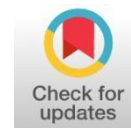


Developing Inquiry-Based Worksheet to Explore The Mathematics Critical Thinking for Seventh Grader Students



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Abstrak

Penelitian ini bertujuan untuk mengembangkan Lembar Kerja Peserta Didik (LKPD) berpendekatan inkuiri terbimbing yang memenuhi kriteria valid dan praktis. Jenis penelitian adalah *research and development* (R&D). Model pengembangan yang digunakan adalah model 4D yang terdiri dari tahap *define, design, development, and disseminate*. Penelitian ini melibatkan validator materi, validator media, dan siswa SMP Islam Al Azhar 26 Yogyakarta. Data penelitian diperoleh dari hasil penilaian menggunakan lembar validasi dan angket respon siswa. Skor rerata hasil penilaian dari validator materi sebesar 74 dengan kriteria tingkat validitas sangat baik, dari validator media sebesar 127,5 dengan kriteria tingkat validitas sangat baik, dan dari uji kepraktisan kelompok besar diperoleh rerata sebesar 88 dengan kriteria tingkat kepraktisan sangat baik. LKPD dinyatakan valid dan praktis berdasarkan tahapan pengembangan dan kriteria yang ditetapkan, dan selanjutnya bisa digunakan untuk mengeksplorasi kemampuan berpikir kritis siswa.

Kata kunci: Pengembangan LKPD, Berpikir Kritis, Inkuiri Terbimbing, 4D

Abstract

This study aims to develop student worksheets with a guided inquiry approach that meets valid and practical criteria. This type of research is research and development (R&D). The development model used is a 4D model consisting of define, design, development, and distribute stages. This study involved material validators, media validators, and students of Al Azhar 26 Islamic Junior High School Yogyakarta. The research data was obtained from the results of the assessment using a validation sheet and student response questionnaires. The average score of the assessment results from the material validators is 74 with very good validity level criteria, and the media validator average score is 127.5 with very good validity level criteria. The average score of the large group practicality test results is 88 with very good practicality criteria. Student worksheets are declared valid and practical based on the stages of development and established criteria, which can then be used to explore students' critical thinking skills.

Keyword: Critical Thinking, Guided Inquiry, Student Worksheet Development, 4D

INTRODUCTION

Mathematics is a subject that must be taught at the junior high school level in Indonesia. One of the objectives of teaching mathematics at this level is to equip critical thinking skills (Depdiknas, 2006). The government supports this goal by orienting the learning process on mastering critical thinking skills, creativity, collaboration, and communication or known as the 4Cs (Makhrus et al., 2018, p.125). This government support is based on the identification of the US-



based Partnership for 21st Century Skills (P21), which states that one of the competencies needed in the 21st century is critical thinking (P21, 2013).

Critical thinking is defined as the ability to think reflectively and reasoned about what is believed and will be done (Ennis, 2011). Critical thinking is a complex thought process, and requires a high level of cognitive in processing information (Choy & Cheah, 2009). Critical thinking skills are one of the skills that are needed in facing the challenges of life in the era of the digital revolution (Kalelioglu & Gulbahar, 2014). Critical thinking ability is very important for life in the future, but until now the critical thinking ability of students in Indonesia is still low. This can be seen from the results of the International Program for International Student Assessment (PISA) study which shows the ability level of students in Indonesia is still below the international average (Mita et al., 2019). The results of PISA 2018 state that students' mathematical abilities in Indonesia are ranked 73 out of 79 participating countries, with an average score of 379 (Schleicher, 2018). The test questions used in PISA are of the High Order Thinking Skills (HOTS) type, one of which requires students to think critically. So when viewed from the results of PISA it can be concluded that the critical thinking ability of students in Indonesia is low.

The PISA report can be used as a strong reason to revamp the system and program for everything in education in Indonesia (Pratiwi, 2019). Researchers feel challenged to participate in making improvements to the ongoing learning process in one school unit, especially improvements in an effort to improve students' critical thinking skills. The first step taken by the researchers was to make observations at Al Azhar Islamic Junior High School 26 Yogyakarta. The researcher gave a pretest of critical thinking skills to class VII students. The pretest questions used contain indicators of critical thinking skills adapted from Facione (2011). The purpose of giving pretest questions is to determine the level of critical thinking skills of students in the school. The results of the pretest can be seen in Table 1.

