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Preliminary Stage: Student Worksheets Oriented to Higher Order Thinking Skills Based on Learning Styles

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ABSTRAK

Tuntutan industri 4.0 bergerak menuju masyarakat sosial 5.0, menuntut dunia pendidikan memiliki kesiapan. Berdasarkan data PISA 2019, Indonesia berada di kuadran kinerja rendah dengan ekuitas tinggi artinya memiliki peluang untuk meningkatkan kemampuan berpikir kritis karena memiliki kapasitas dan potensi yang belum berkembang untuk menghadapi tantangan abad 21. Berdasarkan hasil survey dengan guru dan siswa, peneliti menemukan bahwa tidak tersedianya LKS yang sesuai dengan gaya belajar siswa menyebabkan minat belajar siswa menjadi rendah. Penelitian ini bertujuan untuk menghasilkan LKS berorientasi keterampilan berpikir tingkat tinggi berdasarkan gaya belajar mereka. Jenis penelitian ini adalah penelitian pengembangan dengan menggunakan model 4D. Subyek penelitian adalah 32 siswa kelas VIII semester Genap dan 1 orang guru IPA di SMP Manbaul Ulum. Penelitian ini dibatasi pada tahap analisis kebutuhan sekolah terhadap pengembangan LKS berorientasi keterampilan berpikir tingkat tinggi berbasis gaya belajar dengan menggunakan teknik survei. Hasil penelitian menunjukkan bahwa LKS yang berorientasi pada keterampilan berpikir tingkat tinggi berdasarkan gaya belajar perlu dikembangkan untuk melatih keterampilan berpikir kritis.

ABSTRACT

The demands of industry 4.0 are moving towards social society 5.0 to purpose education must be ready. Based on PISA in 2019, Indonesia has low performance quadrant with high equity, means that opportunity to improve critical thinking skills because it has underdeveloped capacity and potential to face the 21st century. Based on the results of survey with teachers and students, researchers found that the unavailability of worksheets base learning styles caused decreasing the student learning interest. This study aims to produce worksheets oriented to higher order thinking skills based on their learning styles. This type of research is development research using the 4D model. The research subjects were 32 even semester VIII grade students and 1 Science teacher at Manbaul Ulum. This research is limited to the analysis stage of school needs towards the development of worksheets oriented to higher order thinking skills based on learning styles using survey techniques. The results of the study show that worksheets that are oriented towards higher order thinking skills based on learning styles need to be developed to train critical thinking skills.

1. INTRODUCTION

Many methods and learning models have been used by teachers in the learning process in class to improve the quality of learning, but in reality there are still many students who do not understand the review material discussed by the teacher. Era of the Industrial Revolution 4.0. marked by the implementation of many research findings related to information technology applied to the industrial world (Alaloul et al., 2020; Winarni et al., 2022). In the Industrial Revolution 4.0. the world of education has challenges and imperatives to prepare graduates with 21st century skills, namely communication, collaboration, critical thinking, and creativity skills and are able to prepare graduates who are able to compete globally (Anagün, 2018; Shahroom & Hussin, 2018). The 2013 curriculum as a solution provided by the government to answer the challenges of today's era has various advantages, namely the 2013 curriculum carries integrative thematic learning. The content, process, and assessment standards in the 2013 Curriculum have met the qualifications of 21st century skills (Ibrahem & Alamro, 2020; Rahayu et al., 2022). Based on Program for International Student Assessment (PISA) in 2019 research shows that

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Indonesia is in low performance quadrant with high equity. Indonesia still has the opportunity to improve critical thinking skills because it has undeveloped capacity and potential. Critical thinking skills are highly valued in the current era where current educational practices still emphasize basic skills that are felt to be lacking to equip students to face the challenges of the 21st century. The Minister of Education made a breakthrough assessment in minimum abilities including literacy, numeracy, and character surveys (Fatimah & Santiana, 2017; Sari et al., 2019).

In the K13 curriculum the learning process is a scientific process so teachers are encouraged to use a scientific approach in learning. One aspect of competence that we wish to improve in implementing the 2013 Curriculum in this study is 21st century competence, namely critical thinking (Anam, 2020; Raharjo et al., 2018). Higher-order thinking skills are divided into three things: creative thinking, critical thinking, and problem solving (Pratiwi & Puspito Hapsari, 2020; Saraswati & Agustika, 2020). In Bloom's Taxonomy aspects of higher-order thinking skills involve students' high-level knowledge, namely analysis (C4), evaluation (C5), and creation (C6) (Pitt et al., 2015; Seibert, 2020). When a person receives information that is interconnected in previously stored memory and then tries to expand that information to find answers to a situation appropriately, it is the implementation of higher-order thinking skills (Ellerton, 2022; Widarti et al., 2020). In everyday life students are required to have high thinking skills so that students can solve the problems they face.

