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## **Developing scientific writing materials by using RDR and R2D2**

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**Abstract.** The purpose of this research was to develop the participative and collaborative scientific writing materials to develop the social and emotional intelligence among students. In an effort to reach the goal, the research model used was R2D2 and RDR. Research data were in the form of notes, corrections, comments, criticism from expert teams and practitioners of the product. Data were analyzed by domain technique and t test. The results of the effectiveness test showed that this development product had advantages compared with conventional scientific writing materials. The learning of scientific writing by utilizing this development product significantly influenced the improvement of social and emotional intelligence, the quality of learning process, and the achievement of student's scholarly writing. The results of this study have implications that scientific writing materials that will be used in the learning process should be done in advance development process to obtain reliable and high quality teaching materials to achieve the quality of the process and as well the results of scientific writing.

**Keywords.** democratic, emotional intelligence, social intelligence, collaborative, scientific writing, participative

### **1. Introduction**

Participative and collaborative scientific writing learning can be utilized to develop participative attitudes of all members of the study group, the hard work of all members, shared responsibility, democratic attitudes, tolerance, mutual giving and receiving, mutual help, respect for differences and diversity, and the attitude of other noble characters in students (Triyono, 2012: 35; Isyanti, 2005: 97). As stated by Basuki (2012: 88) that the participative and collaborative learning of scientific writing is a learning in which students can develop democratic attitudes, togetherness, discussion, shared responsibility, exchange ideas, give each other and receive opinions of friends, mutually correcting the work of friends, and helping each other in learning. Therefore, participative and collaborative scientific writing learning needs to be realized in developing the students' social and emotional intelligence. In realizing the participative and collaborative learning of scientific writing, it must begin with the realization of participative and collaborative learning materials as well.

Until now, there is not yet sufficient teaching material available to devote participative and collaborative scientific writing that can be used to develop the students' social and

emotional intelligence. Teaching materials available and used by lecturers are still conventional and do not encourage students to take part in the preparation of teaching materials, so the lesson is less innovative. Based on observations and discussions with lecturers, it was found that 85% of scientific writing materials at the Universitas Negeri Gorontalo, Manado, and the majority of universities in Sulawesi cannot be classified as participative and collaborative teaching materials.

Participative and collaborative scientific writing materials are needed to encourage more intense participation and cooperation among students (Machotka, Nedic, & Zdemir, 2008) in learning to compile scientific writing. Scientific writing is a work that needs to be completed collaboratively and the students' active role in determining the goals and learning materials in order to obtain high quality scientific work. Students actively participate and collaborate in completing the entire series of writing scientific papers from the stage of determining topics to the editing stage. Students need to learn, so all the learning needs must be actively prepared by students themselves (Coldwell, [et al], 2011: 96). The role of the lecturer is only as a facilitator who facilitates the students' learning needs.

Participative and collaborative teaching materials are teaching materials that can shape students to have participative attitudes for all members of the study group, hard work of all study group members, shared responsibility, democratic attitudes, tolerance, mutual giving and receiving, mutual help, differences and diversity, mutual understanding of each individual's character, and other noble attitudes that exist within the students are absolutely necessary in the study of writing scientific papers. By utilizing participative and collaborative scientific writing materials, scientific writing process can produce a high quality of the students' scientific work.

Participative and collaborative learning is an active process of students in building the knowledge and skills learned through a number of meaningful interactions with the environment. Learning is a process of assimilating and linking old experiences that have been acquired with new experiences. Participative and collaborative learning processes are characterized by the following seven points (Suparno, 1997: 76) (a) coaching familiarity, (b) identification of wholeness, (c) source and possibly obstacles, (d) formulation of learning objectives, (e) programming Learning, (f) implementation of learning, and (g) assessment of the processes, outcomes, and impacts of the learning process undertaken.

