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Testing the Feasibility of Practical Student Worksheets Based on the Soil Testing Module Learning

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***Abstract*—This research aims to develop and assess the feasibility and attractiveness of learning media in the subject of soil mechanics practicum in terms of practical student worksheets based on learning modules for soil testing, which functions as an understanding of the concepts contained in soil testing so that students can correctly interpret the data at the end of the lesson, and it can be used as a basis for knowledge in the work of civil engineering, especially in soil investigation. This research uses three stages of the 4D model, that is, define, design and develop, The subject of the research is the students of civil engineering, that takes the subject of soil mechanics practicum and the object of the research is a practical student worksheets that is validated by four validator (two media of validator and two subject matters of validator), From the result of the validator test carried out, it is found that students worksheets are valid or very suitable for use as teaching materials in the subject of soil mechanics practicum.**

Keywords—practicum, soil testing, worksheets

I. INTRODUCTION

Soil testing is an activity to determine the carrying capacity and characteristics of the soil and the condition of geological, such as knowing the structure of the layer of soil/ soil properties, knowing the strength of the layer of soil in the context of investigating the subgrade for building foundation, road or other construction purposes. Soil testing is carried out in two jobs, that is soil investigation is carried out in the area and soil testing is carried out in the laboratory [1].

Soil testing learning in the subject of Soil Mechanics practicum is to apply and analyse the concept of Soil Mechanics through the process of investigating and analysing and interpreting data from the results of soil testing in the scope of job of Civil Engineering.

Soil investigation are obtained in undergraduate level, in the scope of Civil Engineering, in the subject of Soil Mechanics. the subject of Soil Mechanics is taught so that the students are able to analyse and apply the concept of Soil Mechanics within the scope for job of Civil Engineering, and the application of analysis of the concept of Soil Mechanics is contained in the subject of Soil Mechanics Practicum. In the Soil Mechanics practicum, students will be required to be able to do learning experimental about soil testing to obtain the soil parameters that are needed to apply the concept of Soil Mechanics.

The activity of the students in the practical activities are more than the activity of the students in the classroom. In this case, the practicum has an important role to increase the activity of the students in learning and strengthen of the understanding of concepts in the theory. the Students need guidance activity that is carried out in the laboratory so that practicum activities in learning can run effectively. There are various kinds of teaching materials that can be used in the learning process. Student worksheets is one of the types of printed material that is often used by the lectures in the process of learning [2].

Student worksheets is one of resource that can be in the learning that can be developed by educators as facilitators in the activity of learning [3]. The purpose of making practical student worksheets at least have four objectives, those are: First, to present teaching materials that make it easier for the students to interact with the material that is given. Second, presenting assignments that improve the student mastery of the material that is given. Third, training independence in the learning process for the students. Fourth, the goal is for the teaching staff in giving assignments to the students. every student worksheet is prepared with the certain materials and assignments that are packaged in such a way for a specific purpose [4].

Student worksheets are assignments that contain what students must do. Activity sheets are usually in the form of instructions, the steps to complete a task. A task ordered in the

activity sheet must be clearly related to the basic competencies that will be achieved [5].

Student worksheets are sheets that contain assignments that must be done by students. The student activity sheet will at least contain; degree, the student's desired competency, completion time, equipment/materials needed to complete tasks, brief information, work steps, tasks to be completed, and reports that must be completed [6].

The process of learning for the Soil Mechanics Practicum uses teaching materials in the form of guidebook and module. The module is created as an effort to improve the effective of learning process, especially in terms of procedures and analysis of testing data, but there are still mistakes in interpreting the results of the testing data [7]. From the results of the observations that have made, possible mistakes that occur are due to (1) the Students are only able to follow the work steps that are shown in the module and guidebook; (2) the Students do not understand the concept in analysing test results; (3) The laziness of the students to read other textbooks make the solution in interpreting and analysing data to be erroneous.

Based on the difficulties are experienced by the students in interpreting and analysing the data, it shows the importance of understanding the concepts that are contained in testing soil. Therefore, understanding the previous concept in Soil Mechanics is a prerequisite to understanding the next concept, because the concept will be used by the students in understanding the subject that is related to soil, such as Foundation Engineering, Geotechnical Applications, Stockpiles and Soil Retaining Construction, so that the implications for the study must be gradual and sequential in a systematic manner and based on the past learning experiences.

