

## Development of student worksheet based on guided inquiry with class activity and laboratory in thermochemistry material

Kiprah Piawi<sup>1</sup>, Umar Kalmar Nizar<sup>2</sup>, Mawardi<sup>3</sup>

<sup>1</sup> Universitas Negeri Padang, Padang - Indonesia, (kiprahpiawi@gmail.com)

### Abstract

The study of development student worksheet based on guided inquiry has been conducted for thermochemistry subject for high school. This study aims to determine the validity, practicality and effectiveness of development student worksheet using plomp model. The results show that the developed student worksheet in very valid categorized (82.1%). The application of guided inquiry in student worksheet has been practicality tested by teachers and students, and it show the result of 81.25% and 85.1%, respectively. This value indicates that student worksheet is very practical. Based on the students activity aspect, the effectiveness student worksheet based on guided inquiry reaches 84.4% (very effective), whereas based on learning outcomes have a n-gain value of 0.6 (medium). It can be concluded that the developed student worksheet is in very valid, very practical and very effective category so as to improve the students understanding.

**Keywords:** Student worksheet, guided inquiry, thermochemistry.



This is an open access article distributed under the Creative Commons 4.0 Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited. ©2018 by author and Faculty of education, Universitas Negeri Padang.

## Introduction

Student Worksheets is one form of teaching materials which consists of the sheets that should be done by students. When students answer questions on students worksheet, they must fulfill cognitive activity so that it can improve their understanding. (Celikler 2012: 4611). The Problem occur in schools today that the teaching materials used by the teachers can not fully support the studnets to understanding chemistry lessons, especially thermochemistry. Students are not accustomed to making sequential answers from low cognitive to high cognitive levels. The teaching materials used by teachers has also led the students in answering questions to find the concept. If students are left alone in answering questions to form concepts, then it will cause the misconception. Another problem is the teaching material does not have an illustration of the image to understand the material. Abstract concepts in chemistry can be explained by picture illustration (submicroscopic level). In addition, the concepts in chemistry also require practical activity in understanding it.

Based on the problems occur, it is necessary to develop student worksheet so that students can understand the lesson. Developed student worksheet based guided inquiry that presents various illustrations of images (models) and key questions that guide students in finding concepts. There are two activities. Thet are classroom and laboratory activity with guided inquiry stages. Student worksheet based guided inquiry can improve the student activity in the learning process. Inquiry

based learning is well suited for high school level. Guided inquiry provides more direction for students who are not ready to overcome problems and experiences (Irham, et al., 2017: 39).

Some studyrs have reported that student worksheet based on guided inquiry can improve learning outcomes, attitudes and skills of students. Aini (2015) implements guided inquiry in student worksheet in chemical equilibrium material). Irham (2017) applies student worksheet to hydrolysis material. In general, student worksheet based on guided inquiry can improve students' understanding and ability to learn effectively.

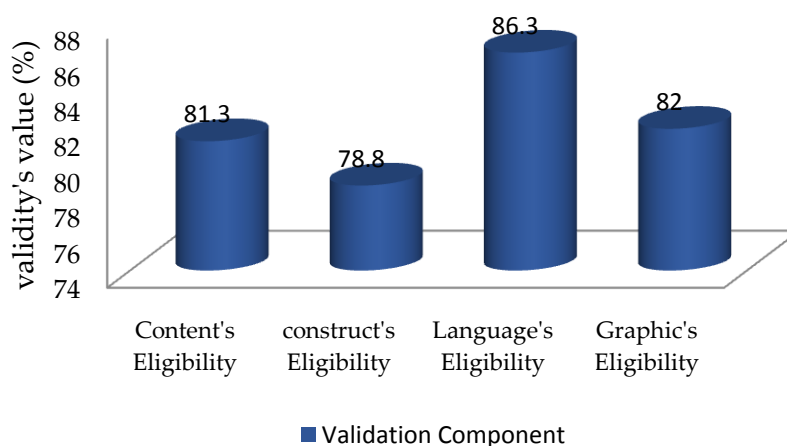
## Method

The population in this study is high school students in padang city. The sample of the study is the students of SMA N 5 Padang. Sampling technique is purposive sampling. The type of study is Educational Design Research (EDR). The development model used in this study is the Plomp model consisting of 3 main stages: (1) preliminary study, (2) prototyping stage (design stage), and (3) assessment phase and assessment). The instruments used in this study are validation sheet by lecturer and teacher, teacher and student response questionnaire, and effectiveness test instrument through students' learning result and activity.

