The effectiveness of experiment-based student worksheets with map concept in understanding the physics concepts of static fluid materials

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Abstract. Research has been done to find out the effectiveness of experimentally based student worksheets in understanding the physics concept of static fluid material. The study was conducted in Madrasah Aliah Sorong Regency. Descriptive research method uses purposive sampling technique with student’s class XI IPA amounted to 13 students. The learning is done by concept map in which applying the experiment-based student worksheet. The results of pre-test and post-test data processing on each it found that the gain values were 0.36 and 0.51 respectively in the medium criterion. The results illustrate that the experimental based student worksheet with concept maps are effective in learning to understand the concepts of physics. Psychomotor skills responses are included in good criteria. The mean value of psychomotor skills in each learning was 70.64 and 80.6, respectively.

1. Introduction
Education in schools is created through the process of teaching and learning between teachers and students. The process of learning in the classroom greatly affects the level of achievement of learning objectives that have been designed by teachers [1]. Science as one of the important lessons in school presents a contextual concept that should appeal to students, but the fact that there are so many misconceptions found in science learning [2,3]. It is especially likely because teachers have not yet optimally incorporated students in terms of the learning experience as a foundation for building new knowledge. Teachers also need to have the ability to catalysis [4] to drive the development of a structured, evolving conceptual understanding that leads to a more scientific concept as well as having the ability to assess each student’s progress from understanding the taught concepts. Conceptual changes at each stage of learning can be identified based on the understanding each of individual learners.

Physical learning as part of learning science is closely related to nature that has various phenomena surrounding student life, and this is the part that should not be separated from the learning set when the teacher teaches the concept. Physical learning can be done by concept mapping so that a student can understand it in a structured and systematic. Concept maps are also a way of developing meaningful learning experiences for students. Through mapping the main ideas, can illustrate the relationship between the concepts of subject matter.

The student worksheet is a collection of sheets of paper containing instructions that the student must do in the form of steps to complete a task [5]. Student Worksheet is an important component that should be done by all students in the learning process so that the learning objectives can be achieved [6]. The
results show that the use of effective student worksheets to improve student learning outcomes. Student worksheets can increase student participation and achievement [4] and also student worksheets are more effective as they cause students actively participate in learning activities [7].

2. Method
The research method used descriptive with purposive sampling technique. This method does not manipulate, or changes to independent variables, but describes them according to the conditions [8]. The sample in this research is the students of grade XI IPA MA State Preparation of Sorong Regency, amounting to 13 students. Variables consist of independent variables of the experimental student worksheet with the concept map and the dependent variable that is the concept of physics. Understanding the concept of physics is derived from the result of the value before the learning (pre-test) and the result of the final value of learning (post-test). The material taught is a static fluid with a discussion of hydrostatic pressure for the first encounter and Archimedes’ principle for the second meeting described by the concept map. Learning is done by concept map in it using experimental student based worksheet and arranged with systematic practice according to scientific rule. In addition, data were collected for psychomotor skills by two observers to see students' responses to learning using experimental student worksheets.

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\text{Score result} = \frac{\text{ Obtained score}}{\text{ Maximum score}} \times 100
\]

Table 1. Criteria for student skill scores [9].

| Score result | Criteria/Clasification |
|--------------|------------------------|
| 80 – 100     | Very Good              |
| 66 – 79      | Good                   |
| 56 – 65      | Passable               |
| 40 – 55      | Poor                   |
| < 39         | Very Poor              |

3. Result and discussion
Through student worksheets, students can be able to analyze in solving problems in the learning process. The cognitive development of students can be seen in some students having the ability to analyze the problem is still low. This student worksheet is used to train students' ability to understand the concepts in the subject matter, so that students become able to understand the concept after following the lesson [10].

The content of the taught material is still in the form of an outline, so the students are assigned to detail the contents of the material [11]. The materials are arranged in concept maps so students can analyze the concepts of the given them. Problem-solving activities in the form of experimental worksheets require students to think logically and systematically in the appropriate ways according to scientific rule [12].

