Teacher’s conception about static fluid

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Abstract. The purpose of this study is to see how the conception of high school teachers and to see how the professionalism of teachers relates to the conceptions held in one of the high schools in the city of Palu, Central Sulawesi. The method used is to conduct a survey of 3 teachers. The instrument used in this study was 23 tier test diagnostic as many as 23 about static fluid. The results of the analysis show that the three teachers who were given the test did not experience misconceptions on the main topics of hydrostatic law, Pascal's law and Archimedes law but experienced doubts in answering questions on the main hydrostatic legal material with the scientific knowledge category of 95.3% and the category of 4.7%. Based on data analysis, conclusions can also be drawn both teachers who have been certified and have not experienced misconceptions, the difference is seen where teachers who have not been certified hesitate to answer some of the questions given.

1. Introduction
One of the important lessons mastered by students at school is physics. [1]. Explicitly the general purpose of learning physics is to emphasize mastery of concepts so that learning is meaningful [2]. Physics is one of the lessons that examines natural phenomena around humans and is a learning with complex concepts [3]. This conception can be obtained by students through learning experiences at previous educational levels, reading books, watching television or the internet, as well as possible from phenomena in the surrounding environment [4].

Seeing the importance of concepts in physics learning, teachers must be able to teach with a constructive approach [5]. Ajaja and Urhievwejire [6] said that when the teacher teaches with a constructive approach the teacher is able to solve problems in teaching so that the learning objectives are achieved.

The concept possessed by students also depends on the teacher's ability to teach. Therefore the teacher must be creative in making cognitive resources so that students are able to understand the concept [7]. Looking at the complexity of physics itself, Based on research [8] received very alarming results where the students from elementary-high school studied were still understanding the wrong concepts about material related to Archimedes' law because the teacher dominated the learning process.

Today most teachers who teach physics only do learning using conventional methods [9], where the teacher provides material explanations, sample questions, questions and concludes the problem simultaneously. Learning with such methods is conventional learning which can result in a lack of understanding of students' concepts or can even cause students to experience misconceptions [10, 11].
Conception that has been built by students is not necessarily considered appropriate in the view of the scientific community. Student conceptions that are not in accordance with the views of the scientific community and are used by students consistently are referred to as misconceptions [12]. From the above understanding misconception can be interpreted as a conception that is not in accordance with scientific understanding or understanding received by scientists.

Based on research conducted by Saputra [13], it was found that almost half of the samples experienced misconceptions about static fluid. So that must be sought for the cause of misconception in students. One of the main causes of misconceptions that occur in students is the teacher who teaches the subject.

Teacher errors usually occur in two ways, namely mastery of concepts and application of appropriate learning methods. Mastery of concepts can be caused by low teacher reading interest which only relies on makeshift reading sources, or the teacher's educational background is not from physics education. At least the physics teachers and their low income have caused most physics teachers to teach at various schools and tutoring, so the number of teaching hours per week is out of propriety. This has implications for the lack of attention of physics teachers on innovative learning techniques and the low reading interest and reluctance to conduct research.

Based on the paragraph above, of course it is necessary to do a diagnostic to get an idea of how the teacher's conceptions teach students who experience misconceptions and get the reasons why students experience misconceptions.

2. Methods
The method used in this study is a survey method in one of the public schools in the city of Palu, Central Sulawesi. The sample used in this study were 3 physics subject teachers in class X, XI and XII.

Data collection method was conducted using misconception test instrument in the form of three tier test of 23 questions. Misconception test instruments are used to measure teachers' misconceptions on static fluid materials. The problem distribution used in this study can be seen in the Table 1.

| Subject matter         | Question number        |
|------------------------|------------------------|
| The main law of hydrostaticism | 1, 2, 3, 4, 5, 6, 17, 18, 19, 21, 22 |
| Pascal's law           | 10, 15, 20             |
| Archimedes' law        | 7, 8, 9, 11, 12, 13, 14, 16, 23 |

The data analysis of the test results was performed to find out how the teachers' conception of static fluid material by referring [14] with the assessment rubric as illustrated in the Table 2.

| First tier | Second tier | Third tier | Categories                  |
|------------|-------------|------------|-----------------------------|
| correct    | correct     | certain    | Scientific knowledge        |
| correct    | incorrect   | certain    | Misconception (false positive) |
| incorrect  | correct     | certain    | Misconception (false negative) |
| incorrect  | incorrect   | certain    | Misconception               |
| correct    | correct     | uncertain  | Lucky guess, lack of confidence |
| incorrect  | correct     | uncertain  | Lack of knowledge           |
| incorrect  | incorrect   | uncertain  | Lack of knowledge           |

3. Result and Discussion

3.1. Result
Analysis of answers from 3 teachers high school students on 23 three tier test to see how the conception of students can be seen in the Table 3.