Table 1. Critical Thinking Ability Pretest Results

Critical Thinking Indicator	Completeness of Pretest Results
Interpretation	65%
Analysis	65%
Evaluation	30%
Inference	26%
Interpretation	65%

Table 1. shows the average achievement of students' critical thinking skills is only 46.5%. So that the results of the pretest carried out can strengthen the conclusion that the critical thinking ability of junior high school students in Indonesia is still low. Critical thinking skills must be improved because it is one of the graduation standards set by the Indonesian government (Kemendikbud, 2016).

The researcher is of the view that students' critical thinking skills at the junior high school level can be improved through the use of student worksheets with a guided inquiry approach. The researcher's view is based on several research results which state that the use of student worksheets with a guided inquiry approach can facilitate the improvement of students' critical thinking skills (Mardana, et al., 2018; Fatikhah & Kamid, 2018; Sayyidah, 2019; Fananto & Nurita, 2020.). Khusnah (2016) has also succeeded in developing guided inquiry-based worksheets that have an influence on increasing students' critical thinking attitudes. Ma'rifah, et al (2014, p.133) also succeeded in developing a guided inquiry-based student worksheet that was focused on activating students' critical thinking skills. The use of guided inquiry-based teaching materials also has a positive influence on student learning outcomes (Suprihatiningsih & Sudibyoy, 2020). Other research also states that the use of the guided inquiry learning model has a positive influence on students' understanding of mathematical concepts (Dewi et al, 2020), and can improve other

mathematical abilities (Sari, 2018). Based on the explanation above, the development and use of student worksheets with a guided inquiry approach needs to be considered as an alternative solution to improve students' critical thinking skills in Indonesia, which is relatively low. So that this study aims to produce student worksheets with a guided inquiry approach that meets valid and practical criteria, which can then be used to facilitate improving the critical thinking skills of grade VII students.

METHOD

This research is a research and development (R & D). The purpose of the research is to develop student worksheets with a guided inquiry approach that is valid and practical, and is expected to facilitate the improvement of students' critical thinking skills when the effectiveness test is carried out. Student worksheets are developed following the procedures for developing teaching materials and certain predetermined criteria. The 4-D model development procedure was chosen because it is considered systematic and suitable for developing learning tools such as student worksheets (Tanjung & Nababan, 2018). The 4-D model consists of defining, designing, developing, and deploying. The flow of student worksheet development is presented in Figure 1.