Stages of problem solving completed by students are done in the form of practicum activities. There are work steps to be followed in solving the problem. The static fluid material at the hydrostatic pressure for the first meeting and the law of Archimedes for the second meeting is arranged in the concept map, as shown in figure 1.
Figure 1. Concept maps for static fluid materials.

Table 2. Scores of each student’s skill stage using an experimental student worksheet.

| Stages       | Indicator                             | Score | Criteria |
|--------------|---------------------------------------|-------|----------|
| Preparation  | preparing tools and materials         | 83,66 | Very good |
|              | Setting tools and materials           | 82,69 | Very good |
| Implementation| Process lab                           | 81,73 | Very good |
|              | Results of the lab                    | 75,96 | Good     |
| Reporting    | complete and neat                     | 65,39 | Passable |
|              | Punctuality                           | 59,62 | Passable |

Table 2 show the stages in implementing learning using an experimental based student worksheet. These stages are combined with concept maps according to the material taught in the first and second lessons. The preparation stage with its two indicators falls into very good criteria, implementation stage, process lab indicators in very good criteria and result of the lab indicators in good criteria. The final stage of reporting, the two indicators are included in passable criteria.

The reporting stage with the complete and neat indicator score is 65.39 and the punctuality indicator score is 59.62, still below score 70 because this learning is the first time done in the school, so the students need time to understand the learning stage to complete with complete, neat and on time. This is in line with Sevilay research [13] that there are several aspects that will be responded by the students in the learning, namely the level of fun, learning atmosphere, novelty, material understanding, material attractiveness and ease of use of student worksheets.

Table 3. Gain value criterion understanding of physics concept.

| Material                | N | Pre-test | Post-test | Gain | Criteria |
|-------------------------|---|----------|-----------|------|----------|
| Hydrostatic pressure    | 13| 38,2     | 60,2      | 0.36 | Medium   |
| Archimedes principles   | 13| 46,7     | 73,9      | 0,51 | Medium   |

Table 3 shows the pre-test and post-test results on the hydrostatic pressure material and the Archimedes principle. The Gain results were 0.36 and 0.51, respectively, indicating that the students in understanding the physics concepts using experimental based student worksheets were still in medium criterion. The value is also supported by the value of student worksheets and psychomotor skills, as shown in table 4.
### Table 4. Average score of experimental student worksheets and psychomotor skills.

| Learning Material                  | Mean value student worksheet | Mean value Psychomotor skill |
|-----------------------------------|------------------------------|-----------------------------|
| 1 Hydrostatic pressure            | 68.9                         | 70.64                       |
| 2 Archimedes principles           | 79.6                         | 82.6                        |

Table 4 shows the mean values of experimental student worksheets are 68.9 and 79.6, respectively. This experience improves from first to second learning. It shows that the students give a positive response to the learning activities. The mean psychomotor skill score of 70.64 and 82.6 indicates that the students' skill is improved by the use of experimental based student worksheet. The use of student worksheets in effectively learning develops both the character of students who initially begin developing and student skills [5]. In line with the results of research using LKPD Problem Solving Polya increase Student interest in following learning [14]. Also supported by Özdemir which states that the use of model-based student worksheets (Predict, Observe, Explain = POE) can improve student learning activities [15]. The interaction between student worksheets greatly influences student learning outcomes and their scientific attitudes based on improved science process skills [16].

### 4. Conclusion

Learning using experiment based student worksheets can stimulate the ability of students who are still low to be more active in learning. Learning is done in class XI IPA Madrasah Aliah State Preparation of Sorong Regency. The effectiveness of an experiment based student worksheet with concept maps in enhancing the understanding of physics concepts has a medium value Gain criterion. With an experiment based student worksheet, students' understanding of the concepts of physics is increasing. Student psychomotor skills are included in good criteria, characterized by the value of each stage in an experiment that shows very good in the preparation, good in the implementation and passable in the report.

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