Each student has a different learning style depending on age, learning achievements and life experiences. Someone can learn easily if they find a learning style that suits them. There are 3 types of learning styles namely, visual learning styles, auditory learning styles, and kinesthetic learning styles (Putri et al., 2019; Putri Ningrat et al., 2018). Student learning styles determine how individuals receive and absorb knowledge so that students can master the lessons they learn. Teachers should know the differences in the learning styles of each student so that students can learn actively and effectively. Someone is said to be a successful teacher if he knows what students need and treats them according to what they need, including learning styles. Therefore, the teacher must identify the learning styles of the students he teaches in order to find out trends in the learning styles of the students he teaches (Gilakjani, 2012; Shahroom & Hussin, 2018). Previous study state that learning style is a combination of absorbing, organizing, and processing information (Surur et al., 2020). Humans can absorb as much as 70% of material from what they do, 50% from what they hear and see (audio visual), the remaining 30% of the material can only be captured from what they see, then 20% of material that he only hears, and 10% of the material he reads.

The results of the non-cognitive initial diagnostic assessment conducted by the researcher show that the students' have variety of learning styles. The problem with the media is the lack of learning media that can accommodate a variety of student learning styles. During study students will have meaningful learning experiences so that at this stage students are able to develop values from learning natural sciences. Student-centered learning is very effectively applied to student learning environments (Parvathamma & Pattar, 2013; Sutarto & Syarifuddin, 2013).

Previous research on the use of student worksheets aided by audio visual media in science-biology learning on the subject of structure and function of plant tissues as an effort to improve learning outcomes in MTSN 5 Jambi showed the results of an increase in learning activities and learning outcomes from the use of worksheets assisted by audio-visual media (R. S. Dewi, 2020). The results of this study indicate that the use of student worksheets assisted by audio-visual media in science learning can be used to improve student learning outcomes. The use of worksheets assisted by audio-visual media can actually improve the completeness of student learning outcomes in a classical manner and make students become active learners in class. This study aims to use learning style-assisted worksheets on other subjects to improve students' critical thinking skills as an aspect of skills that students must have in facing the industrial revolution era 4.0.

This research is limited to the analysis stage of school needs towards the development of worksheets oriented to higher order thinking skills based on learning styles. Students learning activities using worksheets can provide opportunities for students to explore abilities and skills and students are challenged to develop their thinking processes. The new thing contained in this research is has new solutions in the science learning process using differentiated worksheets capable of increasing higher-order thinking skills by fulfilling learning styles so that they are able to optimize their potential towards the expected goals. The learning process can finally run more optimally, because students learn according to their learning style. The results of improved learning can be seen from the increase in test scores.

2. METHOD

The type of research used in this study is experimental research, because researchers will examine the impact of a treatment or intervention on research results. Experimental research methods are included

in quantitative research methods. Previous study state that experimentation means trying, searching, and confirming (Fraenkel et al., 2012). Causal or causal relationships are the essence of experimental research.

Research on developing higher-order thinking skills test instruments will be carried out at Manbaul Ulum Middle School. The population in this study were all class VIII students in the 2021/2022 school year. Samples were taken randomly using the cluster random sampling technique so as to get class VIII B totaling 32 people as the experimental class who were given treatment in the form of giving higher order thinking oriented worksheets. The researcher took class VIII of junior high school because the material of *Additive and Addictive Substances* was taught to class VIII students.

Research and development methods (Research and Development) are research methods used to produce certain products and test the effectiveness of these products (Sugiyono, 2012). The research design used in this study is the 4-D model development research design (Four D Models) according to Thiagarajani. This includes 4 stages, namely the define, design, develop and disseminate stages. Data collection techniques in this study used a test instrument. The test instrument used in this study is to measure students' problem-solving abilities. The tests to be given to students are in the form of essay questions. Tests are carried out at the beginning of learning (pretest) and at the end of learning (posttest). For more details regarding data collection techniques, presented in Table 1.