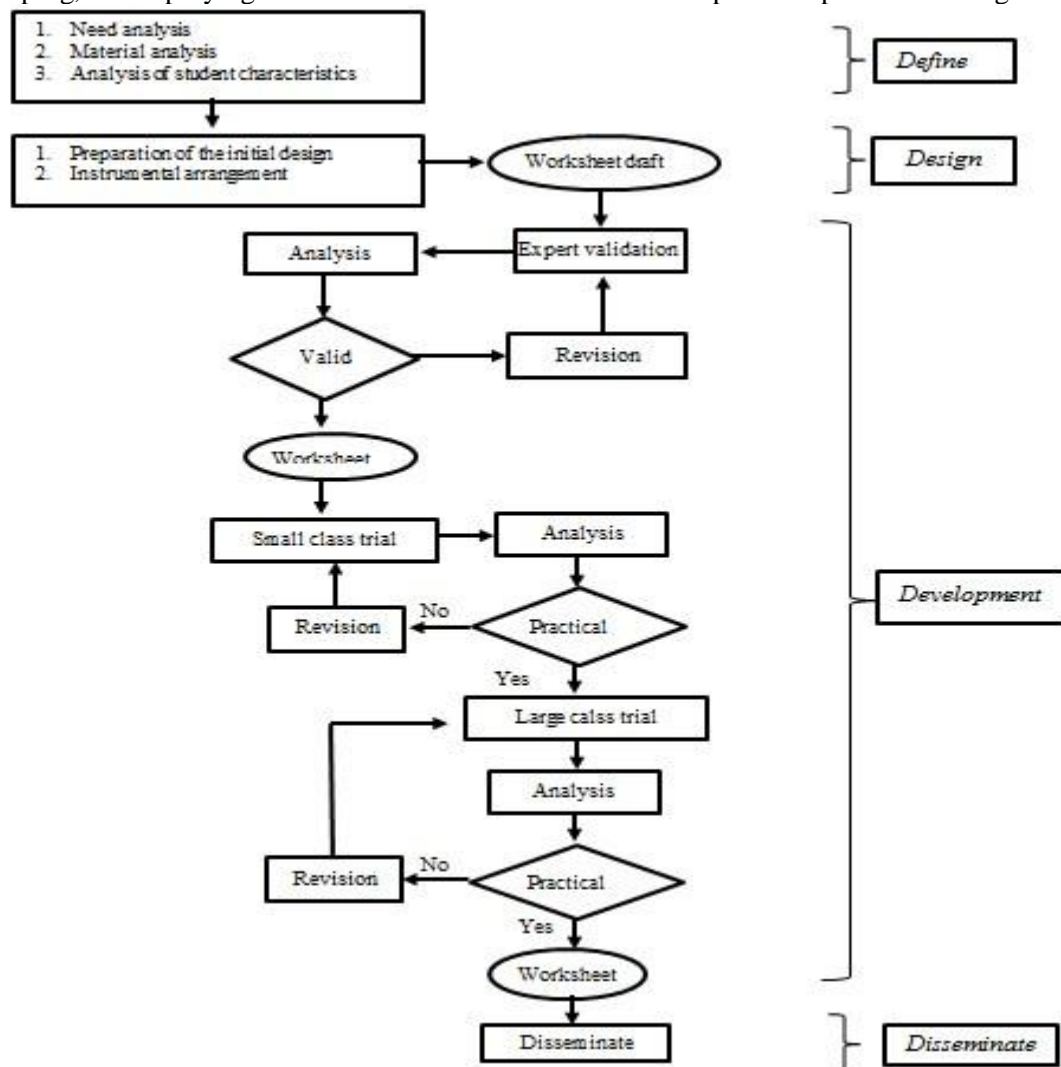


Figure 1. Student Worksheet Development Flow

The development procedure in Figure 1 can be explained as follows:

1. **Stage of Define**

At the definition stage, needs analysis, material analysis, and student character analysis are carried out.

2. **Stage of Design**

At the design stage, a product design is carried out based on the results of the analysis. The steps taken at the design stage are: (1) preparation of the initial draft of student worksheets, and; (2) preparation of validation sheet instruments and student response questionnaires.

3. **Stage of Development**

At the development stage, several activities were carried out, namely: (1) validation; (2) revision, and; (3) practicality test. The validation process is carried out by the material validator and media validator using a validation sheet. The revision process is carried out by researchers by following suggestions for improvement from validators and or students. The practicality test was carried out by students in small classes and students in large classes using student response questionnaires.

4. **Stage of Dissemination**

In the disseminate stage, the distribution of worksheets that have met the valid and practical criteria is carried out to several parties who need it.

The research subjects consisted of two material experts, two media experts and students of Al Azhar Islamic Junior High School 26 Yogyakarta. The students involved were limited to students who attended boarding education, namely 7 students in a small class and 20 students in a large class. It is necessary to limit the number of students due to the Covid-19 pandemic.

The research data was obtained from the results of validation by material validators and media validators, as well as from filling out student response questionnaires in small and large classes. The results of the validation are used to determine the criteria for the level of validity, and the results of the student response questionnaires are used to determine the level of practicality. The data obtained were analyzed using descriptive qualitative data analysis techniques, namely techniques that systematically describe the facts and characteristics of the object or subject being studied appropriately (Sukardi, 2009). The results of data analysis will show the level of validity and practicality of the developed student worksheets. Student worksheets are declared valid if the criteria for the level of validity of the material and the level of validity of the media are at least "good", and declared practical if the criteria for the level of practicality are at least "good".

RESULTS AND DISCUSSION

The final result of this research is a student worksheet with a guided inquiry approach to improve students' critical thinking skills that meet valid and practical criteria. The following are the results of the stages of research that have been carried out:

Stage of Define

At the definition stage, needs analysis, material analysis, and student character analysis are carried out. The results of the analysis concluded (1) teachers need worksheets that are focused on the goal of improving students' critical thinking skills; (2) grade VII students in the previous academic year still had difficulties in understanding comparison mathematics; (3) the critical thinking ability of class VII students is still low as evidenced by the results of the pretest.

Stage of Design

At the design stage, the initial design of student worksheets and preparation of validation sheet instruments and student response questionnaires was carried out. The initial design consisted of selecting the format and designing the parts of the student worksheet, which consisted of: cover, identity, preface, concept map of mathematical comparison material, table of contents, list of competencies, learning objectives, instructions for use, list of symbols, content of material, and finally the bibliography. The initial design of student worksheets was based on a guide for making

teaching materials, and adapted to the needs of teachers, students, and the author's condition. The results of the initial design are called student worksheet drafts. An example of the draft section of a student worksheet is presented in Figure 2.

