Design of Student Worksheet Development Based on the Jigsaw Cooperative Learning Model

Sigit Kurniawan,[1] Master of Mathematics Education, University of Ahmad Dahlan, Indonesia
Suparman, Master of Mathematics Education, University of Ahmad Dahlan, Indonesia

Abstract: *Collaboration skills are one of the skills that are built in 21st-century education. With collaborative skills, students are expected to be able to work together with each other to help and complete to carry out certain tasks in order to obtain a predetermined goal. The jigsaw cooperative learning model as one of the means in building collaboration skills requires the adequacy of teaching materials. This study aims to produce products in the form of Student Worksheets (LKS) that fit the jigsaw cooperative learning model. This study uses the Design Research type Development Study development model. The research subjects were students of class X Muhammadiyah Cangkringan Sleman Yogyakarta. The stages in this study were researchers designing prototype 1. The results of prototype 1 were tested one-to-one, parallel to the expert review stage, as the basis for revision to improve and produce a prototype 2. Prototype 2 was tested in the small group as a basis for revision to improve and produce prototypes 3. The results of this study are prototypes 2 which are ready to be used at the small group stage.*

Keywords: *LKS, collaboration, jigsaw*

INTRODUCTION

The ability to cooperate, as one of the many caring behaviors, is one aspect of the formulation of social attitude competencies (Kemendikbud, 2016). On another occasion, the Ministry of Education and Culture (2017) stated that one of the skills needed in 21st-century education is collaboration skills. With collaboration skills, students are expected to be able to work together with each other to help and complete to do certain tasks in order to obtain a predetermined goal.

There are studies showing that in general the learning strategies used by teachers make students tend to be passive and receive material directly (Rosyidi, A., & Sutami, S, 2016). Teacher-centered learning is a conventional learning model, in this case, is direct learning that is dominated by lecture methods (Nur, A, 2016). Therefore another learning strategy is needed so students can play an active role in learning.

There are many studies that show that jigsaw cooperative learning is a good learning model (Musthofa K, 2013; Naomi, Bernard, & Githua, 2013; Ahmad, A., & Jazuli A, 2016). Musthofa K, (2013) states that student activities in the form of discussions in both the origin group and the expert group provide opportunities for students to convey their ideas/ideas / opinions, so as to stimulate students to be active in learning activities. Whereas Naomi, Bernard, & Githua (2013) stated that students taught using Jigsaw cooperative learning strategies performed better than those taught using conventional learning methods. Meanwhile, Ahmad, A., & Jazuli, A. (2016) stated that students gave a positive response to the application of this learning model.

Teaching materials are needed for all subjects, including mathematics lessons (Indrayanti, R. D., & Wijaya, A, 2016). The majority of students agree that cooperative learning with a contextual approach supported by appropriate teaching materials is quite helpful in developing knowledge and thinking skills (Ahmad, H. 2016). Therefore the adequacy of teaching materials is needed in learning.

Observations in the field showed that mathematics learning at Cangkringan Muhammadiyah Vocational School was still conventionally dominant, with lecture methods and learning steps in the form of concept explanations, examples of questions and exercises. Student activities in doing the exercises are still dominated by individual activities. Collaboration between students

1 Kurniawan Sigit, Master of Mathematics Education, University of Ahmad Dahlan, Indonesia. email: sigitkurniawan453@gmail.com

p-ISSN: 2477-3328
e-ISSN: 2615-1588

is still partial, where only a few students are actively involved in discussions with friends around them, even though the teacher has repeatedly suggested that all students are actively involved in discussions in solving the teacher training questions. This happens because the existing teaching materials have not been sufficient to support the discussion process in the learning. Existing textbooks are still general, so the teacher has to do a lot of modification, and this modification capability still needs to be improved. Therefore, it is necessary to develop teaching materials in accordance with the jigsaw cooperative learning model (Kurniawan, 2017). Teaching materials to be developed are student worksheets.

This article is organized into four parts. The first section contains an introduction, while the second part contains research methods. The results of the research and discussion are presented in the third section, and the fourth section contains conclusions.

RESEARCH METHODS

The study was conducted in the odd semester of the 2018/2019 academic year in Cangkringan Muhammadiyah Vocational School. The research subjects were 12 Accounting 1 class X students with details of 4 students at the one - to - one stage and 8 students at the small group stage.

