods (ERM) and to guide students to prepare research plans that are adaptive to school conditions. This study emphasizes the teaching of research methods with a focus on guiding students to develop educational research proposals that can be implemented in learning during the Covid-19 pandemic. Evaluation of the quality of learning is also carried out based on the learning experiences obtained by students in ERM lectures.

METHOD

This study aims to facilitate students' active learning in the field of educational research in order to achieve competence in the ERM course. The research uses a participatory action approach

through reflection, data collection, and follow-up actions based on the results of project assignments that involve students actively participating in learning.

Design

The study was designed as a combination of quantitative and qualitative research. Quantitative data were obtained from subjective assessments of assignments and projects, and objective assessments of learning evaluations, while qualitative data were obtained from observations during online presentations.

Population and Sample

The research was conducted at Universitas Negeri Medan in the 2020-2021 academic year by involving students of the Bilingual Chemistry Education Study Program. The sample involves 16 students who have similar background knowledge in the field of research, and who voluntarily agreed to provide a research sample.

Data Collection Instruments

Data was collected using a mixed exploratory method design, namely quantitative data in the form of scores using a) an assessment rubric from assignments obtained from the assignment project portfolio, b) presentation scores from the ability to present research proposals, and c) learning outcomes from formative test scores. The survey results were obtained by collecting respondents' opinions (Likert scale) and then converted into quantitative data.

Tasks and Project Assessment

The production of tasks and projects was assessed subjectively using an assessment rubric to see how far students had worked on the assignments and completed their respective projects. The components assessed in the project included the ability to choose a topic/title, write an introduction, study literature and references, select methods, complete instruments, and relate to research ethics.

Test

The test items were structured to measure students' knowledge in ERM, namely before lectures, in the middle, and at the end of the semester. The question package consists of a multiple-choice objectives test (10 questions) and essay tests (five questions). The level of difficulty of the questions is arranged in stages to evaluate students' understanding of theories, assignments, and projects in each phase of learning.

Observation

Observations are used to assess students' readiness to present a research plan (proposal) as part of a project in the third cycle. Presentations are assessed using an assessment rubric covering the scope of the topic, appearance and ability to present, the quality of media, research visibility, the attitude, and the ability to answer questions.

Survey

The standard survey package was used to collect respondents' opinions about student experiences on learning strategies and teaching and learning activities implemented in the teaching of ERM.

Research Procedures and Data Collection

The research was conducted following an action research procedure with three stages: the lecture phase (delivery of theory), the research proposal and instrument testing phase (three project-based cycles), and the final evaluation phase. The learning in this study was conducted online during the Covid-19 pandemic to prioritize the safety of students and lecturers. Online lectures were conducted using the University Network Learning System [*Sistem Pembelajaran Dalam Jaringan Universitas*] (SIPDA) and Zoom meetings. The stages of writing research proposals and compiling and testing instruments with integrated guidance were carried out through project assignments, and learning evaluations were carried out online using SIPDA. Face-to-face meetings between lecturers and students were only conducted at the request of

students (in specific circumstances) following very strict health protocols in accordance with applicable regulations at the university. The stages of the research are shown in Figure 1.

<Please insert Figure 1 near here>

The study was conducted in one semester of lectures (16 weeks), involving lecture and students learning activities, assignments and projects, mentoring, and evaluation of learning outcomes. The initial evaluation (pretest) was carried out before the lecture began, followed by an explanation of the stages of online lectures, assignments and projects, and submission of product assignments and projects that must be fulfilled by students. Mid-semester evaluation and final evaluation were carried out according to the schedule set by the university. The lecture phase was devoted to delivering theoretical lecture material on ERM, which was carried out by using SIPDA and Zoom meetings in a predetermined time allocation. Students were provided with learning resources (e-books, PowerPoints, articles, videos, hyperlinks, project examples, and templates) relevant to the topic of the lecture. Each stage of the lecture was accompanied by assignments relevant to the topics studied, such as routine tasks, book analysis, critical journals, and projects.