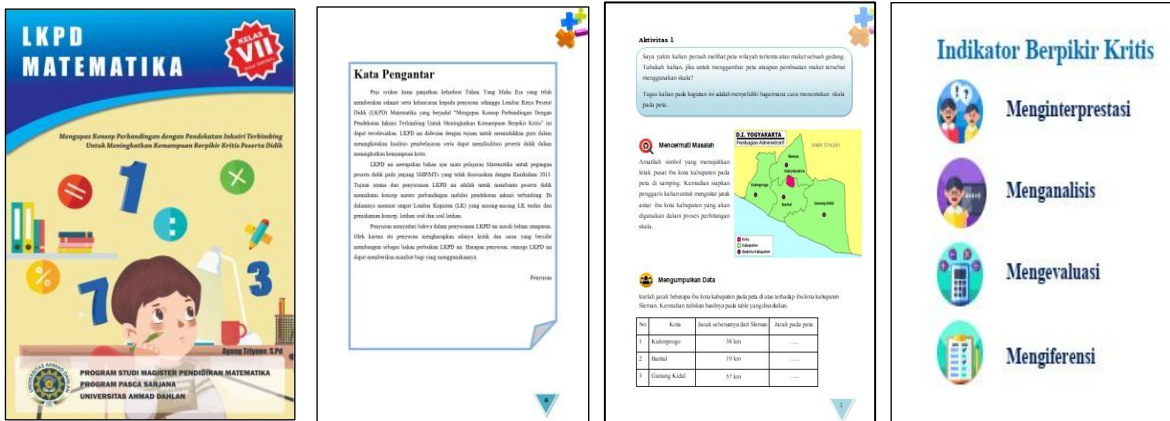


Figure 2. Example of a Student Worksheet Draft

The draft student worksheet shown in Figure 1.2 will then be validated by the material validator and media validator. Then the next activity at this stage is the preparation of validation sheets and student response questionnaires. Validation sheets and student response questionnaires were prepared based on guidelines from the National Education Standards Agency (BSNP).

Stage of Development

At this stage the material validator will assess the feasibility of the student worksheet draft from the aspects of the feasibility of content, language, and presentation. The media validator will assess the feasibility of the student worksheet draft from the aspect of using fonts, layout, design, and graphics. The assessment is carried out using a validation sheet that has been prepared in the previous stage. The results of the assessment of the material validator and media validator are explained as follows.

Material Expert Validation Results

The material validators involved in this study consisted of two experts, namely Dr. Teguh Wibowo, M.Pd. as validator 1, and Dr. Puguh Wahyu Prasetyo, S.Si., M.Sc. as a validator 2. The score of the assessment results on aspects of content feasibility, linguistic aspects, and presentation aspects is presented in Figure 3.

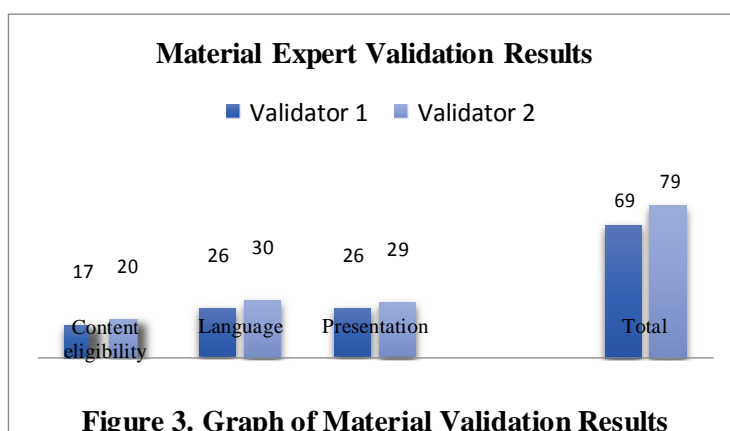


Figure 3. Graph of Material Validation Results

Figure 1.3 shows the total score of the assessment results from validators 1 and 2 are 69 and 79, respectively. The average score is 74. The average score is then converted into the calculation of

the criteria for the level of material validity. The results of the conversion and the criteria for the level of validity of the material are presented in table 2.

