Validation of Physics student’s worksheet based on cognitive conflict strategy to minimize student’s misconception

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Abstract. Misconception is one of the problems that found in physics teaching. This can cause difficulties in the process of learning the concept. Student’s worksheet is one of teaching materials that can make student active in finding learning concept through practicum activity. One of learning strategies which can help students in constructing their own knowledge is cognitive conflict strategy, later on is expected could minimize student’s misconception. Student’s worksheet cognitive conflict strategy based is categorized as good when it has good quality. Valid is one of the criteria to assess student’s worksheet quality. Valid or not, an student’s worksheet is assess by an expert of a professional. The purpose of this research is to know the validity of physics student’s worksheet cognitive conflict base to minimize student’s misconception. This kind of research is research development, with using Plomp development model. Research instrument that is used is validation sheet in form of assessment sheet. The data analysis that is used is descriptive analysis. The result of the research shows that physics student’s worksheet with cognitive conflict strategy based to minimize student’s misconception have average scores 0.91 with valid criteria.

1. Introduction
The subject of physics is one of the subjects in science that require skilled learners to apply the concepts and principles of science gained so as to produce learners who are science and technology literate. To achieve this goal learners are required to carry out practical activities which are the result of the knowledge gained. In the physics learning, understanding the concept is something that is absolute when a learner doing the learning process. To handle the problem of understanding the concept in physics learning should not be arbitrary, this is because basically learners coming to school have brought the initial knowledge gained in the previous education level. Early knowledge brought by the learner is in the form of a scientific conception and some are still misconceptions.

Mistakes that occur in the concepts of learners will interfere with the effectiveness of learning and thinking in receiving the next knowledge. Therefore, the concept in learning physics is a very fundamental thing to be attempted improvement in order to improve the results of physics learning. The fact that happened in the field, there are still many learners who have misconception in learning physics.

One of the learning strategies that can be used to overcome the occurrence of misconception in learners is cognitive conflict learning strategy. According [1] cognitive conflict approach is a set of learning activities by communicating two or more stimulations in the form of something contrary or
different to the learner in order to gain intensive internal process in order to achieve a higher science balance.

According to [2] cognitive conflict model is a model of learning to change the misconceptions of learners into a scientific conception, by presenting conflicts to the minds of learners who misconception. With the conflict, the misconception of the learners’ conception will become shaky in other words that learners are beginning to doubt the correctness of its misconception of conception and eventually there will be modification in its cognitive structure or construct a new, scientific conception.

In implementing physics learning with cognitive conflict strategy, learning resources are needed. One learning resource that can be used learners is the Student Worksheet. According to Depdiknas [4] student worksheet is a series of sheets of tasks that must be done by learners. Activity sheets are usually instructions, steps to complete a task. The advantage of using student worksheet is facilitate the educator in carrying out the learning, for learners will learn independently and learns to understand run a written task. According to [3] student worksheet can be a guide for cognitive aspect development exercises as well as guides for the development of all aspects of learning in the form of experimental guides or demonstrations.

But the reality is found, from the observations that the author does in SMK/SMAK Padang, educators have not arranged student worksheet used in learning by them self. In the learning process learners use purchased student worksheet from the publisher. In addition, in the learning process learners are rarely invited to experiment in the laboratory. Educators have never used cognitive conflict strategies to minimize misconceptions of learners.

Therefore, to solve such learning problems need to be attempted physics student worksheet on valid cognitive conflict strategy base. Valid based on the needs of learners in order to build and develop knowledge and skills that exist in learner itself to improve conceptual consistency, which will be expected to minimize misconceptions of learners. Based on the description above, we have conducted a research titled validation of physics student worksheet on cognitive conflict strategy base to minimize misconceptions of learners.

2. Methods
This research is a research development (Research and Development), by using development model of Plomp. The Plomp model [5] consists of 3 phases: 1) preliminary research, 2) prototype phase (design stage), and 3) assessment phase. Student worksheet validation is one of the design stage (prototype phase)

Validation of student worksheet conducted by 3 experts (lecturers) consists of 2 people of physics, 1 person of Indonesian language and 2 practitioners taken from physics teacher. This student worksheet validation includes content validity, construct validity and language validity. The instrument used in collecting data is a validity test questionnaire with a rating scale using a modified Likert scale from Riduwan [6] with the following four options:

| Score | Category               | % achieved indicator |
|-------|------------------------|----------------------|
| 1     | Highly Disagree (HD)   | 0-25                 |
| 2     | Disagree (D)           | 26-50                |
| 3     | Agree (A)              | 51-75                |
| 4     | Highly Agree (HA)      | 76-100               |

