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The Development of Guided Inquiry-Based Students' Worksheet in Cell Material for Senior High School Students

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Abstract

This research was aimed to develop guided inquiry-based students' worksheet in cell materials for students in senior high school. It has the characteristics of valid, readable, and executable. This research was a Research and Development (R&D) type. The validity of worksheet was valued by validator and analyzed using percentage description. The readability of worksheets can be obtained by small scaled try out to 20 students taken by using purposive random sampling. The executability of worksheets was obtained by bigger scale try out to 32 students. The result of the research showed that the guided inquiry-based students' worksheets had characteristics of: 1) cell titled worksheets with its observation; 2) the activities based on syntax model of guided inquiry learning; 3) the material is related to real example; 4) the illustration picture in worksheets was real and 5) the display of worksheet in full color. The average percentage of validity to the worksheet was 83.06%. The percentage score of the worksheet was 85.31% with executability of 93.18%. Based on the results, it can be concluded that this worksheet has several characteristics and valid category to be used. It also had good readability and executability to the students.

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INTRODUCTION

The current education system curriculum in Indonesia is Curriculum 2013. This curriculum is the enhancement of the previous curriculum, Education Level Based Curriculum. In Regulation of Ministry of Education and Culture Number 69 Year 2013, Curriculum 2013 is enhanced in its learning pattern, from passive to active.

One of teachers' ways to make students active is by applying guided inquiry learning model. Guided inquiry learning model is a learning model developed to make students' active on finding and using sources of information and ideas to improve their understanding regarding certain topics or issues under the control of their teachers (Abidin, 2014). Learning materials are usually taught by teachers as to guide students. Students' worksheet usually becomes the source of learning material in biology. Somehow, problems happen after the use of worksheet where teachers utilize it only for students' exercise.

Based on the interview to biology teachers in some state senior high schools, SMAN 1 Palimanan, MAN Kendal, and SMAN 7 Semarang, there was a problem to the learning system. SMAN 1 Palimanan, used worksheet only as the media for students' exercise. MAN Kendal used the worksheet to help students in the practicum. Meanwhile, biology teachers in SMAN 7 Semarang used students' worksheet incompletely in learning process that there should be more development to the source of materials.

Other observation to XI grade students' responses to their worksheet and material of cells in the respective schools showed that students' worksheet was unclear, not contextual to the real-life example, difficult to understand, and difficult to relate it with real-life materials.

The Cells is one of the main chapters in biology. In order to support this chapter, there should be a relevant learning material and learning model for students to learn. The development of inquiry based students' worksheet has been vastly developed. A research conducted by Wahyuningsih dkk. (2014) showed that the developed worksheet with inquiry basis earned very good category executability in learning process and in improving students' activity. Besides, the worksheet fulfilled the criteria of valid/proper based on expert judgment in material and media.

The development of inquiry based students' worksheet had characteristics of developing material and practicum guidance. The guidance of practicum in students' worksheet contains activity relevant to syntax of guided inquiry learning model. Students' worksheet is completed with contextual materials to students' real-life. It makes students understand the materials easily. It is also supported by clear pictures. The aim of this development is to produce valid, readable, and executable guided inquiry students' worksheet based on the judgment of experts, teachers, and students.

RESEARCH METHOD

This studi used Research and Development (R&D) method. The method consists of these steps: 1) initial observation to potentials and problems; 2) data collection; 3) worksheet design; 4) worksheet validation; 5) worksheet revision; 6) small-scaled tryout; 7) big-scaled tryout; 8) worksheet product. The focuses of this research were students' worksheet characteristics, students' worksheet validation, students' worksheet readability, and students' worksheet executability. The types of data obtained in this research were secondary data (students' worksheet draft, instruments, and literature books) and primary data (validation from experts, teachers, students' responses, and observer data). The methods of data collection included interview, observation, and questionnaire. The developed students' worksheet is valid if the average validity score from three validators is $\geq$ 62.5%. The development of students' worksheet is success if the readability of the worksheet is good with the

percentage of 62.5% ≤ x < 81.25% or very good with the percentage of 81.25 % ≤ x ≤ 100%. The development of the worksheet is success if the executability is executable in the percentage of 62.5% ≤ x < 81.25% or very executable in the percentage of 81.25 % ≤ x ≤ 100%.

RESULT AND DISCUSSION

Characteristics of Guided Inquiry Worksheet

The characteristics of students' worksheet is related to its specification. The characteristics of guided inquiry worksheet in this research are: 1) Entitled with cells and observation to it; 2) The activities are related to the syntax of guided inquiry learning model; 3) related to real-life example; 4) supported with clear picture; and 5) provided in full color.