Looking at the problems above, one of the solutions to answer this problem is that the researcher wants to develop and assess the feasibility and attractiveness of the learning media in the soil mechanics practicum subject in terms of practical worksheets based on the soil testing learning module [8], which serves as an understanding of the concepts There is in soil testing so that the student worksheet that will be developed and used for students can interpret the data correctly at the end of the lesson, and can be used as a knowledge base in civil engineering work, especially in soil investigation.

II. METHODS

This study is the types of research and Development (R&D) with reference to the modification of the Thiagarajan, Dorothy S. Semmel, and Melvyn I 1974 [9] consist of 4 stages, those are Define, Design, Develop and Disseminate. and Borg & Gall's model are a basic research activity to obtain information about the need assessment, then it is continued the activity of development to produce a product [10].

The subjects in this study were students of the Civil Engineering study program who took the soil mechanics practicum course, with the low, medium, and high ability categories and a soil mechanics practicum lecturer.

The steps of development consist of Define (research and collect the information, Design (planning, media selection, format selection and initial product form development, develop) (validation by validators, product revision and preliminary test, field trial, testing the effectiveness, dissemination (implementation) [11].

In the product feasibility test a validation section by the validators, which mean that the feasibility of worksheets is assessed based on the results of the validation that have been done by the validators. This feasibility test is done by material experts, media experts and one of the team of instructors in the subject of the soil mechanics practicum (practitioner).

The feasibility test is based on a validation process that is done by material experts with a minimum educational qualification of postgraduate and a minimum of experience for five years with material experts experience in the scope of Geotechnics, media experts who have experienced in the scope of Graphic Design and one of the team of instructors in the subject of soil mechanics practicum (practitioner).

A. Types of Data

In this research, data collected in empirical studies can be either quantitative or qualitative data. Quantitative data includes numbers and classes, while qualitative data includes words, descriptions, pictures, diagrams, etc. Quantitative data were analysed using statistics, while qualitative data were analysed by categorization and sorting [12].

Quantitative data were obtained from the validator and lecturer assessment scores on the assessment sheet [13]. Data is in the form of a scale with a range of 1 to 5 which states the suitability of the product with the statement contained in the assessment sheet [14].

B. Research Instrument

The research instrument was a questionnaire. The questionnaire in this study contains a Likert scale made in the form of a questionnaire or questionnaire with a checklist which aims to obtain an assessment/validation from the validator, namely material experts, media experts and soil mechanics practicum lecturers, which then the results of the Likert scale are translated by interval analysis. In order to be calculated in quantitative form, the answers of these respondents can be given weighted scores or Likert scores such as Very Good/Very Suitable with a score of 5, Good/ Appropriate with a score of 4, Fairly Good/Doubtful with a score of 3, Deficient /Unsuitable with a score of 2, and Very Deficient/very inappropriate with a score of 1 [15]. The following is a questionnaire based on the teaching material assessment standards [16].

1) Materials experts: Assessment by material experts is used to determine the feasibility of the worksheets. Content appropriateness includes quality of content, presentation and language are used [16]. It is shown as in the Table I below:

TABLE I. MATERIAL EXPERT ASSESSMENT

No	Assessment Aspects	Statement	
1	Quality Of Content	1	Completeness of learning materials in accordance with basic competencies
		2	Accuracy of concepts and definitions based on learning objectives
		3	Accuracy of data and facts
		4	Soil testing material given is effective
		5	Suitability of the experiment with the material presented
		6	The experiment instructions are clear and complete
		7	The accuracy of the terms used
		8	Conformity with the development of science and technology
		9	Suitability of evaluation questions with indicators of concept understanding
2	Presentation	10	The arrangement of material in the student worksheets are systematic
		11	The introduction to each material is consistent and effective
		12	Activities that involve students are quite interesting
		13	Encourage the curiosity of students
		14	Creating student questioning skills
3	Language	15	The accuracy of the sentence structure used
		16	The effectiveness of the sentences used
		17	The standardized level of the language / terms used
		18	Language is easy to understand
		19	Accuracy of language and spelling

2) Media experts: Assessment by media experts is used to determine the feasibility of the resulting media (presentation and graphic feasibility). The aspects are assessed include appearance, consistency, use of letters and physical criteria [16]. it is shown as in the Table II below:

TABLE II. MEDIA EXPERT ASSESSMENT

No	Assessment Aspects	Statement	
1	View/Layout	1	The arrangement / layout of the initial appearance of the student worksheets are attractive
		2	The student worksheets background display is interesting
		3	The suitability of the image with the content of the student worksheets
		4	The appearance of the student worksheets cover is attractive
		5	The combination of colours (fonts) on the student worksheets display is harmonious and attractive
		6	The clarity of the appearance of letters in student worksheets
		7	The attractiveness of the student worksheets layout display

Table II. Cont.