## Results and Discussion

### Validitas

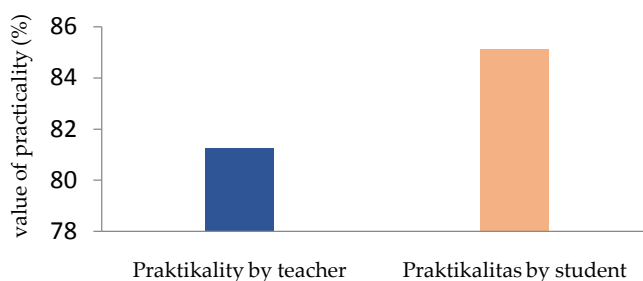
Based on the analysis of student worksheet validation, it was concluded that student worksheet based on guided inquiry have valid validity with the average percentage of 82.1%. The highly valid category of students worksheet is obtained because the students worksheet developed is in accordance with the demands of core competence and basic competence. The teaching materials are said to be valid if they are in accordance with the existing curriculum (Tukiran, et al., 2017; Yulastri, et al., 2017). Students worksheet content is also in accordance with the learning objectives to be achieved. If the teaching material used in accordance with the learning objectives to be achieved then the teaching materials can be used by students to study. The models and key questions presented in the student worksheet also lead students to understand the concept. The model is also presented with sub-microscopic levels so that students can understand abstract concepts. Abstract concepts can be explained through the sub-microscopic level. The key questions presented have an important role in guiding students in discovering concepts. Key questions have been compiled from low cognitive levels to high cognitive levels.



Students worksheet also presents an orientation stage that prepares learners to learn and connect old knowledge with new knowledge. The given application problem is a direct application of the concept learned so as to strengthen the concept. The eligibility assessment of the construct has a valid criterion. the systematics of students worksheet have been arranged well and there is coherence between the concepts studied. Students worksheet has been developed using a sentence that is good and correct according to the rules of Indonesian grammar and easily understood by learners. The use of terms, symbols and chemical equations is also consistent. The use of good sentences in students worksheet can help learners in using students worksheet and can improve learners' understanding. The graphical assessment of the developed student worksheet is in very valid category because the layout, picture, clarity, font size, and colour are good.

### Praktikalitily

The practicality of students worksheet was analyzed from the teacher and student response questionnaire. Based on the data that has been obtained shows that students worksheet which is developed including very practical katogori with practical value of each is 81,25% for teacher response questionnaire and 85,1% for student response questionnaire.



The practicality of the students worksheet is seen from the product's usability of the limited trial results in the field regarding the practicality and the implementation of the developed product. The teaching materials are said to be practical if they can be used to carry out logical, sustainable learning without much of a problem. From the results of the teacher's questionnaire assessment, the students worksheet has a very practical category. Practicality considerations seen from the aspects of ease of use and attractiveness of teaching materials to learners' learning interests.

The developed students worksheet has been prepared on the basis of conformity with the objectives to be achieved, the clarity of the manual use students worksheet, the suitability of the model with the objectives to be achieved and clarity of key questions. Based on the aspect of its ease of use that teaching materials in the form of students worksheet based guided inquiry developed that can facilitate teachers in achieving learning objectives and facilitate teachers to enhance the activities of learners in the learning process. students worksheet based guided inquiry can be said to be practical because students worksheet can be used easily by teachers and learners in the learning process.

Based on practical instrument valuation data from questionnaire responses learners have very practical category. students worksheet developed to facilitate learners in terms of its use. This ease can be seen from the language in students worksheet that is easily understood by learners, so that its meaning is well conveyed. students worksheet also provides instructions for use for learners so that learners can understand how to use the students worksheet. Another convenience is that guided inquiry-based students worksheet provides an opportunity for learners to discuss with their friends to improve their understanding of thermochemistry through key questions that guide learners to explore models. The help of the students establishing the material after using students worksheet indicates that the process of delivering messages on the students worksheet runs well. The use of color and design on the picture is very helpful for learners interested in learning (Rahmiati and

Mawardi 2016: 69). The high interest or attention of learners can occur because the learners feel happy with the existence of the pictures are communicative, make the mindset of learners more systematic and help in constructing the understanding, and can increase interest in reading, motivation, and curiosity learners. Shabiralyani, et.al (2015), say that using visuals aids as a teaching method stimulates thinking and improves learning environment in a classroom. Effective use of visual aids substitutes monotonous learning environments. Students develop and increase personal understanding of the areas of learning when they experience a successful and pleasant learning in the classroom. Students find visual aids sessions useful and relevant when it has some direct relation to the course content. The present study gave insights on students' perception and opinions on the use of visual aids and resources. However, it is also imperative to redirect teachers opinions, perceptions, experiences, failures and success while using visual aids resources