These characteristics refers to the structure proposed by Prastowo (2012), consists of title, students' guidance, competence, supporting information, tasks, and working steps with its scoring. In addition, Astuti and Setiawan (2013) states that the component of students' worksheet consists of title, students' identity, basic competence, learning goals, and content.

The Validity od Guided Inquiry Worksheet

The complete design of the worksheet was then validated by three validators, including material experts, media experts, and biology teachers. The recapitulation of the validators is delivered in Table 1 as follows.

Table 1 Recapitulation of Validators' Score to Guided Inquiry Students' Worksheet in Cells Materials for Senior High School Students

No	Scoring	Percentage	Scoring Category
1.	Material Expert	75,00 %	
2.	Media Expert	98,40 %	
3.	Biology Teachers	75,78 %	
Rata-rata		83,06 %	Very Proper

The average score of worksheet validity from the validators was 83.06% with very proper category. From the percentage of worksheet validity, media expert gave highest score of 98.40%. The score came because the worksheet has been made based on their expectation to its language and graphics. It is in line to Lesmana dkk. (2015), saying that students' worksheet is very appropriate to use since it has been used appropriate Indonesian language with clear picture and interesting design. It should also have interesting layout, not only contained with writings. Muslich (2010) says that good worksheet should be proper from its language, words, and sentence to deliver message based on valid Indonesian language.

The result of validation scoring of students' worksheet showed the strength and weakness of the developed worksheet. The strength is related to the relation to experts' expectation, while the weakness can be enhanced by experts' suggestion and correction. The weakness of the worksheet by material experts is shown by 2 points in the aspects of (1) relation to real-life example; (2) the completion of materials; and (3) the accuracy of materials and example.

The weakness of the worksheet from media expert is shown by 3 points in the aspects of (1) the accuracy of language; (2) language consistency; and (3) the appropriateness of guidance of practicum with guided inquiry learning model. The weakness shown by biology teachers is in the aspect of the incorrect allocation between time to class learning hours.

The Readability of Students' Worksheet Based on Guided Inquiry

The design of students' worksheet was validated and revised. It was then tried in small scale to 20 students in XI grade of SMAN 7 Semarang. The trials aims to know the readability of the worksheet. The scoring to worksheet's readability is delivered in Table 2 as follows.

Table 2 The Percentage of Guided Inquiry Students' Worksheet Readability in Cells Materials for Senior High School

No	Questionnaire Items	P
1.	Related to Guided Inquiry	100%
2.	Easy to Understand	82,50%
3.	Providing Useful Information	81,25%
4.	Activity 1 and 2 are interesting to read and understand	86,25%
5.	Questions in activity 1 and 2 are interesting to do and understandable	85,00%
6.	Questions in activity 3 and 4 trains students' thinking skills	83,75%
7.	The guide in the worksheet is clear and understandable	85,00%
8.	The mapping concept eases students	91,25%
9.	The real example in activity 1 and 2 ease students to relate it with real-life example	86,25%
10.	Problems in Students' Worksheet raises students' curiosity	82,50%
11.	Activity 3 and 4 ease students to do practicum	83,75%
12.	Activity 3 and 4 attract students to do practicum	83,75%
13.	The cover is clear and interesting	81,25%
14.	Pictures in activity 1 and 2 are clear and understandable	83,75%
15.	Pictures in activity 3 and 4 helps students to do practicum	81,25%
16.	The sentences in the worksheet is understandable	85,00%
17.	The font is interesting	87,50%
18.	The delivery of data, table, and pictures are interesting	86,25%
19.	Students' understanding to cells are improved	83,75%
20.	The worksheet motivates students to learn	82,50%
Final Percentage (P)		85,31%
Scoring Categories: very good to use		

In small-scaled trials, guided inquiry worksheet was proved having high readability of 85.31% or very good to use. Based on this result, students deemed the developed worksheet had clear mapping concept to understand the materials, interesting font, and interesting presentation of data, table, and pictures. The material in activity 1 and 2 was also interesting to students to read and understand as well as motivating students to learn. It is in line to Dewayanti dkk. (2015) that guided inquiry can motivate students.