The assignment phase was carried out to deepen the theory given in lectures. Project assignments were carried out to develop a student research plan, divided into three cycles. The first cycle was to prepare a draft of a research proposal, the second cycle involved improving the proposal with guidance, and the third cycle was to write the final proposal after presenting the proposal in front of lecturers and peers. The mark for each assignment and reflection (improvement comments) was available in the SIPDA account of each student. Guidance to facilitate active learning and optimize the independent learning process in writing research

proposals was also provided online. Instructions for writing research proposals, proposal templates, examples of research instruments, and assignment assessment rubrics were all available on SIPDA. Improvements to the project product (research proposal) from the first cycle were uploaded to SIPDA to facilitate reflection on ways to improve the content of the proposal in the next cycle. Standardization of the research instrument package was carried out through a small sample trial after obtaining input from expert lecturers according to the type and characteristics of the data collection instrument. The presentation of the research plan was done online via Zoom in order to clarify the research objectives and the visibility of the research plan. The deadline for submitting project products (research proposals) for three cycles was announced at SIPDA. The mentoring strategy was ordered based on the speed with which students uploaded task products to SIPDA. The team of lecturers would immediately provide input, suggestions and reflections on the contents of the uploaded proposals and research instruments. Notifications of progress and product grades for assignments and projects were announced on the SIPDA dashboard of each student.

The presentation of research proposals was done online in front of lecturers and all students via Zoom meeting. Students were drawn in lots to give them the opportunity to present their research proposals, and lecturers gave an assessment of their performance following the rubric for evaluating proposal presentations. Questions and input were given by the lecturer team to clarify anything which was unclear and suggest ways to improve the proposals. The final proposals were uploaded after all the stages of improvement and input from lecturers had been accommodated. At this stage, the complete proposal along with the research instruments were packaged completely and uploaded to SIPDA. The period for compiling research proposals was 6 weeks, including one week to present the proposals. Formative tests were conducted to measure learning outcomes in the middle and end of the lectures. Students were also given a

questionnaire to collect their opinions about the quality of the implementation of project-based learning applied in this study.

Data Analysis

The research data consisted of product task and project scores, learning evaluations, observation, and a questionnaire. Product assignments, projects and presentation observation were assessed subjectively by using a scoring rubric on a score scale of 0-100. Learning outcomes (pretest, midtest and posttest) were obtained based on the ability to answer questions (test package), and the score was marked to a scale of 0-100. The questionnaire was assessed using the Likert scale with the lowest score (1) and the highest score (4). The average evaluation score, assignment portfolio and respondents' opinions are presented in the form of tabular data.

Ethical Consideration

Students involved in this research gave their consent to participate as a research sample according to the protocol of the Social Science Code of Ethics in the field of education research set by the university. Students were informed of the purpose of the research, and their participation was voluntary; they were made aware that they may withdraw at any time.

RESULTS

The Description of Education Research Methodology

The ERM course is prepared for students on the Bachelor of Education program according to the curriculum oriented to the Indonesian National Qualifications Framework [*Kerangka Kualifikasi Nasional Indonesia (KKNI)*] (Unimed, 2016). Educational research (theory and practice) is required to conduct research to prepare a thesis as a final project. Teaching materials have been developed and arranged systematically to provide insight and develop students' experience in the field of research (Creemers, Kyriakides & Sammons, 2010; Ary, Jacobs,

Irvine & Walker, 2018; Oruç, 2012). Lecture materials include an introduction to education research, research proposals, research instruments, the use of statistics to process data, conducting education research, writing reports, and presenting research plans and results. The distribution along with brief descriptions of the topics, and type of assignments are summarized in Table 1.

Please insert Table 1 is about here

Preparation of Research Proposal

The educational research proposal is one of the mandatory products in the course, and writing research proposals had become a particularly challenging task among the teaching and learning activities. In order to address this, project-based learning was implemented to support students in preparing research proposals in the field of education which can be applied to teaching in both normal and abnormal times, such as during the Covid-19 pandemic. As a result, students are now more enthusiastic in drafting research proposals, participating in mentoring, presenting research plans, and in writing final research proposals. The assessment results of the project portfolio in three cycles, including the preparation of a draft research proposal, the research proposal improvements, and a final proposal are summarized in Table 2.

<Please insert Table 2 is about here>

In the first cycle, 81% of students wrote a proposal draft but the uploaded assignments did not meet the requirements; the contents were incomplete, unfocused, and difficult to understand. The average value of the proposal draft (M=39.79±41.27) was classified as very low and requiring thorough improvement in the next cycle.