Analysis of validity data using Aiken’s $V$ formula is [7]:

\[ V = \frac{\sum s}{n(c-1)} \]  

where :
s = r – l0
l0 = The lowest validity score (in this case = 1)
c = The highest validity score (in this case = 4)
r = The number given by the validator

Category of validity based on the final value obtained can be seen in Table 2.

| Score | Criteria |
|-------|----------|
| ≥ 0.6 | Valid    |
| < 0.6 | Not Valid|

### 3. Results and Discussion

Student worksheet (LKS) that have been designed, validated by the validator. Validation results and suggestions of improvements provided by the validator are used to revise the student worksheet. Data on student worksheet validation results from validator experts and practitioner are presented in Table 3.

| No  | Observed Aspects | Average scoring | Average Total | Category |
|-----|------------------|-----------------|---------------|----------|
|     |                  | experts Practitioner |              |          |
| 1   | Content          | 0.92 0.88       | 0.90          | Valid    |
| 2   | Construct        | 0.90 0.92       | 0.91          | Valid    |
| 3   | Language         | 0.89 0.94       | 0.91          | Valid    |

The results of the student worksheet assessed by the validator in Table 3 can be seen on average in general is 0.91 are in valid category. The validation results for the proper content aspects show the average value 0.90 with valid criteria. In the aspect of proper content of the assessed aspects, that is: the supporting information presents the dynamic electrical material in a concise and systematic manner, the tasks and work steps in the student worksheet in accordance with the steps of cognitive conflict strategy, orientation and presentation of learning experiences of learners containing questions aimed at expressing early knowledge of the learners, at the step of exploring the idea, learners formulate predictions about the phenomenon to be discussed and proven, the restructuring of ideas, learners do practical activities in groups. Steps Restructuring of learners’ ideas consists of: the purpose of the experiment, the tools and materials, the work steps, the data/experimental results, the application of the learners' ideas contains questions that the learners can solve by using the scientific concepts they have proved through experiments, review ideas contain class discussion activities to explain scientific concepts and principles, and review the results of experiments that have been done. Evaluation on student worksheet contains several questions about the material that has been studied. In the student worksheet, there is a place or part of the learner to conclude and write down the answers to the question. Student worksheet requires learners to be active in the learning process, student worksheet can motivate learners to ask and discuss in learning process, LKS lead learners to find the concepts of learning itself.

While the aspects of construction are very valid with the average 0.91, where aspects are assessed are: Presentation of student worksheet in accordance with the standard student worksheet sequence, strategic steps cognitive conflict clearly illustrated in the student worksheet, Consistency in using symbols and signs, There is a balance between illustrations of images with writing, student worksheet on cognitive conflict strategy base: presents attractive images, uses attractive colors, uses clear and legible fonts, has a regular layout, has a regular layout, and has an attractive display design.

In terms of aspects of language included in the category of valid, with the average 0.91, where aspects are assessed are: student worksheet is using good and correct language according to
Indonesian grammar, student worksheet is using language with enhanced spelling, student worksheet is using language suitable to the stage of development of learners (communicative), student worksheet is using simple language, straightforward, and easy to understand, the language used in the student worksheet is not ambiguous in meaning, and use the term in accordance with the concept of the subject.

4. Conclusion
Student worksheet physics on cognitive conflict strategy base to minimize misconceptions of learners included in the valid category in terms of proper aspects of content, constructs, and language. Validation results obtained from the validators obtained an average value of 0.91 in the valid category. Validators in this research is physics lecturer, lecturer of language and practitioner.

References
[1] Sugiyanta. 2005. Pendekatan konflik kognitif dalam pembelajaran fisika. (http://lpmpjogadiknas.go.id/index.php?option.com_content&task.view&id=225&Itemid=70).
[2] Sadia, I Wayan. 2014. Model-Model Pembelajaran Sains Konstruktivistik. Singaraja, Graha Ilmu.
[3] Trianto, 2010. Integrated learning model. Surabaya: Bumi Aksara.
[4] Depdiknas. 2008. Panduan Pengembangan Bahan Ajar. Jakarta : Direktorat Pembinaan SMA.
[5] Plomp, T 2013. Education and Training System Design. Enschede. University of Twente. Netherlands.
[6] Riduwan. 2008. Variabel-variabel Penelitian. Bandung: Alfabeta.
[7] Azwar, Saifudin. 2015. Validitas dan reabilitas. Yogyakarta. Pustaka Belajar.