Table 1. Data Collection Techniques

Data Source	Data Type	Instrument Data Collection	Techniques
Student	Student's problem-solving abilities before treatment was applied to the experimental class	Carry out the initial test (pretest)	Essay questions
Student	Student's problem-solving abilities after treatment was applied to the experimental class	Carry out the final test (posttest)	Essay questions

This instrument was used to obtain data about the expert's assessment of the developed high-order thinking oriented worksheet media. The results of this assessment are used as a basis for product improvement before being tested. The media feasibility assessment sheet is worksheet oriented to high-level thinking which is prepared using a Likert scale . The preparation of this validity sheet was developed based on a high-level thinking-oriented worksheet media assessment instrument grid for material experts and media experts which can be seen in Table 2, and Table 3.

Table 2. Material Assessment Instrument Grid

No.	Indicator	Number of Items
	A. Content Eligibility Aspects	
1	The suitability of the material with basic competence	1
2	The depth of the material is in accordance with the cognitive development of students	1
3	The correctness of the concept presented	1
4	Completeness of teaching materials	1
5	The use of worksheet media is oriented to higher order thinking	1
	B. Linguistic Aspect	
6	Conformity with Indonesian EYD rules	1
7	Language effectiveness and efficiency	1
	C. Presentation Aspects	
8	Clarity of goals and indicators in the media	1
9	Completeness of information	1
10	Presentation of material logically and systematically	1
11	Presentation of material motivates students	1

Table 3. Media Rating Instrument Grid

No.	Indicator	Number of Items
	A. Display and Content	
1	Color Composition	1
2	Picture	1
3	Letter	1

No.	Indicator	Number of Items
4	Layout	1
5	Instructions for Use	1
	B. Characteristics	
6	Use	1
7	Attractiveness	1
8	3D Elements	1

Data analysis in quantitative research is an activity after all data has been collected, namely by grouping data based on variables and types of respondents, presenting data for each variable studied, performing calculations and percentages of success to measure student achievement.

3. RESULT AND DISCUSSION

Result

This research is a type of Development Research which aims to produce learning media products in the form of HOTS-oriented worksheets assisted with learning styles using the 4-D development model (four-D model). The initial stage is to carry out a needs analysis which aims to determine the main problems faced by teachers. This stage is carried out by filling out a questionnaire on the availability of learning resources for science subject teachers at Manbaul Ulum Middle School. Based on the questionnaire analysis on the availability of learning resources, the researcher obtained data that the learning process that is often used in science learning is the conventional method of lectures, practice and discussion. Meanwhile, the learning media that are often used by teachers in schools are videos from YouTube, printed books, and power points.

From the interview results, the teacher also said that he had made learning media in the form of power points. But for worksheets, teachers usually use worksheets that is already available in printed books. The teacher realizes that learning media is needed to help students concretize abstract science material. Using learning media helps teachers to clarify material concepts and make learning more interesting. Grade VIII students in semester 2 at Manbaul Ulum Middle School were the subjects of research on developing HOTS-oriented worksheets with the help of learning styles. Student analysis was carried out on 32 students by distributing questionnaires to find out information related to the Student Worksheets to be developed. Based on the results of the student's analysis, they stated that they had used worksheets as one of the learning media at school. The results of the questionnaire provide data that Student Worksheets have not trained critical thinking skills, problem solving and decision making. This is known based on the results of distributing questionnaires to students presented in Table 4.

Table 4. Student Worksheet Used by Students

High Order Thinking Skills (HOTS)	Percentage	
	Yes	No
Critical Thinking Skills	27.3%	72.7%
Problem-Solving Skills	21.5%	78.5%
Decision-Making Skills	18.3%	81.7%

Table 4 shows that the Student Worksheets used by students have not been able to train students' higher order thinking skills (HOTS). Of the 32 respondents, 72.7% of students answered the Student Worksheets had not been able to train students' critical thinking skills, and 78.5% of students answered Student Worksheets had not been able to practice problem solving skills, and 81.7% of students answered Student Worksheets had not can practice decision-making skills. From the results of this questionnaire, the researcher made an agreement with the students to develop HOTS-oriented Student Worksheets with the help of learning styles which were complemented by problem solving activities to train critical thinking skills, problem solving, and decision making. The results of developing this Student Worksheet can be seen in Table 5.

