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DEVELOPING TEACHING MATERIAL OF RESEARCH METHODOLOGY AND LEARNING WITH 4D MODEL

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Abstract: This research and development aimed to produce teaching materials for research and teaching methodology courses using the 4D model. Teaching materials are arranged based on a 4-D procedure: Define, Design, Develop and Disseminate. The development results are teaching materials that are validated by four expert validators: content-focused material, curriculum-focused material, learning design, and language. The validated teaching materials were tested through small groups of 30 students and large groups of 90 students. It collected data using observation, interviews, documentation, and questionnaires. The data were analyzed qualitatively by data reduction, data presentation, and drawing conclusions and verification. The quantitative analysis by processing data from expert reviews and responses from lecturers and students using percentages. The research and development results in a defined stage obtained material elaboration from the point of view of the research methodology of language, mathematics, and geography. The design stage is based on the design validator's suggestion regarding an attractive appearance on the cover, chapter titles, and the format of the content of the Deepublish textbook. In the development stage, the validation results obtained an average of 76.37% with good qualifications, and the average test decision was feasible with revisions in certain parts. The test results of small group students obtained 75.19% or good qualifications. The results of the large group trial got 76.83% or good qualifications. The research concludes that teaching materials have been compiled based on 4D steps.

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Introduction

Teaching materials can be developed from various sources in the form of data, facts, and information from research or literature studies. Students use teaching materials to study separately or in combination, which provides convenience in achieving learning objectives. Teaching materials become a guideline in the learning process containing the substance of the competencies learned (Efendi, 2014; Purnamasari et al., 2019; Solehana et al., 2019).

Consideration of the need to develop teaching materials is an essential part of university teaching and learning activities. Teaching materials can make it easier for lecturers to learn and help students in education. The teaching materials developed to make the materials varied and better, as needed, become solutions to the learning process and encourage more optimal and final quality results (Biduri et al.,, 2018; Solehana et al., 2019).

The teaching materials development in courses is need to be done because it can improve the learning of these courses. Teaching materials increase student learning independence (HL et al., 2020; Kusmana, 2011). The development of teaching materials can increase motivation, especially on rote material's character, making it more fun (Arpan, Aunurrahman, and Fadillah, 2018; Sistriana, Aunurrahman, and Usman, 2019; Tanjung and Fahmi, 2015).

The research and development methodology is a course in all study programs within the Faculty of Teacher Training and Education (FKIP), Universitas Sembilanbelas November Kolaka (USN Kolaka). The development of teaching materials is based on obstacles in the lecture process in the Research and Development Methodology course at FKIP USN Kolaka. The barrier is the unavailability of teaching materials for research and teaching methodology courses. The lack of teaching materials is the reason for research on the development of teaching materials (Indrawini, Amirudin, and Widiati, 2017; Puspasari, Astuti, and Suratman, 2018).

Research and teaching methodology courses are found in all study programs within FKIP USN Kolaka. The name of this course differs by including the study program's field of study. Research and language education are examples of courses in the S-1 Study Program for Indonesian Language and Literature Education. Courses in Geography Education become a geography research methodology. In the Mathematics Education Study Program, the name of the course is general, in this case, the research methodology. The entire study program does not have its developed teaching materials. Mathematics education research skills have unique characteristics, especially in design, implementation, and publication (Prahmana, Kusumah, and Darhim, 2016). Geography teaching materials always pay attention to physical and human or geosphere phenomena (Prawindia, Fatchan, and Astina, 2016; Wijiningsih, Wahjoedi, and Sumarmi, 2017). Language research can examine only one subject qualitatively (Supriatna, 2017).

Research Tegeh and Kirna (2013) develops teaching materials for research methods with the ADDIE model. The test subject is one lecturer, six students for small groups, and 18 for large groups. The research that will be carried out is very different from that because the model used in 4D, with the test subjects being 12 lecturers, 30 students in small groups, and 90 students in large groups. The research carried out has a focus in addition to research methodology in general as well as on the specific teaching scope of FKIP.