Table 1.2. Material Validity Level Criteria

Score	Level
—	Very good
—	Good
—	Enough
—	Less
—	Very less

The Table 2 shows that the average score of 74 is included in the criteria for the level of material validity "very good."

Media Expert Validation Results

The media validators involved in this study consisted of two experts, namely Anggit Prabowo, M.Pd. as a validator, and Susi Murwani, M.Pd as a validator 2. Scores from the assessment of aspects of font usage, layout aspects, design aspects, and graphic aspects are presented in Figure 4.

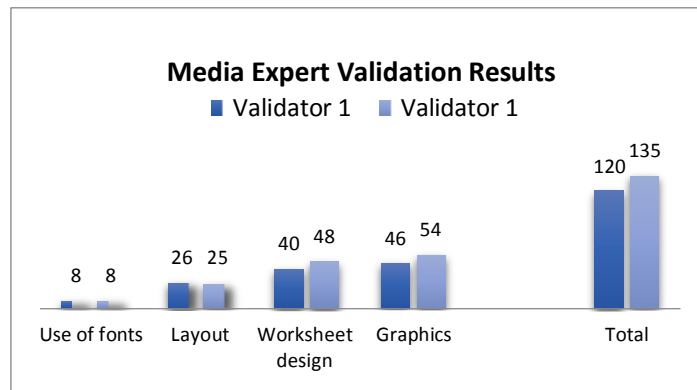


Figure 4. Media Validation Results Graph

Figure 4 shows the total score of the assessment results of validators 1 and 2 are 120 and 135, respectively. The average score is 127.5. The mean score is then converted into the calculation of the media validity level criteria. The results of the conversion and the criteria for the validity of the media are presented in Table 3.

Table 3. Media Validity Level Criteria

Score	Criteria
—	Very Good
—	Good
—	Enough
—	Less
—	Very Less

The table 3 shows the average score of 127.5 included in the criteria for the media validity level of "very good." The next researcher made revisions based on suggestions for improvement given by the validators. Suggestions for improvement from material validators and media validators are presented in Table 4.

Table 4. Suggestions for Improvement from Material Validators and Media Validators

No	Suggestions from Material Validators	Suggestions from Media Validators
1	Student worksheets are created in a version for teachers and a version for students.	Cover should contain illustrations of mathematical comparison material
2	Critical thinking indicators should appear in the material flow	At the bottom margin of each page should be given a footnote so that it looks more attractive.
3	Critical thinking indicators should be shown in the steps for working on the questions	Please provide a clearer map image.
4	Writing the comparison form on page 27 to be corrected	Use other symbols that more accurately indicate the activities of "interpreting" and "evaluating"

The revision process has been completed according to the suggestions for improvement in the table above. The results of the revision are presented in Figure 5.

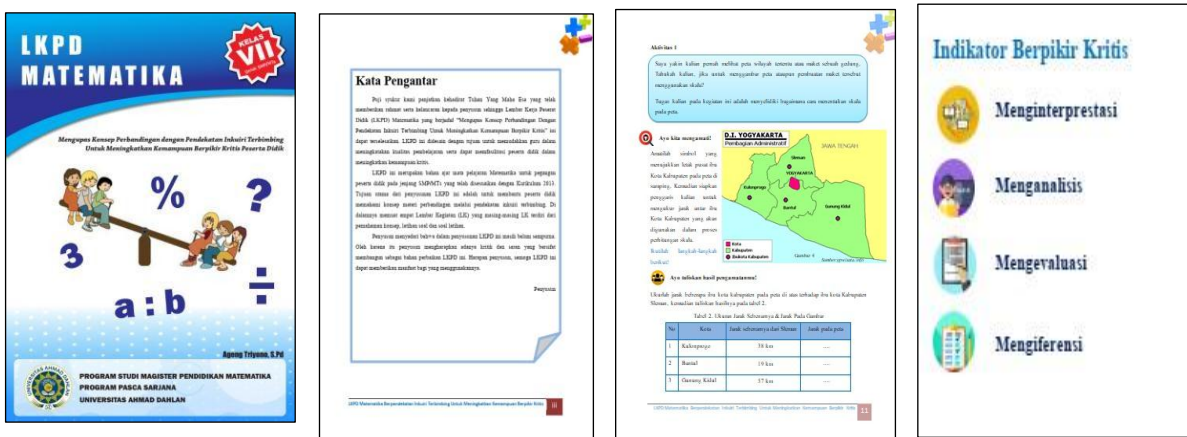


Figure 5. Revised Student Worksheet

Worksheets that have finished the revision process are consulted again with the material validator and media validator. The student worksheets were then declared valid based on the criteria for the level of material validity and the criteria for the level of media validity that reached the very good criteria. and the results of the revision, the developed student worksheets can be concluded to have met the valid criteria. The student worksheets can then be used for practicality tests.