Research on the development of Collaborative LKS based on jigsaw cooperative learning model using the Design Research method. Design Research can be used for research that has the function to design (to design) or develop (to develop) an intervention with the aim of solving complex problems in the field of education (Plomp & Nieveen, 2013). This study uses the type of Development Study (Akker, et.al, 2006: 4). Development study is an activity to develop design principles that are used to solve problems in the field of education and the practical interests of the field (Prahmana, 2017). This study develops a valid and practical Collaborative Worksheets so that further research can be conducted to find out potential effects on student learning outcomes.

This development research through two stages, namely the Preliminary Study stage (covering the analysis and design stages) and Formative Evaluation (Tessmer, 1999; Zulkardi, 2002) including the stages of self-evaluation, expert review, one to one, small group and field test). Data collection techniques of this research are walkthrough, documentation and interviews. The research stage can be seen in Figure 1.

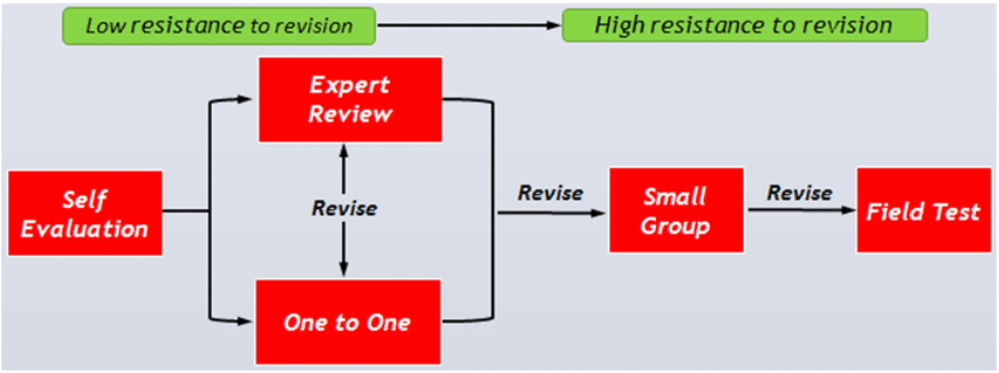


Figure 1: Design flow of formative evaluation (Tessmer, 1993)

RESULTS AND DISCUSSION

The teahhing materials development with the Design Research method, with the Preliminary Study stage (including the analysis and design stages) and Formative Evaluation includes the stages of self-evaluation, expert review, one to one, small group and field test). This research was only at the Preliminary Study stage, namely the analysis and design stage, and part of the Formative Evaluation stage, namely expert review and one-to-one.

Analysis Phase, at this stage the preparation is carried out namely the analysis of teaching material needs, curriculum analysis, and student analysis. First, the analysis of teaching material needs is done by reviewing the results of previous research, which shows that mathematics teaching materials based on the jigsaw cooperative learning model are still needed. Secondly, curriculum analysis is carried out on Basic Competencies contained in the 2013 revised edition 2017 Curriculum. From the analysis, the Competency Achievement Indicators and Learning Objectives are then formulated. The decline from KD to the Competency Achievement Indicator can be seen in table 1.

Table 1: Basic Competencies and Indicators of Achievement of Competence, and Learning Objectives

No	Basic Competencies	Competency Achievement Indicators	
3.4	Determine the maximum and minimum values of contextual problems related to a linear two-variable program	3.4.1	Determine the set of settlement areas from a linear inequality system
		3.4.2	Determine the linear inequality system of the settlement set area
		3.4.3	Determine the maximum and minimum values in the settlement area of the linear inequality system
4.4	Presenting contextual problem solving related to a linear two-variable program	4.4.1	Develop mathematical models of contextual problems that correspond to the linear program of two variables and solve them

Meanwhile, the Learning Objectives formulated from the indicators are as follows: Through discussion activities with the help of this LKS students work well so that they can:

1. Determine the set of settlement areas from a linear inequality system
2. Determine the linear inequality system of the settlement set area
3. Determine the maximum and minimum values in the settlement area of the linear inequality system
4. Develop a mathematical model of contextual problems that correspond to the linear two-variable program system and solve them

The third analysis of students, was carried out to obtain information that the research subjects at the one - to - one stage were 4 students of Class X Accounting 1, the small group stage was 8 students of Class X Accounting 1, and in the field test stage were 16 students of class X Accounting 2.