In the second cycle of learning, the influence of mentoring proved to be very effective in improving the contents of the research proposals, with the input and direction given by the

lecturer team really helping students understand the contents of the proposal as a whole. At this stage, all components of the research proposal had been completed. The research topic focused on teaching that can be done during the Covid-19 pandemic or in normal learning situations. The content of the research proposal was synchronized between the introduction, literature study, research methods and research instruments. Students already know the relationship between problems and problem formulation, research objectives, research hypotheses, types of data collection instruments, and data processing techniques to be used. The average value of the improvement proposals in the second cycle was good (M=82.61±6.48).

Based on the results of the learning analysis (Table 2), several difficulties in writing research proposals were identified, and actions were taken to resolve the problems, as summarized in Table 3. The online guidance provided by lecturers and tutors via SIPDA succeeded in assisting students in completing their research proposals.

<Please insert Table 3 is about here>

The results showed that project-based learning implemented through action research was effective in teaching students about research methods and in helping them overcome difficulties in writing research plans during the pandemic. Through project implementation, students' knowledge of research methods was expanded, and they were able to apply this to improve their research proposals. Student problems were resolved through online tutoring, mentoring, and teaching. Theories and practices related to research methods were therefore achieved as the competency targets for this lecture.

The third cycle was the last stage in producing the final research proposal. This tested the ability of students to present a research plan as a guarantee of mastery of the proposed research plan, as well as to ensure that the research plans could feasibly be implemented as part of the final project. The input and suggestions given by the lecturer team were used as a reflection of the

content of the research plan, as well as to test the feasibility of the proposal if applied in teaching, especially during the unpredictable Covid-19 pandemic period. The results of the assessment of the presentations are summarized in Table 4, and show that, overall, students presented their research plans well (M=84.40±8.07). At the end of the third cycle, all the students had succeeded in improving their research proposals. The content of the proposals were in line with the research topic, and the components, such as problems, problem formulation, research objectives, methodology and data collection instruments, were complete, giving an average score is 88.20±3.55, which is classified as very good (See data results of Cycle 3 in Table 2). All the research plans were feasible and could be implemented during normal times or in abnormal times if this Covid-19 pandemic continues.

<Please insert Table 4 is about here>

Learning Experience and Student Learning Outcomes

Project-based learning implemented in action research provides an interesting learning experience for students to learn education research. Giving assignments and projects that are relevant to the teaching material being studied guides students to learn actively, to deepen knowledge independently, and focus on learning to achieve the set competency targets. Project-based learning in action research makes students study thoroughly, develop knowledge and skills in the field of research, and be able to answer formative exam questions well. Student learning outcomes based on the value of the assignment portfolio and evaluation are summarized in Table 5. The average value of the assignment portfolio (M=88.38±3.00), midterm exam (M=87.06±5.15), and final exam (M=92.06±2.17) were all classified as very good. This value is significantly higher than the low pretest score (M=36.88±9.46), as evidence that assignments and projects have succeeded in encouraging students to learn ERMs. It was concluded that the students' competence in the research was achieved.

<center>**\<Please insert Table 5 is about here\>**</center>

Evaluation of Learning Implementation

Evaluation of the implementation of learning was carried out as summarized in Table 6. Students gave positive responses to the learning strategies given in lectures. They enjoyed project-based learning because the targeted products were realistic, contextual, and useful for students. Learning components such as the availability of learning resources, methods and stages of learning implementation, assignments and projects, learning assistance (reflection), and student motivation were also in the very good category.

<center>**\<Please insert Table 6 is about here\>**</center>

DISCUSSION

The spread of the Covid-19 posed problems for education in Indonesia. Face-to-face learning changed to online learning, making it difficult for students to do research at school, resulting in a slowdown in study completion. Students were not able to prepare research plans that are adaptive to abnormal school situations, such as the conditions during the pandemic. However, project-based learning through action research succeeded in teaching students research methods and enabling them to write research plans that are adaptive to different classroom situations. This learning model is proven to lead students to learn actively in achieving their competency targets (Yin & Yuan, 2021; Nainggolan, Sitorus, Hutabarat & Situmorang, 2020; Situmorang, Purba & Silaban, 2020). Action research with projects is, therefore, a good choice for teaching ERMs. The availability of innovative learning resources facilitates online learning for students to adapt to ongoing abnormal situations (Lemay, Doleck & Bazelais, 2021; Nisiforou, Kosmas & Vrasidas, 2021). In addition, success in analyzing educational problems and the