Research Qondias, Winarta, and Siswanto (2019) develops teaching materials for research methods with the ASSURE model in research methodology courses in general. The research that will carry out has a focus in addition to research methodology in general as well as in specifics no teaching within the scope of FKIP. Research (Adriani et al. (2019) develops educational research with a trial subject of economic education. The research that will be conducted looks at educational research from various scientific groups, namely the issue of language, Mathematics, Natural Sciences, and Social Humanities.

Research and information on complex research and teaching methodologies, as well as their use as teaching materials, are still limited. Various research results that have been carried out have not led to a comprehensive teaching research methodology such as general research methodologies Tegeh and Kirna (2013) and other general research methods such as research Qondias et al. (2019). Research has not combined various fields of education, especially those within the scope of FKIP.

The provisional results achieved are that after being studied scientifically, the subject matter of research and teaching methodology courses needs to be developed and used as a

guide for students. The results of the analysis of initial observations became the main reason for conducting development research (Tinja, Towaf, and Hariyono, 2017). Needs analysis is exciting for developing teaching materials (Alba, Akbar, and Nurchasanah, 2019).

Research and development of teaching materials for research and teaching methodology courses is an effort to improve student knowledge. This research is expected to get teaching materials in accordance with student learning needs. Learning activities become complete and meaningful with teaching materials (Puspasari et al., 2018; Sistriana et al., 2019). Meaningful learning is relating new information to relevant concepts in one's cognitive structure (Harianto et al., 2019). Students gain comprehensive knowledge of the subject matter (Biduri et al., 2018).

Teaching materials with the development of print and files facilitate the lecture process during the Covid-19 pandemic. Files can be studied by students online. The development of teaching materials in courses packaged with e-learning can improve student learning outcomes (Djidu et al., 2021; Sejati et al., 2021; Vahlia, 2017). The specific aimed of this research was to identify the subject matter of research and teaching methodology courses at FKIP USN Kolaka. The development aimed is to produce products in the form of teaching materials for research and teaching methodology courses at FKIP USN Kolaka.

Research Method

The method used is research and development. Research and development of teaching materials research and teaching methodology adapted to 4-D measures based on Thiagarajan, Semmel, and Semmel (1974). There are four stages of the 4D model, namely Define, Design, Develop, and Disseminate. This teaching material is intended explicitly for FKIP students, USN Kolaka, which is used as material in the Research and Teaching Methodology course. The definition and design stages begin the development of the 4D model teaching materials (Adriani et al., 2019).

In the Define stage, an analysis is carried out on the subject that is the target of development, namely students of the Language and Indonesian Education Study Program as the language. Students of the Mathematics Education Study Program as the Mathematics and Natural Sciences. Students of the Geography Education Study Program are the Social. Analysis of the concept of teaching materials to be developed and the formulation of objectives for developing teaching materials for Research and Teaching Methodology.

The Design stage is done by designing teaching materials, defining and designing teaching materials. The researcher produced the Deepublish format as the basis for preparing teaching materials and selecting the configuration, in the form of a writing structure for teaching materials obtained from the FGD with the lecturers in charge of the courses. FGD support in collecting research and development research data is beneficial for researchers to complete product development (Suyantiningsih, Munawaroh, and Rahmadona, 2016). the structure of the book can be used as a development reference, for example, a book at the Cambridge publisher (Prawindia et al., 2016).

The Develop stage begins after the teaching materials have been compiled, then validation is carried out. Validation of teaching materials includes material experts, learning design experts, and language experts. The validation results will be revised until criteria good or very good percentage are obtained so that the teaching materials can be used as a Research and Teaching Methodology course. Expert validation is a necessity that development

researchers must take to get corrected products from various expert views (Adriani et al., 2019; Arpan et al., 2018; Puspasari et al., 2018; Wahyudi, Nurhadi, and Pratiwi, 2018).

The teaching materials' test subjects produced are currently programming students or who have passed the Research Methodology course. A small trial of 10 students and a large group of 30 students in three selected study programs. Development with many test subjects improves the validation results (Adriani et al., 2019; Rusilowati, Nugroho, and Susilowati, 2016; Sistriana et al., 2019).