In the design phase, at this stage, the LKS design was made with the Word 2007 Microsoft Program. The teaching materials used were collaborative worksheets with the jigsaw cooperative learning model. The initial design was a prototype 1. LKS that has been designed in prototype 1 is made with the cover component, the summary of material, and

p-ISSN: 2477-3328
e-ISSN: 2615-1588

core LKS. First, the LKS cover contains the identity of the LKS, the identity of the compiler, and the place to fill the student's identity. The cover design of LKS can be seen in Figure 2

Figure 2: Cover Prototype 1 LKS

Second, a summary of the material contains brief and practical material explanations that can be used as a reference in solving the problems raised in the contents of the LKS. The summary design of the material can be seen in Figure 3

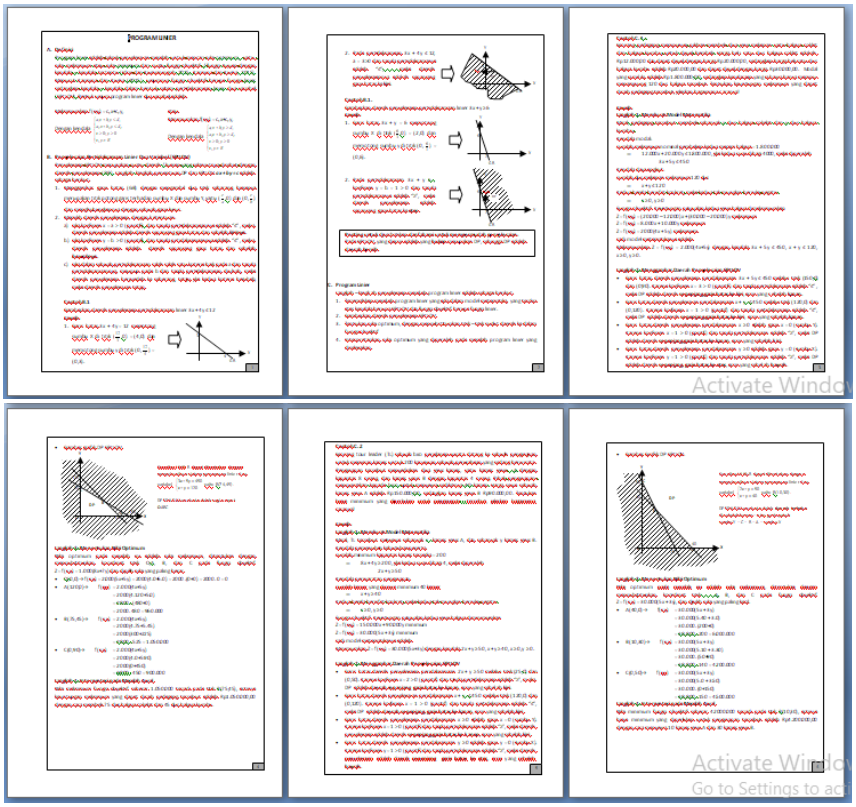


Figure 3: Summary of Prototype 1 LKS Material

Third, the core worksheets contain problems - problems that students will solve in groups and collaborate using jigsaw techniques along with instructions for their use. One of them is LKS 1. On LKS 1 there are four different problems about drawing a graph of the completion of the two variable linear inequality system. The four problems will be solved by students through discussions in the expert group within 20 minutes. The LKS 1 design can be seen in Figure 4.

Figure 4: LKS 1 Prototype 1

Evaluation Stage, at this stage the LKS design on prototype 1 was evaluated using formative evaluation developed by Tessmer. The stages at the evaluation stage include self-evaluation, expert review, and one - to - one. First self-evaluation. At this stage, the prototype 1 design is re-evaluated by paying attention to the content, construct, and language. At this stage, there have not been found any things that need to be significantly revised. Both expert review. Prototype 1 is consulted with competent experts. The experts are Dr. Suprapto and Dr. Puguh Wahyu Prasetyo, who are the lecturer in the Master of Mathematics Education, Ahmad Dahlan University and Surajiyono, S.Pd, M.Sc, who is the Chairperson of the SMK Mathematics Subject Teacher Training (MGMP) throughout Sleman. The results of the review of the three experts can be seen in table 2.