## **2. Methodology**

The models used to develop teaching materials were the Recursive Reflective Design and Development Model (R2D2) by Willis (1995; 2000) and Research Development Research (RDR) by Borg & Gall (2003). The R2D2 model consists of three focuses: focus of (a) determination, (b) design and development, and (c) dissemination. RDR has three activities, namely preliminary research, development of learning tools, and implementation of effectiveness test activities. This development procedure is a combination of procedures in the R2D2 and the procedures in the RDR model. These developmental research procedures were respectively (a) the focus of the preliminary study, (b) the focus of determination, (c) the design and development focus, and (d) the focus of the product effectiveness test.

Research data consisted of two kinds namely qualitative and quantitative data (Supriyadi, 2015). Qualitative data were descriptive and reflective data. Descriptive data included comments, criticisms, suggestions, corrections, and assessments provided by practitioners and experts on the product. Reflective data in the form of comments and interpretations of the descriptive data by researchers. On the other hand, the quantitative data

were the pretest and the posttest score of the students' scientific writing skill obtained from the implementation of the product effectiveness test.

Sources of research data was practitioners, experts, students, lecturers, and learning process. Data from practitioners and experts were in the form of comments, criticism, suggestions, corrections, and assessment of scientific writing device learning products. Data from students were in the form of speech (oral and written), behavior, attitude of students in learning process, and score of the pretest and posttest of the of students' scientific works of the learning process. Data from lecturers were in the form of speech (oral and written), behavior, attitude in the learning process, document learning tools, comments, criticism, suggestions, corrections, and assessment of learning device product of writing scientific papers. On the other hand, data from the learning process (effectiveness test) was a pattern of interaction among students, students and lecturers, students and material, students' participation in learning process, and learning reflection.

The data analysis activity was divided into three namely (a) data analysis from test result of practitioner and expert, (b) data analysis during product trial, and (c) data analysis result of product effectiveness test activity. The data analysis activities of the participants and experts were performed with domain analysis techniques. Data were grouped by content, format, and language domains based on the developed teaching materials. Data analysis result of product effectiveness test activity was done by applying statistical technique of related samples t-test (Santoso, 2010).

### 3. Results

Teaching materials were selected as optimal as possible to assist students in achieving competence standards and basic competencies (Depdiknas, 2008). The matters to be considered regarding the selection of teaching materials were the type, scope, sequence, and treatment of the teaching materials. Therefore, teaching materials had strategic functions for lecturers and students. The strategic function of the teaching materials is as follows.

**Table 1.** The Strategic Function of the Learning Materials

No.	Strategic Function of the Learning Materials
1.	Guidance for the lecturers in performing the learning process.
2.	Substance of the competency taught to the students.
3.	Guidance for the students in the learning process.
4.	Substance of the competency learned/mastered by the students.
5.	Tool of evaluation of the achievement/mastery of the learning outcomes.

**Table 2.** The Source of the Learning Materials

No.	Source of the Learning Materials
1.	Scientific paper
2.	Scientific journal
3.	Scientific magazine
4.	Students' writings
5.	Scientific papers from various sources

Sources of teaching materials can be utilized optimally by the students by understanding the substance of writing materials of scientific papers. The substance of teaching

materials is a construction of knowledge, skills, and attitudes that can develop in the students through learning activities (Pratiwi, 2005). The construction is a set of facts, concepts, laws, and values that the students find through the learning process. Teaching materials are used by the students to obtain information and data to perform tasks, exercises, and solve the students' learning problems.

In accordance with the principles of participative and collaborative learning, the structure of teaching materials units is arranged in an inductive pattern. That is, students are given the widest opportunity to learn teaching materials to write scientific papers. The teaching materials units are studied through various exercises and assignments. Exercises and assignments include reading texts of scientific papers and non-scientific writing texts in groups to form learning communities, self-employment, small group discussions for analyzing texts, and presenting the results of small group discussions alternately in class discussions to obtain some inputs and assessments.

This product of designed learning materials has its own peculiarities compared with the conventional teaching materials. Such specificity can be seen in table 3 below.