Based on Table 5, it can be seen that more than 50% of students agree to develop Student Worksheets which are equipped with problem solving activities to practice critical thinking skills (HOTS) with the help of learning styles. The data obtained shows that 97.8% of students agree to develop Student Worksheets with problem solving activities to train critical thinking skills, as much as 97.7% of students agree to develop Student Worksheets with problem solving activities to practice problem solving skills, and

as many as 96.6% of students agree to develop worksheets which is equipped with problem solving activities to practice decision making skills. Besides being equipped with problem solving activities to train critical thinking skills, the development of this worksheet is equipped with questions that can train students to improve critical thinking skills, problem solving, and decision making. This data can be seen from the table diagram in Figure 1.

Table 5. Development of HOTS-Oriented Student Worksheets

High Order Thinking Skills (HOTS)	Percentage	
	Yes	No
Critical Thinking	97.8%	2.2%
Solve the Problem	97.3%	2.7%
Make Decisions	96.6%	3.4%

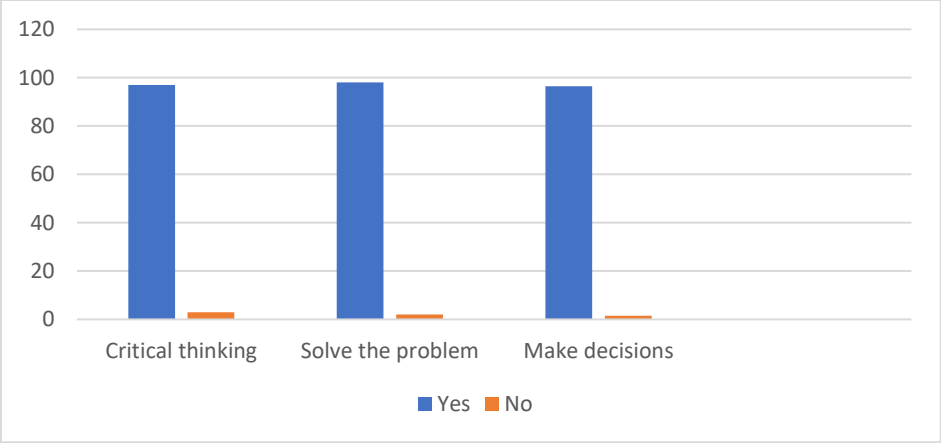

Figure 1. Development of Student Worksheets Equipped with HOTS Questions

Based on Figure 1, it can be seen that 97% of students agree if the developed Student Worksheet is equipped with questions that can train critical thinking skills. As many as 98% of students agreed to develop Student Worksheets that could practice problem-solving skills, and 96.5% of students agreed to develop Student Worksheets that could practice decision-making skills in solving problems.

Discussion

Based on this explanation, the development of worksheets oriented towards higher order thinking skills assisted by learning styles is needed to improve students' higher order thinking skills. Teachers usually use textbooks and worksheets which are sometimes not in accordance with the demands of the curriculum. The worksheets used usually contain verbal information about science concepts and are supplemented with practice questions. The worksheets used tends to lead students to solve questions and look for answers in the summary of the material so that it does not lead students to think critically. With the existence of worksheets oriented towards higher order thinking skills assisted by learning styles, students no longer have difficulty solving questions that are required to be solved by thinking critically in solving problems. Learning becomes more meaningful for students because in the learning process students do not just memorize material but can understand the material studied in more depth. Based on the results obtained in general, this research can answer the problems and the expected goals, namely to improve students' critical thinking skills and to increase student learning activities in the classroom. Not only that, students find knowledge that is built by themselves and the role of the teacher as a facilitator can be improved properly.

From the results of the questionnaire the researcher found that learning media in the form of Student Worksheets which could be used independently or in groups by students to train students' higher order thinking skills had never existed. So that the Student Worksheet compiled by this researcher is equipped with activities that can train students' critical thinking skills and HOTS-oriented questions that have facilitated learning styles. The Natural Science subject for class VIII semester 2 on the topic "Additives" is presented in Student Worksheets oriented towards higher order thinking skills assisted by learning styles. Explanation of concepts assisted by this learning style can facilitate students with pictures, supporting writing/conversations and practice questions on Student Worksheets to train students in

critical thinking processes. The analysis of learning objectives which form the basis for designing Student Worksheets aims to identify learning objectives from core competencies, basic competencies, and learning indicators according to the 2013 curriculum (Gupta et al., 2022; Kurniaman & Noviana, 2017).