No	Assessment Aspects	Statement	
			student worksheets are consistency with the table of contents
		9	Consistent use of letters per page
3	Use Of Letters	10	The typeface (font) used is interesting
		11	The use of variations of letters (fonts) is not excessive
		12	Use of spacing between lines is appropriate
		13	Main title and sub-title level, clear and proportionate
4	Physical Criteria	14	Main title and sub-title level, clear and proportionate
		15	Be able to reveal the meaning/meaning of objects
		16	Design creativity

3) Lecturer who teaches the subject: Assessment by lecturer expert of the subject aims to determine the appropriateness of worksheets when it is used in learning. The aspect are assessed include material, presentation, worksheet and language [16]. it is shown as in the Table III below:

TABLE III. ASSESMENT BY THE LECTURE OF THE SUBJECT

No	Assessment Aspects	Statement	
1	Material	1	Material conformity with basic competencies
		2	The depth of the material is in accordance with the learning objectives
		3	Systematics of material presentation
		4	Suitability of the material with the development of science
		5	The accuracy of the concepts and definitions used
		6	Accuracy of data and facts
		7	The accuracy of that term used
2	Presentation	8	The student worksheets appearance is attractive
		9	Consistency of student worksheets contents with table of contents
		10	The contents of the student worksheets are clearly printed
		11	The student worksheets contains interesting supporting pictures
		12	Presents the content of the soil testing worksheet
		13	Encourage student curiosity
		14	Creating ability ask the student
3	Worksheet	15	Soil testing makes it easier for students to understand the concept
		16	The variety of material listed on the worksheet is interesting
		17	Placement of soil testing material content
		18	The contents in the worksheet displayed interesting
4	Language	19	Instructions for use of student worksheets easy to understand
		20	Instructions for assignments & practicum easy to understand
		21	Terms used in student worksheets it can be understood
		22	Sentences in LKMP are easy understood

C. Data Analysis Techniques

The data analysis technique in this research is data analysis of the needs of student worksheet product development using qualitative descriptive techniques and will be explained in a narrative. This data analysis includes a preliminary study of the student's condition, material / concept and learning objectives. The assessment of the student worksheets is based on the soil testing learning module by experts and practitioners using quantitative analysis.

Data collection techniques in this study used non-test techniques to determine the feasibility of the worksheets. Non-

test techniques consist of observation, interviews or discussions, review of documents and questionnaires. Data processing in this study was carried out using qualitative and quantitative analysis with the validity and feasibility of student worksheets data. After the data is analysed, it will be used to revise the developed worksheets in order to obtain worksheets that match the specified criteria, namely valid, practical and effective.

The steps used to determine the criteria for the validity of the worksheets are as follows: (1) Data in the form of a questionnaire in the form of scores obtained from expert judgment through an assessment sheet consisting of 5 assessments, namely Very Poor. (score 1), Bad (score 2), Fairly Good (score 3), Good (score 4), and Very Good (score 5); (2) Data in the form of scores obtained from experts through validation sheets; (3) The total score obtained in the subsequent research is analysed by using descriptive quantitative evaluation techniques that describe and interpret each component compared to the reference criteria based on the ideal average score (Mi) and the ideal standard deviation score (sbi) using the formula developed by Eko [17] and Toharuddin [18]. The determinations (Mi) and (sbi) are presented in Table IV below:

TABLE IV. CONVERSION SCORE ON SCALE OF 5

Range Of The Score	Category
$X > \overline{X_i} + 1{,}8\ sbi$	Very Good
$\overline{X_i} + 0{,}6\ sbi < X \leq \overline{X_i} + 1{,}8\ sbi$	Good
$\overline{X_i} - 0{,}6\ sbi < X \leq \overline{X_i} + 0{,}6\ sbi$	Fairly Good
$\overline{X_i} - 1{,}8\ sbi < X \leq \overline{X_i} - 0{,}6\ sbi$	Deficient
$X \leq \overline{X_i} - 1{,}8\ sbi$	Very Deficient

With; Xi: Actual score (empirical); Mi: The ideal mean, calculated using formula (Mi = ½ (ideal maximum score + ideal minimum score); SBi: Ideal standard deviation, determined by formula (SBi = 1/6 (ideal maximum score - ideal minimum score)