**Tabel 3.** The Uniqueness of Learning Materials of Designed Products

No.	Participative and Collaborative Learning Materials	Conventional Learning Materials
1.	The formulation of objectives involves students' participation	The objective formulation is done by the lecturer
2.	The preparation of teaching materials involves students' participation	Preparation of teaching materials is done by lecturer
3.	Determination of method involves students' participation	Determination of method is selected by lecturer
4.	Lecturer as facilitator	Lecturers as the only source of information
5.	Interactive learning climate	Monotonous learning climate,
6.	The preparation of evaluation tools involves the students' participation	Preparation of evaluation tools is conducted by lecturer

The learning process with product development is designed to enable students, both physically and psychologically active in building knowledge and writing skills of the learned papers. The role of the lecturer does not dominate the course of the learning process but rather to empower the active role of the student as the subject of learning. The lecturer acts as a facilitator, motivator, student of learning, and address to ask for students if they have learning difficulties and have not got satisfactory answers from their peers. The role of lecturers is to train students to learn independently, responsible for tasks assigned, able to solve problems, and able to work with colleagues. Student's scientific reasoning should be developed to avoid a static and tendency to imitate learning patterns, so that a creative and constructive learning style will grow. Such learning process is a participative and collaborative learning process (Suparno, (1997).

#### **4. Discussion**

This product development instructional material has been declared feasible and steady, and can be used in the process of scientific writing in the field because it has been through a series of tests, ranging from practitioner test, expert test, field test, to the test of effectiveness

of the product. The result of the development of scientific writing materials is also expected to provide awareness for lecturers in developing scientific writing learning in universities in a sustainable manner.

From the experimental activities of teaching materials, it was found that there was a real increase of participation and collaboration among students in the learning process. Students had been motivated, enthusiastic, passionate, and active (Bereiter, 2010; Shymansky, 2011) physically and psychologically in following the whole series of scientific writing learning process. It was also evident at the time of the implementation of the teaching materials effectiveness test activities that the quality of the process and the quality of learning outcomes had increased significantly.

From the effectiveness test activity, the improvement of learning achievement can be seen from the difference between pretest and posttest score on participative and collaborative learning of scientific writing. The difference in scores that occur is significant. From the activity of product effectiveness test is known that the average score of pretest of scientific papers at the beginning of the learning process is 79.96 and the average score of posttest of scientific paper is 94.04. The mean score of treatment is 17.08. The result of paired sample t-test shows significance (2 tail)  $p = 0.000 < \alpha = 0.005$ . It means that there are significant differences between pretest and posttest score. From the results of statistical tests, it appears that the use of learning tools product development in the process of learning to write a scientific paper influence significantly on the students' achievement. Thus, it can be stated that there is an increase in the students' learning achievement of scientific writing significantly.

Doolittle & Camp (2012) stated that participative and collaborative learning materials can encourage student interaction and cooperation with other students or with their environment. In the effectiveness test activity, this development product has been shown to increase participation and collaboration, students' scientific writing skills, process quality, and quality of learning outcomes (Coldwell, et al., 2011). Other things that accompany the process of learning scientific writing also increase, such as increased interest and motivation to learn, learning interaction, cooperation with peers, responsibilities, familiarity, and other things that can encourage the spirit of the students' learning.

The results of this development research proves the existence of the excellent participative and collaborative learning compared to the conventional learning in the process of scientific writing learning. Participative and collaborative learning as a generative learning model proved able to improve the students' social and emotional intelligence, students' scientific writing skills, and process quality, and learning outcomes.

## **5. Conclusion**

This product development teaching material is proven to improve social and emotional intelligence, as well as students' scientific writing skills. The increase can be seen from two aspects, namely increasing the students' participation and collaboration and improving the students' achievement. The increased students' participation and collaboration is proven in the active participation and collaboration of the students, both physically and psychologically in the learning process. Improvement of the students' achievement can be seen from the increasing of score of their final learning result, that is the difference between pretest and posttest score. The improvement of the students' achievement is very significant.

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