Table 2: Comments and suggestions from Expert

No	Expert	Comments and suggestions
1	Dr. Suprapto	• Fix punctuation • Use the equation consistently • Use clear numbering • Apply mathematical concepts, not just those that are considered mathematics
2	Dr. Puguh Wahyu Prasetyo	• Use standard words • Use the equation consistently • Increase the variety of problems
3	Surajiyono, S.Pd, M.Sc	• Materials for teaching materials are suitable for students' needs • Systematics of teaching materials is in accordance with the jigsaw learning model • Summary of material does not need to be included for students

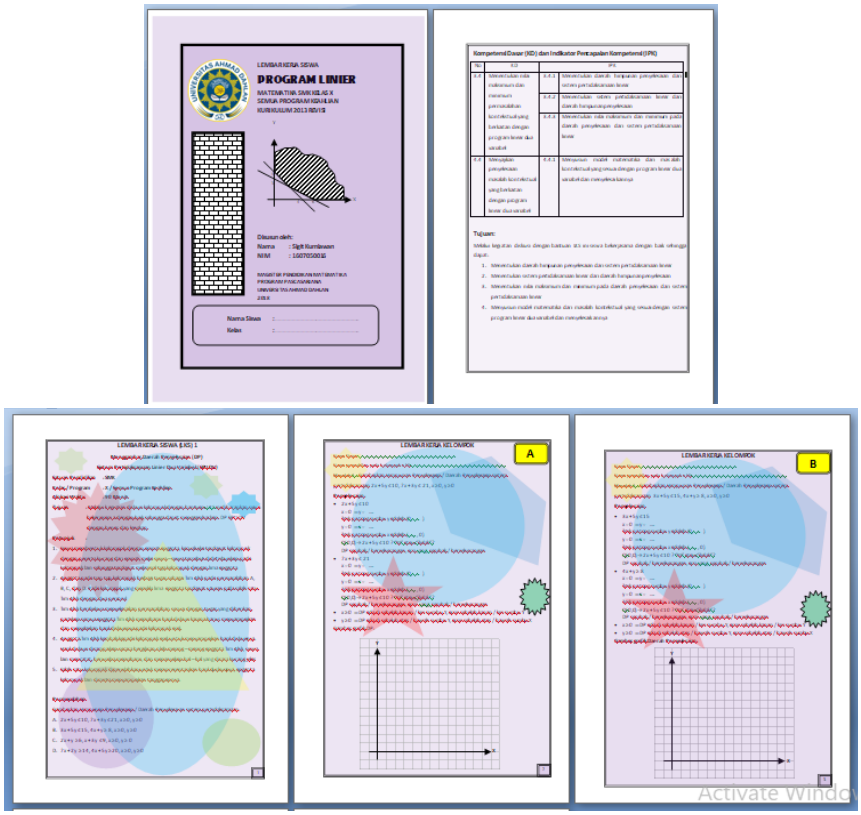
p-ISSN: 2477-3328
e-ISSN: 2615-1588

Third one - to - one. At this stage, the first prototype tested on 4 students with different abilities of class X Accounting 1 is Duwi Volaika, Fitri Rahmayanti, Nyarwanto, and Three Vashti Safana Nafisa. The four students are asked to learn, try to work, then submit comments and suggestions. The results at the stage one-to-one can be seen in table 3.

Table 3: Comments and Suggestions from Students

No	Students	Comments and Suggestions
1	Duwi Volaika	• Worksheets facilitate understanding • Explanations are easy to understand • Problems are difficult to understand • Writing is not attractive
2	Fitri Rahmayanti	• LKS cover is less attractive • We recommend binding • Problems are difficult to understand • Need additional explanation
3	Nyarwanto	• Explanations are difficult to understand • The formula is difficult to understand • The words are difficult to understand
4	Three Vashti Safana Nafisa	• Material that is difficult to understand • The problem is that there is a muter • Less interesting

Based on expert comments on the stages and opinions of students in the one - to - one stage, prototype 1 was revised to become a prototype 2. The portion of the revision can be seen in Figure 5.