In this research, (Based on Table I), the worksheets are said to be valid if it fulfils qualitative criteria with Good minimum. And practicality using a Likert scale does not allow the statement of neutral items. So that there are only two statements on a Likert scale, a positive item statement and a negative item statement as suggested by Acting [19]. And grouped as in Table V below:

TABLE V. RESPONSE ATITUDE CATEGORY

Response Attitude Category	Category
Very Positive Attitude	$Kuartil\ 3 \leq X \leq skor\ maksimal$
Positive Attitude	$Median \leq X < kuartil\ 3$
Negative Attitude	$Kuartil\ 1 \leq X < median$
Very Negative Attitude	$Skor\ Minimal \leq X < Kuartil\ 1$

Where; (1) Minimum: The minimum of score that is obtained by each respondent is multiplied by the number of respondents; (2) Quartile I: The sum of the minimum total scores with the median divided by two; (3) Median: The sum of the maximum total score with the minimum total score divided by two; (4) Quartile 3: The sum of the maximum scores with the median divided by two. (5) Maximum: The maximum score obtained by each respondent multiplied by the number of respondents.

Practicality data from the worksheets consist of data on the results of research of the lecturer in the subject of Soil Mechanics practicum. Before determining criteria for practicality, first of all, it is determined the minimum value, quartile 1, median, quartile 3 and the maximum value of the worksheets. It is Similar with the validity assessment; a worksheet is said to be practical if it fulfils the minimum qualitative criteria for positive classification.

III. RESULTS AND DISCUSSION

This student worksheet is validated by two experts, that is material and media experts, and 1 practitioner. Material validator by Mrs. Ir. Jupriah Syarifah MT and Mr. Ir. Husin Gultom, MT (the lecturers of Geotenic expert). Media Validators by Mrs. Nurhasanah S.Sos., M.I.Kom and Mr. Faizal Hamzah Lubis, S.Sos., M.I.Kom (the lecturers of Graphic Design expert). Practitioner validator by Mr. Ir. Hamidun Batubara, MT.

A. Feasibility of Material Experts

The feasibility of the material aspect consists of 3 aspects. that is *the content of the quality* aspect with 9 points of the test for the assessment aspect, the *presentation* aspect with 5 points of the test for the assessment aspect, and the *language* aspect with 5 points of the test for the assessment aspect. The results of material expert validation, as in the figure 1 below:

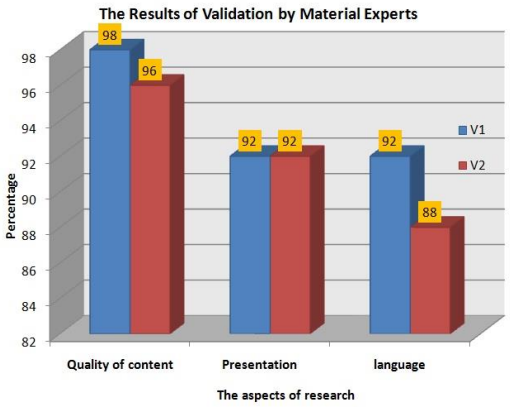

Fig. 1. Diagram of the results of material validation expert.

The percentage results shown in Figure 1 are obtained from the average score of the questionnaire validation data (Table I). and from the average score, the mean value of validator 1 is 93.93% and the mean value of Validator 2 is 91.85%, so that if the average value of the validator is combined and averaged, it will get a value of 92.89%. then from this value is converted into Table IV, it will get a **very good** category (with min = 19; max = 95; Xi = 57; and Sbi = 19). The score and score table is shown in Table VI below:

TABLE VI. MATERIAL EXPERT ASSESMENT ASPECTS

No	Assessment Aspects	Average Mark		(%)	
		V1	V2	V1	V2
1	Quality Of Content	4,9	4,8	98	96
2	Presentation	4,6	4,6	92	92
3	Language	4,6	4,4	92	88
			Total	93,93	91,85
			Average	92,89	
			Category	**Very good**	

Where, V is the validator

B. *Feasibility of Media Experts*

The feasibility of the media aspect consists of 4 aspects, that is the *view* aspect with 7 points of the test for the assessment aspect, the *consistency* aspect with 2 points of the test for the assessment aspect, *Use of the Letters* aspect with 4 points of the test for the assessment aspect and the *physical criteria* aspect with 3 points of the test for the assessment aspect. The results of the validation by media experts are shown in the form of a diagram, it is obtained as in the Figure 2 below:

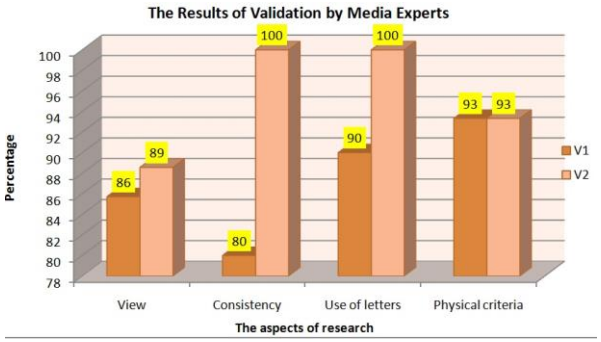

Fig. 2. Diagram of the results of media validation expert.

The percentage results shown in Figure 2 are obtained from the average score of the questionnaire validation data (Table II). and from the average score, the mean value of validator 1 is 87,26 % and the mean value of Validator 2 is 95,47%, so that if the average value of the validator is combined and averaged, it will get a value of 91,37%. then from this value is converted into Table IV, it will get a **very good** category (with min = 16; max = 80; Xi = 48; and Sbi = 16). The score and score table is shown in Table VII below:

TABLE VII. MEDIA EXPERT ASSESMENT ASPECTS

No	Assessment Aspects	Average Mark		(%)	
		V1	*V2*	*V1*	*V2*
1	View	4,3	4,4	85,71	88,57
2	Consistency	4,0	5,0	80	100
3	Use Of Letters	4,5	5,0	90	100
4	Pysical Crireia	4,7	4,7	93,33	93,33
Total				87,26	95,47
Avarage				91,37	
Catagory				**Very good**	

Where, V is the validator

C. *Feasibility of Practitioner*

The feasibility of testing practical aspect is done by the lecturer who teaches the subject of soil mechanics practicum consists of 4 aspects, that is the *material* aspect with 7 points of the test for the assessment aspect, the *presentation* aspect with 7 points of the test for the assessment aspect, the *worksheets* aspect with 4 items of the test for the assessment aspect and the *language* aspect with 4 assessment aspect items of the test. The results of the response by the Lecturer who teaches the subject is shown in the form of a diagram, it is obtained as in the Figure 3 below:

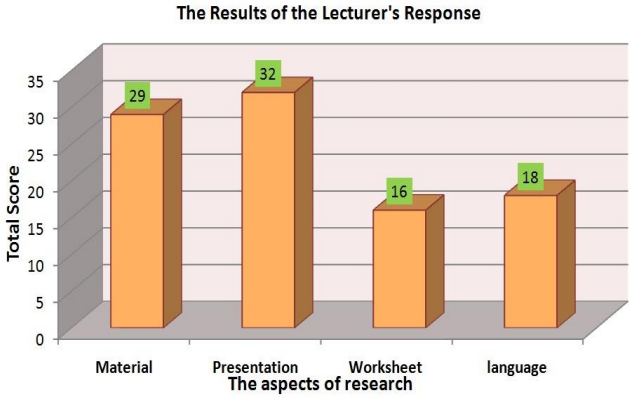

Fig. 3. Diagram of the results of material validation lecture.

The percentage results shown in Figure 3 were obtained from the validation questionnaire (Table III). and from the questionnaire obtained a total value of 95. Then from the total value is converted to table VI it will get the value of a **Very Positive Attitude** category (with min = 22; max = 110; me = 66; Q1 = 44; and Q3 = 88). The results of the responses by the lecturer of the subject is as in the Table VIII below:

TABLE VIII. ASPECTS OF RESPONSE ASSESMENT BY THE LECTURE OF THE SUBJECT

No	Assessment Aspect	Score	(%)
1	Material	4,1	82,86
2	Presentation	4,5	91,43
3	Worksheet	4	80
4	Language	4,5	90
Total/Avarage		95	86,07
Catagory		**Very Positive Attitude**	

From the three feasibility tests that have been done by the three validators (media, material and practice), the worksheets are feasible to be developed, because the scores that are obtained are into the feasible and practical category. it means that the use of worksheets based on soil examiner learning modules can enable students to learn independently so that they can foster student activities deeper in the management of those who have them and can instil independent character and responsible , that also contained in the research of Wahyuni et al [20] and Keristiana et al [21] about the use of student worksheets, they state that by using the worksheets can form

the knowledge and skills to form better and longer from the knowledge that has possessed by the students.