implementation of research is a critical thinking skill needed by educators (Sutiani, Situmorang & Silalahi, 2021). The teaching materials previously available on SIPDA had not built students' knowledge of preparing research plans optimally. However, project-based learning through action research successfully leads students to understand the research plan, as shown in the progress of their learning from one cycle to the next (Martinovic, et al., 2012; Mitana & Kitawi, 2021). In the first cycle, students did not understand the purpose of writing a draft proposal (Perez, Rabionet & Bleidt, 2017). The research title, problem formulation, research objectives and literature study were not in sync, even though these concepts had been explained in the lecture. Research problems had not been identified, research objectives were not clear, and data collection techniques were not applied. These results indicated that previous online teaching had not succeeded in equipping students with the knowledge to write their research plans.

The student learning progress was very significant in the second cycle, as a result of the guidance provided by blended learning for students who had difficulties (Morton, et al., 2016; Vallée, Blacher, Cariou & Sorbets, 2020). Reflection and mentoring were also very effective in helping students to improve their research plans. There was a thorough improvement in the content of the research proposal, and the average score of project products in the second cycle was high. Students succeeded in compiling proposals that are adaptive to learning at both normal and abnormal times, which could be applied if the Covid-19 pandemic continues. The role of the facilitator was also very important in directing students in the preparation of research proposals. In the second cycle of learning, the facilitator directed students to choose topics and types of research and assess what could be done given the conditions in schools, especially in schools that implemented online learning during the pandemic. Alternative topics of choice must always be adapted to the curriculum, student characteristics, and the availability of facilities, infrastructure and information technology in schools. Consideration of the school

atmosphere, which has yet to return to normal as a result of Covid-19, becomes a priority in choosing the topic of the research plan.

The final research proposal was obtained after the third cycle of learning. The ability to communicate research plans orally and in writing was an important part of the students' readiness in implementing their research proposals. Feedback from lecturers increased the students' confidence in their research plans, and there was an increase in the scores for the project product portfolio in the third cycle, which indicates that students' knowledge of research was very good. The facility for students to track their scores from one stage to the next on the SIPDA website provided a motivation for them to improve their research proposal projects, and the facilitator's follow-up, and the fast, transparent, and objective scoring given by the instructors greatly enhanced the improvement in student learning outcomes.

It is realized that there are limitations that must be taken into account in this study, especially for the acquisition of quantitative data related to the limited sample size (Gruijters & Peters, 2022; Lakens, 2022). However, research data have confirmed the effect of action on improving learning performance. The research findings show that there is a trend of increasing student learning outcomes in line with the number of intervention cycles in teaching and learning activities. The research data consistently shows an increase in the average learning outcomes and is followed by a decrease in the variation in values consistent with an increase in the number of action cycles (See cycle data in table 2). Thus the data from this study can be trusted even though it only uses a small research sample.

These findings suggest that project-based learning, combined with relevant learning resources, motivates students to learn actively and enhance their competence in research (Situmorang et al., 2018; Tang, et al., 2021). The knowledge and skills obtained from this course are needed by future educators for the continuous improvement of education (Samosir, Bukit, Situmorang & Simorangkir, 2020), and the strategy applied in this study will help them acquire these more

quickly because the difficulty of planning research that is adaptive to the school situation has been overcome. The research findings demonstrate that project-based learning optimizes the potential of students to use learning resources for the achievement of their competencies. This learning is adaptive and can be applied to both normal and abnormal classroom conditions, notably those during the Covid-19 pandemic, and scientifically appropriate to be implemented in other courses that require an increase in knowledge and skills.

CONCLUSION

Project-based learning through action research, as applied in this study, is an effective strategy for teaching educational research. This learning strategy is effective in building knowledge and skills in the field of research and can be applied in both normal and abnormal times. The integration of tasks and projects in the learning process motivates students to learn more actively in studying research methods, and, in this case, action research has gradually succeeded in leading students to write research plans that are adaptive to the classroom situation. This learning strategy has facilitated students to utilize the available learning resources to improve their knowledge and skills in ERM independently, and the skills required to work on assignments and projects to produce effective learning products have also been formed. As a result, the students succeeded in writing research plans that are adaptive to classroom situations, the stages of learning were well executed, learning outcomes were classified as very good, and the target research competence was achieved.