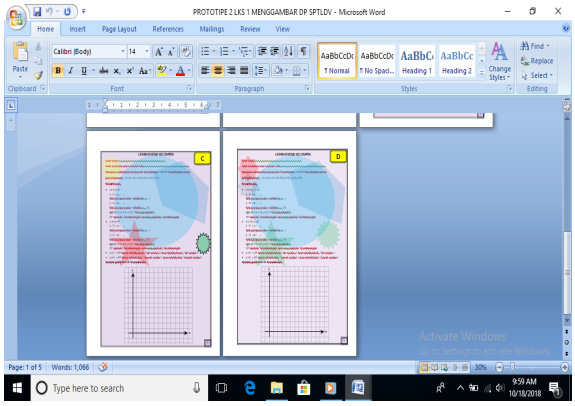


Figure 5: Some Prototype 2

CONCLUSION

From the results of the study concluded that the development of worksheets based on jigsaw cooperative learning model has gone through all stages in the Preliminary Study stage, which includes analysis and design. Some stages in the Formative Evaluation stage that have been passed are the self-evaluation, expert review and one to one. The product produced is a prototype 2. For the next stage, the prototype 2 will be used in the small group stage.

REFERENCES

Ahmad, A., & Jazuli, A. (2016). *Jigsaw Type of Cooperative Learning as a Means of Improving High School-Students' Mathematical Communication Ability*. EDUCARE, 1(2)

Indrayanti, R. D., & Wijaya, A. (2016). *Pengembangan Lembar Kerja Siswa Berbasis Pendidikan Matematika Realistik Untuk Topik Matriks Di SMK Kelas X [Development of Student Worksheets Based on Realistic Mathematics Education for Matrix Topics in Class X Vocational Schools]*. Pendidikan Matematika-S1, 5(6), journal.student.uny.ac.id

Kagan, S, Kagan, M. *Kagan Cooperative Learning. San Clemente*. Kagan. 2009. 17.20-17.21

Kemendikbud. (2016). *Lampiran Permendikbud no.22 tahun 2016 dan lampiran 16 Permendikbud tahun2016 [Attachment No. 22 of the Minister of Education and Culture 2016 and annex 16 of the Minister of Education and Culture of 2016]*.

Kemendikbud. (2017). *Implementasi Pengembangan Kecakapan Abad 21 dalam Penyusunan RPP [Implementation of 21st Century Skills Development in Preparation of RPP]*.

Kurniawan S, (2017). *Analisis Kebutuhan Bahan Ajar Berbasis Pembelajaran Kooperatif Tipe Jigsaw [Teaching Material Needs Analysis Based on Jigsaw Cooperative Learning]*, Makalah Yang Diseminarkan dalam ETNOMATNESIA 2017. Yogyakarta: UST.

Plomp, T., & Nieveen, N. (2013) Educational Design Research. Illustrative Cases

Prahmana, R.C.I. (2017). *DESIGN RESEARCH (Teori dan Implementasinya: Suatu pengantar)*. Depok: PT Raja Grafindo Persada

Musthofa K. (2013). *Pembelajaran Fisika dengan Cooperative Learning Tipe Jigsaw untuk Mengoptimalkan Aktivitas dan Kemampuan Kognitif Siswa Kelas X-6 SMA MTA Surakarta [Physics Learning with Jigsaw Cooperative Learning to Optimize Cognitive Activities and Ability of Students of Class X-6 of SMA MTA Surakarta]*. Jurnal Pendidikan Fisika 1(1): 55 – 63

p-ISSN: 2477-3328
e-ISSN: 2615-1588

Nur, A. (2016). *Pengaruh Model Pembelajaran Inkuiri Dan Gaya Kognitif Terhadap Hasil Belajar Siswa Pada Matapelajaran Biologi Di Kelas XI IPA MAN 2 Model Palu [The Influence of Inquiry Learning Models and Cognitive Style on Student Learning Outcomes in Biology Subjects in Class XI Science MAN 2 Model Palu]*. Mitra Sains, 4(4).

Rosyidi, A., & Sutami, S. (2016). *Penerapan Pembelajaran Matematika Dengan Strategi TGT dan NHT Terhadap Hasil Belajar Ditinjau dari Keaktifan Peserta Didik [Application of Mathematics Learning with TGT and NHT Strategies Against Learning Outcomes Judging from the Active Activities of Students]*, publikasiilmiah.ums.ac.id

Tessmer, Martin (1993). *Planning and Conducting Formative Evaluation*. Philadelphia : Kogan Page.

Zulkardi, Z. (2002). Developing a learning environment on realistic mathematics education for Indonesian student teachers. University of Twente.

ABOUT THE AUTHORS

Sigit Kurniawan: Student in the Master of Mathematics Education, Departement of Mathematics Education, University of Ahmad Dahlan, Yogyakarta, Indonesia.

Suparman: Associate Professor, Departement of Mathematics Education, University of Ahmad Dahlan, Yogyakarta, Indonesia