### Table 3. Percentage of subject matter conception

| Subject matter          | Percentage (%) |
|-------------------------|----------------|
|                         | scientific knowledge | lucky guess, lack of confidence | lack of knowledge | misconception |
| The main law of hydrostaticism | 97.0          | 3.0                        | 0                | 0             |
| Pascal’s law            | 88.9          | 11.1                       | 0                | 0             |
| Archimedes’ law         | 100           | 0                          | 0                | 0             |
| Average                 | 95.3          | 4.7                        | 0                | 0             |

The table shows that teachers do not experience lack of knowledge and misconception in the main legal topics of hydrostatics but in the category 97% scientific knowledge and 3% lucky guess, lack of confidence. Whereas in the Pascal law it is seen that the teacher does not experience lack of knowledge and misconception on the main topic of hydrostatic law but in the category of 88.9% scientific knowledge and 11.1% lucky guess, lack of confidence. Different things are seen in Archimedes' law where all teachers are in the scientific knowledge category. If it is totaled, 95.3% results are obtained in the scientific knowledge category and 4.7% lucky guess, lack of confidence.

There were 3 teachers sampled in this study, 2 teachers (teachers A and B) were certified and teacher C had not been certified. Based on the analysis carried out the results are as shown in table 4.

### Table 4. Percentage of teachers conceptions

| Teachers | Percentage (%) |
|----------|----------------|
|          | scientific knowledge | lucky guess, lack of confidence | lack of knowledge | misconception |
| A        | 100                        | 0                          | 0                | 0             |
| B        | 100                        | 0                          | 0                | 0             |
| C        | 91.3                       | 8.7                        | 0                | 0             |
| Average  | 97.1                       | 2.9                        | 0                | 0             |

3.2. Discussion

On the main legal topic of hydrostatics three teachers who were given three tier test diagnostic results obtained 97.0% in the category of scientific knowledge, 3.0% lucky guess, lack of confidence, 0% lack of knowledge and 0% misconception. After analyzing the answers from teacher A, B and C, teacher A and teacher B were able to answer questions with a category of 100% scientific knowledge and teacher C experienced less confidence in the answers chosen. Teacher C assumes that the hydrostatic pressure is inversely proportional to the area of the fluid container, so the smaller the container area the greater the hydrostatic pressure.

![Figure 1. Hydrostatic pressure at a point](image-url)
Figure 1 shows a question to determine how the state of hydrostatic pressure is at a point. In fact, the concept of static fluid is that the hydrostatic pressure at all points with the same depth is the same, does not depend on the shape of the container [15]. Hydrostatic pressure also does not depend on the volume of liquid in the container [16]. Hydrostatic pressure depends on the density of the liquid, gravity, and depth or height.

On the topic of Pascal's law, three teachers who were given the three tier diagnostic questions obtained 88.9% of the scientific knowledge categories, 11.1% were lucky guesses, lack of confidence, 0% lack of knowledge and 0% misconception. After analyzing the answers from teacher A, B and C, teacher A and teacher B were able to answer questions with a category of 100% scientific knowledge and teacher C experienced less confidence in the answers chosen. Teacher C assumes that the pressure will increase when the size of one of the suckers is reduced.

Figure 2 shows the relationship between force and cross-sectional area. Actually Pascal's legal concept is that the pressure felt by an injection will remain even if the shape of the container is minimized, but the fluid that gives the force to the surface has a different lift force because the cross-sectional area is reduced [17]. On the topic of law Archimedes teachers A, B and C have knowledge in the scientific knowledge category. There is no lack of understanding or misconception on the topic.

Physics is one of the lessons learned by students when in high school. According to the Ministry of National Education [18] one of the functions and objectives of physics subjects in high school is as a means to develop the ability of analytical and deductive thinking by using physical concepts and principles to explain various natural events and solve problems both qualitatively and quantitatively.

Physics teacher is a determinant of whether the function and purpose of learning physics in school has been achieved or not. Based on research [19] says that "teacher is the person charge with the responsibility of helping others to behave in new different ways". Based on the quotation, it can be seen that the teacher must have special abilities that are not possessed by someone who is not a teacher. Based on research [20] says that there are several things that must be owned by a teacher, namely: 1) good knowledge in teaching material, 2) pedagogy, and 3) human development and learning.

In table 4, it can be seen that teacher A and B who have been certified are able to answer all questions with the scientific knowledge category and teacher C who has not been certified is still having doubts in answering the questions given. This suggests that content knowledge is a compulsory competency for a teacher, science teachers must be prepared carefully before teaching in the classroom [21]. Preparation of science teachers starts with the level of preservice, beginner teacher and professional teacher.

In Indonesia the guidance of prospective teachers towards professional teachers has been carried out. Teachers who have been certified (including physics teachers) have spread to various schools in the city of Palu. Professional teachers should be able to manage classes and have good mastery of material [22-28], this can be seen in the results of the research that has been done.

If the teacher does not have good content knowledge, it will result in students experiencing misconceptions. Teacher errors usually occur in two ways, namely mastery of concepts and application of appropriate learning methods. Mastery of concepts can be caused by low teacher
reading interest which only relies on makeshift reading sources, or the teacher’s educational background is not from physics education. At least the physics teachers and their low income have caused most physics teachers to teach at various schools and tutoring, so the number of teaching hours per week is out of propriety. This has implications for the lack of attention of physics teachers on innovative learning techniques and the low reading interest and reluctance to conduct research.

4. Conclusion
Based on the identification of misconceptions found in the teacher in the form of the three tier diagnostic tests, 95.3% results in the scientific knowledge category and 11.1% lucky guess, lack of confidence and there were no teachers in the lack of knowledge and misconception categories. Whereas if analyzed based on the professional status of the teacher, namely teacher A and B in the scientific knowledge category and teacher C who has not been certified still has doubts in answering some questions given

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