The research findings prove that there is a relationship between the success of project practice and action research, namely the three-cycle intervention in project-based learning empowers students to write their research proposals. This study has confirmed that action research with projects is effective in actively enabling students to achieve their competency targets, and the learning strategies described here can be applied to teach students in various courses in both

normal and abnormal situations, especially if the Covid-19 pandemic continues. However, the facilitator's capability to respond to students' needs and the availability of learning resources are the key determinants of the success of action research with projects. This suggests that the facilitator must have extensive experience and knowledge in the field of action research to be able to respond to students' needs effectively. The provision of innovative learning resources to facilitate students' independent learning must also be considered in the application of this learning model. Reflecting on the findings of this study it is stated that action research with projects is a solution to facilitate active learning, and can be adopted in other learning practices that require increased in knowledge and skills.

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CONFLICT OF INTEREST

We hereby declare that the authors have no conflict of interest in the implementation of this research project.

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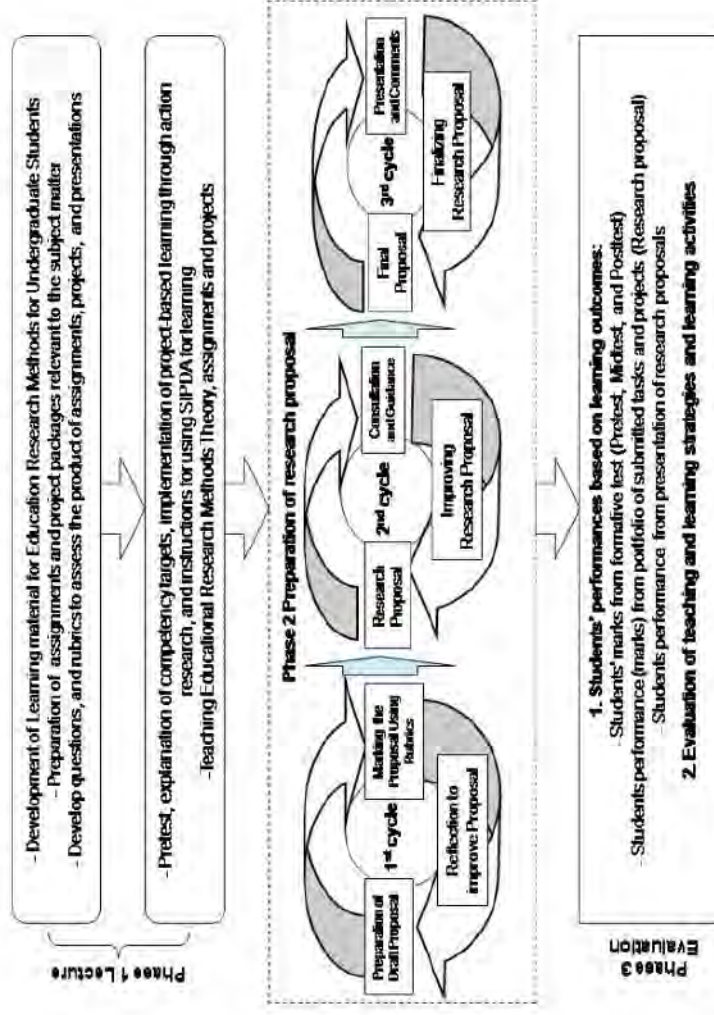
Phase 1 Lecture

- Development of Learning material for Education Research Methods for Undergraduate Students
  - Preparation of assignments and project packages relevant to the subject matter
  - Develop questions, and rubrics to assess the product of assignments, projects, and presentations

- Pretest, explanation of competency targets, implementation of project-based learning through action research, and instructions for using SIPDA for learning
  - Teaching Educational Research Methods Theory, assignments and projects

Phase 2 Preparation of research proposal

1st cycle
- Preparation of Draft Proposal
- Marking the Proposal Using Rubrics
- Reflection to improve Proposal

2nd cycle
- Research Proposal
- Consultation and Guidance
- Improving Research Proposal

3rd cycle
- Final Proposal
- Presentation and Comments
- Finalizing Research Proposal

Phase 3 Evaluation

1. Students' performances based on learning outcomes:
   - Students' marks from formative test (Pretest, Midtest, and Posttest)
   - Students performance (marks) from portfolio of submitted tasks and projects (Research proposal)
   - Students performance from presentation of research proposals
2. Evaluation of teaching and learning strategies and learning activities

Figure 1. Stages of action research with projects for teaching Educational Research Methods

Table 1. Distribution of the subject matter and brief description of the Educational Research Methods course material for undergraduate education programs.