Teaching materials will be disseminated to national publishers (Deepublish), which can later be distributed to the USN Kolaka library, FKIP Study Program reading rooms, partner campuses, and general bookstores. Disseminating is the final stage of 4D, as well as the dissemination of the development results (Laksono et al., 2017; Vahlia, 2017).

The data obtained are grouped into two, namely qualitative data and quantitative data. Qualitative data was obtained from observations at the research site. In contrast, quantitative data was obtained from responses from experts, lecturers, and students regarding the effectiveness of using the teaching materials produced.

Data collection techniques were carried out in four ways: observation, interviews, documentation, and questionnaires. Questionnaire for expert validation and effectiveness testing. Questionnaires for general data and interview guidelines for in-depth interviews in the field.

Data analysis techniques used are quantitative and qualitative. Qualitative data analysis is used by grouping information from qualitative data in the form of responses and suggestions for improvement. Qualitative data analysis was carried out with: data reduction, data presentation, and drawing conclusions and verification.

Quantitative analysis techniques are used to process data from expert reviews and responses from lecturers and students. This data is in the form of input, feedback, criticism, and suggestions for improvement contained in the questionnaire using a Likert scale. The results of this analysis are then used to revise the product of the developed teaching materials. Data from the questionnaire was then taken by comparing the total score obtained with the total ideal score in one item times one hundred percent.

Result and Discussion

The research results are in the form of data presentation based on the 4-D development model, consisting of the define, design, develop, and disseminate stages. The define stage defines the need for student teaching materials tailored to the research and teaching methodology courses. The initial draft of teaching materials is in the form of primary materials: the nature of teaching research, research methodology, types of research, initial section, literature review, methods, data, data analysis, and research proposals.

Suggestions from material expert validators, the decision of the writing team that is included in the draft of teaching materials is the addition of appropriate materials and, in particular methodological specific materials. Specific material written per chapter is expected for students to focus on, and tiered studies based on the material's structure. Students understand general concepts and then enter specific examples to be more understandable and effective in studying research and teaching methodology courses.

The design of teaching materials results after consulting with material experts is the nature of research and teaching research, research methodology, types of research, introduction, theoretical studies, population, samples, and research subjects, data, research instruments, data analysis, and research proposals.

The curriculum expert validator explained the connectivity of teaching materials to the needs of students by looking at the learning tools for the Research and Teaching Methodology course in the Semester Lecture Plan (RPS). Specific materials and characterizing scientific materials that will be studied in teaching materials should be included in the study of courses. The format for writing teaching materials should be more directed to the design of teaching materials because the primary teaching materials are used in the one-semester lecture process. The decision was taken based on suggestions from material experts. The curriculum focus is on preparing teaching materials according to the format of Dikti teaching materials because they are the leading guide in teaching research and teaching methodology courses.

At the design stage, the research team validated with design experts. The material format focuses on the Deepublish publisher format. The Deepublish model is widely applied in textbooks in Indonesia. Presentation per chapter contains an introduction (specific instructional objectives/learning objectives, the importance of studying chapter content, learning instructions for studying chapter content), presentation of material (according to the subject matter per chapter), summary, practice questions/assignments, and bibliography. The attachment section of teaching materials is equipped with semester lecture plans, lecture contracts, a resume of teaching materials, and a profile of the writing team.

At the development stage, the researcher begins to write teaching materials based on the results of the analysis of the concept analysis that has been done. The product consists of an introduction, body, and closing. The percentage of data validation results by material experts is calculated and matched with the eligibility criteria for teaching materials. Table 1 shown the presentation of the percentage data from the validation of the material.