Practicality Test Results

The practicality test aims to determine the level of practicality of student worksheets when used in learning. The first practicality test was carried out by giving a student response questionnaire in a small class. The students involved were 7 grade VIII students. Class VIII students were chosen because they have studied comparative material so that they are considered capable of providing an assessment of the worksheets developed by researchers. The results of the small class practicality test are presented in Figure 6.

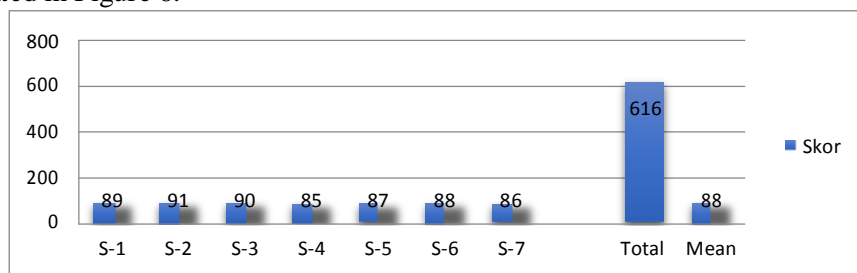


Figure 6. Graph of Practicality Test Results

Figure 1.6 shows the total score of the small class practicality test results is 616 and the average score is 88. The average score is then converted into the calculation of the practicality level criteria for student worksheets. The conversion results are presented in Table 6.

Table 6. Practicality Level Criteria

Score	Criteria
	Very Good
	Good
	Enough
	Less
	Very Less

The Table 6 shows the score of each student's assessment results in the "very good" practical level criteria. The mean score of 88 is also included in the criteria for the practicality level of "very good". Students in the small class practicality test did not provide any suggestions for improvement, so the researchers immediately proceeded to the practicality test phase in the large class.

The students involved in the large class practicality test were 20 students of class VII Islamic Junior High School Al Azhar 26 Yogyakarta. The score of the practicality test results in large classes and the criteria for the level of practicality student worksheets are presented in Table 7.

Table 7. Large Class Practicality Test Results

Student	Score	Criteria
S-1	88	Very Good
S-2	90	Very Good
S-3	89	Very Good
S-4	84	Good
S-5	86	Very Good
S-6	87	Very Good
S-7	85	Very Good
S-8	91	Very Good
S-9	89	Very Good
S-10	88	Very Good
S-11	90	Very Good
S-12	91	Very Good
S-13	87	Very Good
S-14	88	Very Good
S-15	89	Very Good
S-16	90	Very Good
S-17	86	Very Good
S-18	85	Very Good
S-19	85	Very Good
S-20	87	Very Good
Total		1775
Average		87,75

The Table 7 shows that 1 student scored in the "good" practicality level criteria, and 19 students scored in the "very good" practicality level criterion. The average score is 87.75, which means that the criteria for the practicality of student worksheets are "very good". So at this stage it can be concluded that the student worksheets developed by researchers are valid and practical.

Stage of Dissemination

At this stage, student worksheets that have been declared valid and practical are socialized to several parties, including:

1. Al Azhar Islamic Junior High School 26 Yogyakarta, through the seventh grade mathematics teacher in the form of a pdf file.
2. Students who study online use the Widyaedutech Learning Application-PT Widya Kreasi Bangsa Yogyakarta.
3. Other parties who can access in the form of pdf files through www.researchgate.net

CONCLUSION

The development of student worksheets with a guided inquiry approach focused on improving critical thinking skills for grade VII students through the 4-D development model (defining, designing, developing and disseminating) has met the valid and practical criteria. The valid criteria are known from the average score given by the material validators and media validators, which are 74 and 127.5 respectively, which shows the criteria for the validity level are very good when viewed from the material and media aspects. Practical criteria are known from the average score obtained from the student response questionnaire, which is 87.75 with the practicality level criterion of "very good". Furthermore, student worksheets can be used to facilitate the improvement of critical thinking skills in learning.

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