No	Sub-topic	Short description of the lecture*	Time (weeks)	Teaching Method and Tasks
1	Pretest and Lecture Information	Pretest, followed by lecture explanations: competency targets, online teaching and how to use SIPDA, assignment of book analysis and assignment products, and assessment rubrics	1	Pretest, and Task 1: Textbook analysis
2	Introduction to Research Methods and Research Ethics	Introduction to research methods as an enrichment of ERM materials and the explanations related to research protocols and ethics (online lectures and routine assignments)	1	Task 2: Routine tasks and setting research topics (themes)
3	Styles of education research	Types of educational research and implementation techniques (online lectures and assignments to analyze the content of scientific articles according to selected research topics / themes)	1	Task 3: Analysis of scientific articles
4	Qualitative and quantitative approaches in education research	Enrichment of course materials for Qualitative and Quantitative Research in Educational Research (online learning and giving routine assignments and literature studies related to the research topic)	1	Task 4 Selection of articles using an electronic database
5	Writing research proposals and research instruments	Strategy for writing educational research proposals, data collection instruments and standardization techniques (Introduction, Problem Formulation, Research Objectives, Literature Study, Research Methods and Research Instruments), and assigning assignments for research proposal presentations (online lectures and action research project assignments)	3	Project 1: Writing a Draft Research Proposal
6	Mid-Semester Evaluation (Formative test)	The mid-semester formative exam is needed to measure student mastery in the ERM course that has been studied up to the middle of the semester (Online test)	1	Online Formative test
7	Selection and Use of Statistics to Process Research Data	Selection and use of statistical tools and software to process research data according to data characteristics, test hypotheses and draw conclusions	1	Task 5 Standardization of research instruments and data processing devices
8	Practice writing research	Improvement of research proposals for harmonization of the components of research	2	Project 2: Develop

	proposals (Second cycle of action research)	topics contained in the proposal, including the suitability between Research Title, Problem Formulation, Research Objectives, and Data Collection Instruments, based on reflection on the results of the first cycle of action research projects (Consultation and online discussion) for improvement of proposals in Cycle Two		research instruments and standardization
9	Research Presentation (Proposal, Reports & Seminar)	Good presentation strategies and techniques in communicating research at scientific meetings (proposals, reports, and scientific seminars, online lectures and clarifications)	1	Assessing presentation eligibility
10	Research Implementation, Data Collection, Analysis and Hypothesis Testing (Third cycle of action research)	Important components that need to be considered during research implementation, data collection techniques and the use of data processing tools and hypothesis testing, drawing conclusions and maintaining a research code of ethics, follow-up proposals for improvement of proposal exposure reflections, as the third cycle of action research (online lectures and implementation projects 3)	2	Project 3: Improvement of Research Proposals and Research Instrument
11	Research Report Preparation	General information in compiling research reports, and guidelines for good and standard research reports (online lectures)	1	-
12	Product and project evaluation, and final evaluation (Formative test)	Evaluating the product of assignments and projects (including the final research proposal) and formative exams to measure student mastery in the ERM course final evaluation (Formative test)	1	Online Formative test
Total Meetings			16	

*All learning resources related to the topic are available at SIPDA

Table 2. Subjective assessment of project products (educational research proposals) in three learning cycles

No	Observation of on students' skills	Students' performance* ($M \pm Sdv$)		
		Cycle 1 (Draft Proposal)	Cycle 2 (Proposal Improvement)	Cycle 3 (Final Proposal)
1	Research Title (topic), and eligibility for study during normal and abnormal conditions (Covid-19 pandemic)	55.81±39.43	89.69±5.35	91.25±1.65
2	Writing Introduction (problem identification, problem formulation and research objectives)	52.88±38.95	81.69±5.91	88.50±1.97
3	Writing Literature Review (searching, selecting, and citing literature relevant to the research topic)	50.44±35.50	82.25±7.55	89.88±2.25
4	Writing Research Method (research design, procedures, instruments and standardization, and hypothesis testing)	59.81±41.73	83.75±5.76	89.56±1.36
5	Referencing System (bibliography writing technique and consistency according to research guidelines)	59.63±41.60	84.94±4.27	89.38±2.90
6	Writing Attachment (Research instruments, Lesson Plan, and eligibility)	-	78.63±4.43	84.88±3.86
7	Research Ethics (related to adherence to educational research ethics)	-	77.31±3.28	83.94±2.93
	Average	39.79±41.27	82.61±6.48	88.20±3.55

* Obtained from a subjective assessment using the criteria in the assessment rubric of the project report.