Table 1. Percentage of Matter Validation I Test Result

Validation Aspect	Rate	Max	%	Qual.	Decision
Matter Organization	22	28	78	Good	Partial Revision
Matter Depth	12	16	75	Good	Partial Revision
Matter Update	13	16	81	Good	Partial Revision
Applications and Enrichments	10	12	83	Good	No Revision
Percent of Overall	57	72	79	Good	Partial Revision

The calculation results of the percentage of all aspects of expert validation are in a good category, and the revision test decision is in certain parts. Revision of image captions adds image sources, reduces images taken from the internet, and increases the collection of pictures from research by researchers. Corrections made some foreign words that were not italicized, sentences that were too long, and the discussion of the material in the teaching materials had to be related to the general methodology and teaching.

The percentage of data validation results by material experts is calculated and matched with the eligibility criteria for teaching materials. Table 2 shown the data on the percentage of material validation results.

Table 2. Percentage of Matter Validation II Test Result

Validation Aspect	Rate	Max	%	Qual.	Decision
Matter Organization	21	28	75	Good	Partial Revision
Matter Depth	13	16	81	Good	Partial Revision
Matter Update	12	16	75	Good	Partial Revision
Applications and Enrichments	9	12	75	Good	Partial Revision
Percent of Overall	55	72	76	Good	Partial Revision

The calculation results of the percentage of all aspects of material expert validation are in the very good category, and the decision is partially revised. Revisions are in the form of strengthening the original image, representative formulas, specific material, and sharp practice questions.

The percentage of data from the validation results by learning design experts is calculated and matched with the eligibility criteria for teaching materials. Table 3 shown the data on the percentage of learning design validation results.

Based on Table 3, all aspects of the validation of the learning design are in the good category with partial revision test decisions, both for completeness of presentation and feasibility of graphics. The parts that must be revised according to the percentage of product feasibility are the presentation completeness section, cover design, and layout harmony.

Table 3. Percentage of Learning Design Validation Test Result

Validation Aspect	Rate	Max	%	Qual.	Decision
Presentation Equipment					
Introduction	8	12	66	Adequate	Revision
Main	9	12	75	Good	Revision
End part	14	20	70	Good	Revision
Desain Cover					
Layout	7	8	87	Very Good	No Revision
Composition and Elemental Size	3	4	75	Good	Partial Revision
Letter	13	16	81	Good	Partial Revision
Teaching Material Content Design					
Reflection of Content	12	16	75	Good	Partial Revision
Layout Harmony	6	8	75	Good	Partial Revision
Layout Completeness	15	20	75	Good	Partial Revision
Content Typography	16	20	80	Good	No Revision
Percent of Overall	103	136	75.9	Good	Partial Revision

The percentage of data validation results by linguists is calculated and matched with the eligibility criteria for teaching materials. Table 4 shown the percentage data from the validation of linguists.

Table 4. Percentage of Language Validation Test Result

Validation Aspect	Rate	Max	%	Qual.	Decision
Conformity with language rules	10	12	83	Good	Partial Revision
Consistency of paragraph structure	9	12	75	Good	Partial Revision
Digestibility description	11	16	69	Adequate	Revision
Coherence and linkage of thoughts	17	24	71	Good	Partial Revision
Conformity with the correct Indonesian	15	20	75	Good	Partial Revision
Percent of Overall	65	84	74.58	Good	Partial Revision

The calculation results of the percentage of all aspects of the linguist's validation are in a good category, and the decision of the partial revision test. Revisions are made on the results of input on teaching materials. Revisions are reducing sentences that are too long,

eliminating repetition of words in one sentence, increasing the linkage between ideas between paragraphs, and using symbols, especially formulas using representative symbols.

The trials were small group trials, namely ten students per study program. This trial phase was conducted to determine the effectiveness and readability of teaching materials. Table 5 shown the data presentation of the results of small group trials.