IV. Conclusion

Development of Practice Student Worksheets based on the Soil Testing learning module using the 4D model (Define, Design and Develop) and the Feasibility test of Practice Student Worksheets has been carried out by 3 validator experts (media, materials and practitioners) so that the results are very good / valid / very feasible to be used as a teaching material in the subject of soil mechanics practicum because to get a decent product must be classified as good and responsive.

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References

[1] H.C. Hardiyatmo. Teknik Fondasi I. Yogyakarta: Beta Offset, 2002.

[2] S.F.A. Yudha, "Validity of student worksheet based on guided inquiry learning model assisted by digital practicum tool," In Journal of Physics: Conference Series, vol. 1185, no. 1, p. 012058, 2019.

[3] E. Widjayanti, Kualitas Lembar Kerja Peserta Didik. Yogyakarta: Seminar Pelatihan Penyusunan LKPD, 2008.

[4] U. Töman, A.R. Akdeniz, C.S. Odabasi and F. Gürbüz, "Extended Worksheet Developed According to 5E Model Based on Constructivist Learning Approach," Online Submission, vol. 4, no. 4, pp. 173-183, 2013.

[5] S. Salirawati, Universitas Negeri Yogyakarta [Online]. Retrieved from: Http://Staff.Uny.Ac.Id/Sites/Default/Files/Pengabdian/Das-Salirawati-Msi-Dr/19penyusunnan-Dan-Kegunaan-Lks.Pdf, Accessed on January 9, 2017, 2014.

[6] Depdiknas, Panduan Pengembangan Bahan Ajar. Depdiknas, 2008.

[7] S. Suhairiani, H.P. Nahesson and E.K. Sinaga, "The Use Of A Tutorial Video-Aided Learning Module On Soil Mechanical Practicum," International Journal of Scientific & Technology Research, vol 8, no. 12, pp. 3301 -3305, 2019.

[8] S. Suhairiani, H.P. Nahesson and E.K. Sinaga, Modul Pembelajaran Pengujian Tanah. Medan: Yayasan Kita Menulis, 2019.

[9] S. Thiagarajan, S.S. Dorothy and I.S. Melvyn, Instructional Development for Training Teachers of Exceptional Children. Bloomington: Indiana University, 1974.

[10] W.R. Borg and M.D. Gall, Educational research: an introduction (7th ed.). New York: Longman, Inc, 2003.

[11] N. Nieveen and E. Folmer, "Formative evaluation in educational design research," Design Research, vol. 153, pp. 152-169, 2013.

[12] P. Runeson and M. Höst, "Guidelines for conducting and reporting case study research in software engineering," Empirical software engineering, vol. 14, no. 2, pp. 131, 2009.

[13] S.I. Kholida and I.K. Mahardika, "Development Of Work Sheet Students In Guided Inquiry Based On The Game Education Using Macromedia Flash," In Journal of Physics: Conference Series, vol. 1569, no. 2, p. 022006, 2020.

[14] S. Sukardjo, Desain Pembelajaran Evaluasi Pembelajaran, Hand-out Perkuliahan. PPs Universitas Negeri Yogyakarta, 2008.

[15] S.S. Choo, J.I. Rotgans, E.H. Yew and H.G. Schmidt, "Effect of worksheet scaffolds on student learning in problem-based learning," Advances in health sciences education, vol. 16, no. 4, pp. 517, 2011.

[16] U. Purwono, Standar Penilaian Bahan Ajar. Jakarta: BSNP, 2008.

[17] P.W. Eko, Evaluasi Program Pembelajaran. Yogyakarta: Pustaka Belajar, 2010.

[18] U. Toharudin, "Critical thinking and problem solving skills: How these Skills are needed in Educational Psychology," International Journal of Science and Research (IJSR), vol. 6, 2015.

[19] S. Ating and A.M. Sambas, Statistika Dalam Penelitian. Bandung: Pustaka Setia, 2006.

[20] N. Wahyuni, W. Hadi and A. Adisahputra, "Development of Character-Based Thematic Student Worksheets," In 4th Annual International Seminar on Transformative Education and Educational Leadership (AISTEEL 2019). Atlantis Press, 2019.

[21] E.K. Sinaga, Z. Matondang, S. Suhairiani and S.Z. Yuzni, "Efektifitas Penggunaan Lembar Kerja Mahasiswa Berbasis Penemuan Terbimbing Pada Materi Matriks Mahasiswa Program Studi Pendidikan Teknik Bangunan Studi," Educational Building Jurnal Pendidikan Teknik Bangunan dan Sipil, vol. 5, no. 2 DES, pp. 82-86, 2019.