Table 3. Problems experienced by students when writing research proposals and strategies to overcome problems through actions in project-based learning

No	Description of student difficulties	Action for problem solving	Action cycle
1	Students have difficulty determining research problems that will become the topic of research proposals to be implemented in normal or abnormal learning conditions during the Covid-19 pandemic.	Lecturers, tutors and students discuss research topics and ensure the feasibility of research titles that have been submitted online.	Completed in Cycle 1.
2	Students have difficulties in writing research proposals in the Introduction section, (background, formulating problems and research objectives).	An online tutorial is conducted to reveal the relationship between the research background and the formulation of the problem and research objectives.	Completed in Cycle 1 and 2.
3	Students are not skilled at using databases in finding and selecting articles that are relevant to the research plan in writing literature studies, including citation procedures, and writing bibliography.	Demonstrating strategies using databases using keywords to select articles that are relevant to the research topic, teaching citation procedures, and how to write a proper bibliography.	Completed in Cycle 1 and 2.
4	Students' knowledge of research methodologies is inadequate, as indicated by incorrect research design, incomplete research procedures for collecting research data, inappropriate use of data collection instruments, and incompatibility of analytical tools with the characteristics of research data.	Provide guidance to explain scientific steps in preparing research designs, compiling data collection instruments and research data processing tools. Analysis and testing of the relationship between the formulation of the problem with the research objectives. The strategy for selecting the type of data collection instrument according to the characteristics of the research data was also confirmed.	Handled on action in Cycles 1 and 2.
5	Students have difficulty in organizing research proposals, proposal systematics, sentence structure, and the use of terminology.	The lecturer explains the systematics of the research proposal in order to describe the research plan for solving problems through scientific steps.	Completed in Cycle 1 and 2.

Table 4. Subjective assessment of the presentation of research proposals in front of lecturers and peers.

No	Presentation assessment components	Students' performance* ($M \pm Sdv$)
1	The scope of the presentation is in accordance with the content of the research proposal	83.31±10.61
2	Appearance and ability to present material (clear, easy to understand, attract attention, and inspire)	86.25±4.49
3	The quality of the presentation media and its use supports the quality of the material presented	85.63±8.11
4	Feasibility of research proposal (mastery of content, feasibility and coherence of ideas for implementation)	83.44±7.54
5	Attitude and ability to answer questions	83.38±8.91
	Average	84.40±8.07

*Obtained from subjective assessment using the rubric assessment guidelines of presentation

Table 5. Students' performances based on learning outcomes from the average marks of the portfolio of submitted projects reports and formative tests.

No	Type of learning evaluation (marks)	Students' performance (Learning outcome), ($M\pm Sdv$)	Competence summary
1	Pretest*	36.88±9.46	-
2	Task**	88.38±3.00	Competence achieved
3	Midtest*	87.06±5.15	Competence achieved
4	Posttest*	92.06±2.17	Competence achieved
Average***		89.17±3.44	Competence achieved

* Obtained from formative test during the semester

** Obtained from the average marks portfolio of submitted tasks

*** Obtained from the average of tasks and examinations marks

Table 6. Student opinions on teaching and learning strategies and learning activities for teaching Educational Research Methods.

No	Item of the learning activities	Respondents' opinion* $(M \pm Sdv)$, L (n=16)
1	Completeness and suitability of course content and availability of learning resources according to student needs	3.88±0.34
2	Stages of learning and delivery methods	3.75±0.45
3	Quality and relevance of tasks and projects to the target product of research proposal writing	3.75±0.45
4	Availability and relevance of reflections, suggestions, and assistance from lecturers towards improving research proposal writing	3.81±0.40
5	Adequacy and availability of time for lectures, assignments, discussions, and evaluations	3.75±0.45
6	Student motivation in attending lectures and completing assignments	3.88±0.34
	Average	3.80±0.40

*Marking criteria: 4 = very good; 3 = good; 2 = poor, and 1 = very poor

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