Table 5. Percentage of Small Group Test Result

Validation Aspect	Rate	Max	%	Criteria
Cover display (book cover)	89	120	74	Good
Topic/ Chapter title	85	120	71	Good
Matter systematic presented	91	120	76	Good
Simple and straightforward language	95	120	79	Good
Presented material	93	120	77	Good
Matter application	92	120	76	Good
Matter essential	87	120	72	Good
Summary	89	120	74	Good
Evaluation	87	120	72	Good
Communicative language	89	120	74	Good
EYD appropriate language	83	120	69	Adequate
Easy to understand terms	93	120	77	Good
Help study	100	120	83	Adequate
Percent of Overall	355	440	75.19	Good

The results of the calculation of the percentage of all aspects by students are in a good category. The teaching materials that have been tested are still going through the revision stage. The revision is based on suggestions and input from students regarding the attractiveness of teaching materials, typing errors, errors in using punctuation marks, and errors in using capital letters.

Students want that the content in these teaching materials does not need to include supporting materials, such as educational theory, research theory, and philosophy of education. The researcher approved this input so that the teaching materials did not widen. Some students want this teaching material as the primary material in the subject of research and teaching methodologies.

Based on comments and suggestions, it shows that the teaching materials developed are exciting, and the delivery of content or material can be understood by students even though there are some notes from students that typos, commas, and capital letters. Generally, a typo is sometimes automatically spelled in English because of the Microsoft word format. In the comma, the author's details are revised according to student observations, and capital letters are edited.

Teaching materials that have been tested on students get good qualifications in all of their components. Students' comments and suggestions are used as the basis for improvement to producing printed teaching materials entitled to research and teaching methodology that can be used as the primary teaching materials in the learning process. The large group trials are more or less the same as those found to be small groups, in the Good category with a total score of 3596, a maximum score of 4680, and an average score of 76.83 out of 90 students.

The analysis of the accumulation of data obtained from the validator stated that the product of the developed teaching material needed to be partially revised with a percentage

level of 76.37% with good criteria and suitable for use. Thus the product of the developed teaching material could be well received. The developed teaching material product received approval from the validation expert with a partial revision test decision according to important notes as a reference. Table 6 shown the recapitulation of expert validator data.

Table 6. All Validation Result Recapitulation

Validator	%	VG	G	A	L	VL	Decision
Matter Expert I	79	-	√	-	-	-	Partial Revision
Matter Expert II	76	-	√	-	-	-	Partial Revision
Design Expert	75.9	-	√	-	-	-	Partial Revision
Language Expert	74.58	-	√	-	-	-	Partial Revision
Average	76.37	-	√	-	-	-	Partial Revision

Note: VG (Very Good), G (Good), A (Adequate), L (Less), VL (Very Less)

Product revisions are based on judgments and suggestions from experts and test subjects. Product revision includes content, presentation, graphics, and grammar improvement. Product revision aims to improve the product to be feasible and ready to be used in authentic learning. The draft of the revised product is the final draft ready to be used in learning.

The development of teaching materials is based on a needs analysis which includes needs analysis and concept analysis, which refers to the 4-D development stage (Thiagarajan et al., 1974). Based on the needs analysis conducted using interview techniques and document analysis of the Semester Lecture Plan (RPS) for the Research and Teaching Methodology course at FKIP, USN Kolaka, it was found that students lacked learning resources. At the design, research, and development stage, it takes the format of printed teaching materials in the form of teaching materials. The structure of the teaching materials is chosen based on consideration of the needs in the field. According to Rusilowati et al., (2016) on research on the development of teaching materials, needs analysis determines whether research is required or not.

This research and development produce a product in the form of teaching materials for the Research and Teaching Methodology course. These teaching materials are integrated with curriculum analysis from three study programs representing science, language, and social science and various related reference sources to support the learning process in the Indonesian Language Education, Mathematics Education, and Geography Education Study Program, FKIP, USN Kolaka. According to Alba et al., (2019) teaching materials should be developed by curriculum developments.

Teaching materials are printed using custom size paper with font sizes and variations that align with the Deepublish publisher. The cover design is made more attractive than the design on the content or material page or in the text of teaching materials. In the picture, a description is given that functions as a medium for explaining the material description in a large portion in Deepublish format. The purpose of printing is to make it easy for students to learn the content or material presented and interesting to read. According to Prawindia et al., (2016), the development design model's determination determines the book's attractiveness be read, such as the Cambridge model in presenting geography material.