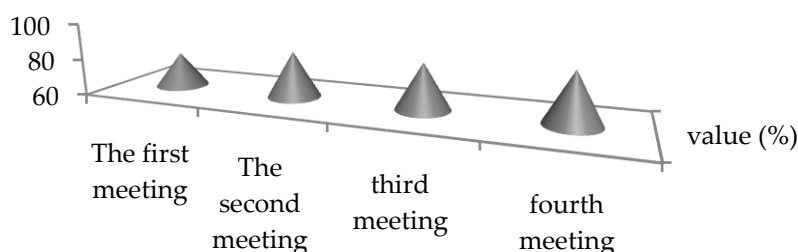
### Effectiveness

#### *Student outcome*

Based on result data, it can be concluded that there is an increase in posttest value with n-gain value is 0.67 medium category indicating that students worksheet used can be said to be effective. N-gain naiqué obtained is 0.67 in the medium category so students worksheet used is said to be effective. This value is obtained because the students worksheet is presented for guided inquiry-based learners emphasizing the interconnection between the three levels of representation. The model used in students worksheet is correct with the material being studied. The key questions provided have also led the learner to improve his understanding. Problem application provides an opportunity for learners to deepen the concept that has been owned. Guided inquiry-based labor activities also make learners learn and master knowledge and skills (The College Board, 2012: 14).

#### *Student's Activity*

Based on the results of the activity analysis of 84.4% with very effective category. This value indicates that the learning activities of learners have been effective for use.



This effectiveness is gained because students worksheet is used to increase the activity of learners in the learning process such as active learners in answering key questions, asking and giving responses, answering applications and concluding the material that has been studied.

### Conclusions

Based on the study that has been done, namely the development of students worksheet based guided inquiry with classroom and laboratory activities on thermochemical lesson grade XI included in the valid, practical and effective category use in the learning process.

### Acknowledgments

Thanks to Dr. Mawardi, M.Si., Umar Kalmar Nizar, Ph.D., and Rizky Zalmi Putra

## References

- Aini, F. Q., Mawardi., and Oktavia, B. 2017. *Guided Inquiry Based Student Worksheet on Chemical Equilibrium Topic*. German: LAP Lambert Academic Publishing
- Celikler, D., and Zeynep. A., 2012. The Effect of the Use of Worksheets About Aqueous Solution Reactions On Pre-Service Elementary Science Teachers' Academic Success. *Procedia - Social and Behavioral Sciences* 46 ( 2012 ) 4611 – 4614
- Hanson, D. M. 2005. *Designing Process-Oriented Guided-Inquiry Activities*. In *Faculty Guidedbook: A Comprehensive Tool For Improving Faculty Performance*, ed. S. W. Beyerlein and D. K. Apple. Lisle, IL: Pacific Crest.
- Irham, S. M., Mawardi dan Oktavia, B. 2016. The Development of Guided Inquiri Based Worksheet on Colligative Properties Solution for Chemistry Learning". *International Conference On Mathematics and Science Education*
- Plomp, T. 2013. "Educational Design Study : An Introduction", dalam *An Introduction to Educational Study*. Enschede, Netherland: National Institute for Curriculum Development.
- Rahmiati, S. dan Mawardi, A. 2016. "Teaching Materials Development of Student Worksheet (SWS) Guided Inquiry Based on the Materials for Learning Rate of Chemical Reaction". *Proceedings of Academics World 28<sup>th</sup> International Conference*, 28<sup>th</sup> March 2016. Tokyo, Japan
- Shabiralayan, G., Hasan, K. S., Hamad, N., and Iqbal N (2015). Impact of Visual Aids in Enhancing the Learning Process Case Study: District Dera Ghazi Khan. *Journal of Education and Practice* www.iiste.org ISSN 2222-1735 (Paper) ISSN 2222-288X (Online) Vol.6, No.19, 2015
- The College Board. 2012. *AP<sup>®</sup> Chemistry Guided-Inquiry Experiments: Applying the Science Practices (Teacher Manual)*. New York: The College Board.
- Tukiran., Suyatno., dan Hidayati N. 2017. Developing Teaching Materials of Natural Product Chemistry to Increase Student's Life Skills. *Journal of Turkish Science Education*. Volume 14. Issue 2
- Yulastri, A., Hidayat, H., Ganefri., Islami. S., dan Edy, F. 2017. Developing an Entrepreneurship Module by Using Product-Based Learning Approach in Vocational Education. *International Journal Of Environmental & Science Education*. Vol. 12, No. 5, 1097-1109