Despite the strength, students considered that the worksheet had lacked in some aspect proved by low score in some questionnaire items. In the item number 3, students considered that the worksheet did not really ease them to answer the questions with the percentage of 81.25%. This result came after some materials which did not appear in the worksheet that make the students difficult. The next was item number 13 where students though that the cover was not really interesting with the percentage of 81.25%. The worksheet should be given more interesting pictures related to daily life example. According to Alfionita (2016), interesting cover of students' worksheet should have clear pictures. Furthermore, Widjajanti (2008) says that it is important to consider the design and appearance of worksheet since it is the main attraction to the students. In questionnaire number 15, pictures in activity 3 and 4 were not clear and less helpful to students in doing practicum with score of 81.25%. This problem can be solved by providing students picture to diffusion and osmosis materials. This thing is relevant to Riza *et al.* (2013) that the guide of practicum should be added with pictures of cells, so that it can optimize the learning process and help students in practicum.

The Executability of Students' Worksheet with Guided Inquiry Basis

The worksheet was then tried in big-scaled trials in SMAN 7 Semarang for XI MIA 3 class to 32 students. The big scaled trials is aimed to know the executability of students' worksheet to teacher and students' activities. The executability was tested in 2 meetings and scored by 2 observers with checklist sheets consist of questions related to syntax of guided inquiry learning model. The result of worksheet executability can be seen in Table 3 as follows.

Table 3 The Percentage of Guided Inquiry Worksheet Executability to Cells Materials for Senior High School Students

No	Syntax of guided inquiry	Meeting 1	Meeting 2
1.	Pre-learning	100%	100%
2.	Problem Identification	100%	100%
3.	Formulating Hypothesis	100%	100%
4.	Doing Experiment	80%	80%
5.	Manipulate and Analyze Data	100%	100%
6.	Hypothesis	100%	100%
7.	Conclusion	100%	100%
8.	Presenting Result	100%	100%
9.	Post-learning	50%	100%
Percentage		90,91%	95,45%
Average		93,18 (Very executable)	

The executability of students' worksheet was scored from teacher and students who executed the worksheet. In this case, students were actively involved in following the guided inquiry steps during practicum. It is in line to Ghumdia and Adam (2016) that guided inquiry strategy was the learning strategy allowing students to actively solve the problems in practicum. The lack of executability in students' worksheet was in the 4th item of experiment in the level of 80%. It was because there was an activity which was not executed; that is preparing tools and materials. Tools and materials were prepared by the researcher to anticipate students who did not bring the stuffs. Colburn (2000) states that in guided inquiry learning, teachers provides required tools and materials while students plan to solve problems by themselves. In guided inquiry, teachers acted as facilitators.

It is in accordance to Herron (2009) that guided inquiry should involve educator as facilitator to lead the discussion and give the guidance.

In the 9th syntax of guided inquiry after meeting 1, the executability was 50%. It was because teacher's activity was not done; that is reviewing problems and alternative solution to solve problems. It was not done because of limited time. Rifa'i *et al.* (2016) mentions that the difficulty faced by teachers during the practicum had several main factors including minimum learning time and difficulty in planning and evaluation to practicum activity of students. The solution to this lack is connecting the experiment in the worksheet to the time allocation and guided inquiry principle. As Martin (2002), the core of guided inquiry is questions referred to investigation goals. Students should be skillful enough to plan the investigation.

This result can be known that the overall executability of guided inquiry based worksheet to cells material obtained 93.18% or very executable. It showed that guided inquiry in the worksheet included formulating problems, making hypothesis, doing experiment, analyzing data, and delivering results can be done by teachers and students by following the guidance in the worksheet. It is in line to the research result of Suprapti and R.Susanti (2015) that developed learning materials with inquiry approach make students able to find and develop concepts they have learned from the experiment. Wahyuningsih dkk. (2014) states that the executability in guided inquiry to teachers and students' activity obtained average scoring of very good. Weaver *et al.* (2008) states that scientific method principles in guided inquiry models are observing phenomena, formulating hypothesis, doing experiment, analyzing data, and communicating the discoveries. The research of Khan and Iqbal (2011) showed that students taught with inquiry model have better performance to scientific methods in practicum. According to Nworgu and Victoria (2013), guided inquiry can help students developing scientific skills.

CONCLUSION

The result of the research showed that the guided inquiry based students' worksheets had characteristics of: 1) cell titled worksheets with its observation; 2) the activities based on syntax model of guided inquiry learning; 3) the material is related to real example; 4) the real picture in the worksheets was real and 5) the display of the worksheet in full color. The average percentage of validity to the worksheet was 83.06%. The percentage score of the worksheet was 85.31% with executability of 93.18%. Based on the results, it can be concluded that this worksheet has several characteristics and valid category to be used. It aklso had good readability and executability to the students.

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