Improvements in substance and appearance are based on evaluating suggestions from validators and test subjects. At the validation stage, it was declared that it was feasible to use and the results of field trials in small or large groups. In general, students are enthusiastic

about learning the teaching material products that have been developed. Inputs and suggestions become material for revision related to the content, presentation, and language feasibility. Some notes from each validator need to be revised again before being tested. The final revision of the product development is based on the assessment and suggestions of student responses as users of teaching material products. Input from experts and group testing must be followed up by development researchers, except in certain parts where the refusal can be explained scientifically (Adriani et al., 2019; Andrinata et al., 2016; Haifurrahmah et al., 2020; Permata et al., 2017).

Based on this assessment, revisions were made to the completion stage of the development of teaching materials. The product review that has been revised includes three things, namely the text content component, the presentation component, and the language component. These three scopes are elaborated and followed up to revise the product of teaching materials for research and teaching methodologies. According to Wijayanti and Zulaeha (2015) material experts are the first consideration before other experts. The language aspect is a perfect touch for developing teaching materials to be more communicative, polite, and technical (Wijayanti and Zulaeha, 2015).

Material that is too general is reduced. Materials that are specific to research and teaching are reproduced. The material is equipped with authentic images along with the source of the picture. Practice questions are made per chapter and are technical, which can be applied in all study programs of the research object. According to Wijiningsih et al. (2017), the content of the material and practice questions are the key to developing books to be applied in learning.

The cover design with a representative layout and font size makes the material more attractive. The header and footer design give the name and summary of the title alternately, becoming a spice for the attractiveness of the material. The layout of the image is also considered, including the size of the picture. According to Mau, Nurchasanah, and Martutik (2019), the layout of the cover components, font size, typeface, size, and location of images are considered in the design of developing teaching materials.

Aspects of language that concern the revision are rechecking typos, punctuation marks, and capital letters. Checking foreign words in italics is always carried out to improve development results. Revising sentence effectiveness, trimming sentences that are too long, revising words that are repeated in one sentence, integrating ideas between paragraphs, and checking the use of symbols in sentences are also concerns in language revision. According to Tegeh and Kirna (2013), typos often appear in the development of teaching materials that need to be checked by many people through validation and testing.

Suggestions for this development are, first, the development of teaching materials for research and learning methodologies is expected to make lecturers more creative in preparing more specific teaching materials as learning resources. Second, students are expected to be able to take advantage of teaching and research methodology teaching materials for classroom lectures. Third, the product of teaching materials as a result of this development is not only in the form of theoretical but also practical application in courses, so that it can attract attention and motivate students to learn to explore their knowledge in the learning process, especially about research methodology. The benefits of development can be seen from the percentage of evaluation of the validation and trial processes. The higher, the better, and this benefit can be explained (Alba et al., 2019; Wijiningsih et al., 2017).

This teaching material was developed by the characteristics of the material for the Indonesian Language Education Study Program, Mathematics Education, and Geography

Education, FKIP, USN Kolaka. The effectiveness of teaching materials with summative evaluation at the dissemination stage. The dissemination stage given to students (Munandar et al., 2022). The dissemination also the general public because the material is published nationally through the publisher of Deepublish IKAPI Members with the product HL et al. (2022). Dissemination is also carried out by participating in international seminars to be published in the proceedings. According to Indrawini et al. (2017), Development dissemination spreads directly at the city level, for example, through professional associations, seminars, and book publishing.

Conclusion

The results showed that the teaching materials had been compiled based on the 4D Step with the Deepublish model. The average validation result is 76.37% with good qualifications, and the average test decision is feasible with revisions in certain sections. The test results of small group students obtained 75.19% or good qualifications. The results of the large group trial obtained 76.83% or good qualifications. These results show the teaching materials are ready to be published.

Recommendation

This development is limited to material in three study programs that represent social, science, and language. Specifically, it is necessary to specify the development per study program. The development of teaching materials should be carried out experimental research to test the effect of the product on the ability to write scientific papers.

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