According to previous study worksheets is one of the learning resources that can be developed by the teacher as a facility in learning activities (Grant, 2019). The prepared worksheets can be designed and developed according to the conditions and situations in the activities to be faced. In worksheets students will get summary material, and assignments related to the material. In addition, students can also find structured directions to understand the material provided (Bystrova, 2020; Prastowo, 2015). Based on needs analysis, a teacher must prepare students with higher-order thinking skills as a driving force in the world of education. The advantage of this HOTS-oriented worksheet compared to other worksheets is that this worksheet prioritizes creative and critical thinking skills in solving problems in the learning process related to the divergent and convergent thinking phases. The divergent thinking phase helps to train students to find problems, formulate problems, and look for options or alternatives. While the thinking phase of students in the convergent phase helps students to make decisions (choose among the various available alternatives), take action (commitment to implementing decisions on the results obtained), and evaluate the results. The problem solving process carried out by students has great potential to train students to think at a higher level. Thus the existence of learning media is useful for stimulating attention, interest, thoughts, and feelings of students in learning activities to achieve learning goals (Aprilianingrum & Wardani, n.d.; Baidillah, 2021). Therefore student worksheets must be design products made by the teacher so that they are able to facilitate student learning needs.

The resulting worksheets are able to train students to think at a higher level, in this preliminary test the researcher uses the *Discovery Learning* model so that the stages given in the student worksheets also refer to syntax learning. In addition, the researcher tried to make an attractive worksheet design including titles, instructions for using the worksheet, competencies to be achieved equipped with lesson objectives to be studied in the student learning process, and at the end given practice questions to measure students' understanding of HOTS.

The 2013 curriculum prepares some of the characters and skills of students to face the challenges of the 21st century. One of them is in the form of learning media in the form of worksheets that are used by teachers, so far the worksheets used prioritize the ability to understand and practice alone and have not accommodated the skills students must have in facing the industrial era 4.0. From the results of the worksheets used in this study, the teacher said that the advantages of using Student Worksheets in the learning process were that the teaching and learning process became more interesting and meaningful, and the learning process was student-centered. The use of worksheets in the learning process can open up opportunities for students to be active and creative in the learning process. This finding is reinforced by the findings of using worksheets with a scientific approach to science object material and its observations can improve science learning outcomes for class VII MTs Negeri 1 Semarang. Other findings that strengthen the results of this study state that the E-Learner Worksheet is feasible and valid for increasing self-confidence during learning activities (N. P. D. M. Dewi & Agustika, 2022; Widiyanti et al., 2021). Student worksheets can help students in the learning process and the implications of this research are expected to help improve students' critical thinking skills. Based on the results of research on the "*Development of Student Worksheets Based on High Order Thinking Skills on Periodic Table of Elements*", the results of this preliminary test are in line with the results of previous studies. The results of this study meet the effective target because the worksheets base HOTS that has been developed is able to activate students with an average of 93 meaning that students are very active and effective in training students' high-order thinking skills with a test score of student learning outcomes of 58 in the HOTS good category (Fitria et al., 2019).

This research found that the use of worksheets oriented towards higher order thinking skills is in accordance with learning styles, the implication of which is that it can increase student involvement in learning. In addition to this worksheet achieving better academic results, it can have a positive impact on teaching planning in the eighth grade. In addition, the results of this research can provide a basis for further development of teaching materials that focus on developing higher order thinking skills and adapting to student learning styles. Another implication could be a contribution to the development of learning models that are more adaptive and responsive to individual student needs. However, this research also has limitations. A limitation in the study is that there is a possibility that other factors outside the variables measured in this study could influence the results. For example, environmental factors or home support.

4. CONCLUSION

Based on the results of this preliminary research, it can be concluded that the use of learning style-oriented critical thinking worksheets as a learning medium has a positive influence to help grow and

develop students' critical thinking skills. A teacher who can facilitate diverse student learning styles allows students to absorb information or learning material easily. There are three types of learning styles namely visual, auditory, and kinesthetic. In this grouping we use the role of the senses, because in the process of learning activities the student's sensory functions work. Sensory linkages with learning styles include aspects of students with visual learning styles requiring facilitation of learning through something they can see, auditory learning styles include aspects of students with learning styles by listening, and kinesthetic learning styles include learning styles by moving, working, and touching . Every student has all three learning styles, it's just that one style usually dominates in the learning process. Through worksheets oriented towards critical thinking skills assisted by learning styles, it is hoped that it can help students develop critical thinking skills that can make them learn actively and independently.

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