WORKSHOP ON INQUIRY LEARNING BASED VIRTUAL LABORATORY IN MAGELANG FOR PREPARING NATURAL SCIENCES TEACHER IN 21ST CENTURY: AN EVALUATION OF IMPLEMENTATION’S PROGRAM

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Abstract

In 21st century, the learning process must be adjusted to the worth values developing in the 21st century. One of the learning process that suitable on the 21st century learning is inquiry learning that collaborated with virtual laboratory. The aim of this research is to evaluate inquiry-learning workshop based virtual laboratory in Magelang for preparing natural sciences teacher in 21st century. The evaluation has done by using CIPP model (context, input, process, and product). This evaluation model was chosen because we wanted to know the effectiveness extent of the program. The result, in general shows that the program is well implemented. The goal of inquiry program has been reached. This is indicated by implementation indicator has been reached. Several indicators among them is : (1) The teacher has good skill in making learning program preparation (Rencana Program Pembelajaran/RPP); (2) The teacher is able to create student’s worksheet; (3) The teachers is well in carry out teaching practices in the classroom, which is all accordance with the principle of 21st century learning.

Keywords: inquiry-learning workshop, virtual lab, evaluation program, CIPP model
INTRODUCTION

The implementation of teaching and learning activities always change along with running times. The changes of teaching implementations and learning activities can be observed both in terms of learning process which applied in the classroom, the learning media used, the evaluation activities carried out until the learning outcomes is expected. The current learning process should be adjusted to the development trend in 21st century era.

In 21st century, the learning process must be adjusted to the worth values developing in the 21st century. The main principles of 21st century learning are student-central learning, collaborative learning, contextual and integrated society (Ahonen, 2015). According to Binkley et al (2012) there are 4 important parts of skills that should be developed in the 21st century, named way of thinking, way of working, tools of work, and life skills. These 4 skills are very important to be facilitated in the learning process for student.

The way of thinking refers to 3 important skills i.e., (1) creativity and innovation; (2) critical thinking, problem solving, and decision making; (3) learning to learn and meta-cognitive. The way of works consists of 2 components i.e., communication and collaboration. Tools for work are built on 2 specific skills: information literacy, and ICT literacy. Life skills lead to citizenship, life and career, then personal and responsibility.

Based on the interviews with head of MGMP IPA Kota Magelang, the teachers of SMP in Magelang have not implemented the learning process that accordance with principles of 21st century learning due to lack of experience and training. In addition, there are still many teachers who have difficulty with implementing the learning process which accordance with learning principles in the 21st century. Therefore, it is important to give training (or workshop) for teachers in carrying out the learning process in accordance with 21st century learning principles.

The training program who has been conducted by researches is to train Virtual Lab inquiry-based learning. Virtual Lab inquiry-based learning is seen to be more suitable with learning principle in 21st century era (Siswanto, S., 2018). Thus, science teachers really need to compile and implement science learning processes using Virtual Lab inquiry-based learning.

Therefore, the aim of this study is evaluate Virtual Lab inquiry-based learning implementations of workshop program in Magelang City in order to prepare science teachers who have learning skill in accordance with 21st century era.

METHOD

In this study, an evaluation of implementation program was carried out using CIPP model (Context, Input, Process, Product). This evaluation model was chosen because we wanted to know the effectiveness extent of the program. In first stage i.e., the context stage, it carried out by determining the context of organization target, identifying problems, and analyzing the objectives of the program. The identification program is done by conducting an interview with the head of MGMP IPA Magelang.

Based on interview results, then we set the goals to be achieved.

In the second stage i.e., input process is done by identifying educational background of MGMP IPA Magelang city. Teachers background identifications is done by distributing questionnaires to all teachers. Next, a program design was arranged (Virtual Lab inquiry-based learning) to prepare science teachers in 21st century.

In third stage i.e., the process. An analysis is carried out on implementation of training program, both conducted by the instructor and the teacher. Analysis was carried out by 3 observer. In fourth stage i.e., the product stage. A goal achievement analysis is carried out by distributing questionnaires to the teachers. The design of the evaluation technique can be seen in Figure 1.
FINDING AND DISCUSSION

Specifically, the workshop program was carried out to overcome the lack of understanding of 21st century learning principles, which caused the teachers to become unskilled in planning and implementing 21st century learning in the classroom. According to Maisyaroh (2014), teacher’s difficulties in designing learning activities can be improved by intensive workshop activities attended by teachers, both conducted individually (person by person) and groups. Training to teachers is Virtual Lab inquiry-based learning.

Inquiry learning is seen as modern learning which focuses on the meaningful of learning process. The inquiry learning process learns how science is built from processes and products (Harlen, 2014; Siswanto, S., 2017). Several research results show that learning activity with inquiry implementation can make the students easy to build mastery concept, train the students to have high-level thinking skills, and facilitate students to act and learn like scientist through experimental activities that exist in inquiry learning stage (Wenning, 2011; Harlen, 2014; Gumilars, S., 2019). The inquiry learning activity exist some stage as follow : (1) identifying problems, (2) formulating hypotheses, (3) conducting experiments, (4) conducting data analysis, (5) communicating the results of the analysis (Harlen, 2014; Febriastuti, 2017).

Table 1. Stages of Inquiry Learning based on Virtual Experiment

| Learning Steps | Teacher’s Activity | Student’s Activity |
|---------------|---------------------|--------------------|
| **Stage I:** Problem Identifications | ✓ Create groups ✓ Distribute Student’s Worksheets ✓ Problem displays related to the concept being studied | ✓ Conduct studies to analyze problems by looking for references or theories that apply (through textbooks / web / other sources of information) ✓ Identifying Problems |
| **Stage II:** Formulate hypothesis | ✓ Guiding students to formulate hypotheses | ✓ Make a hypothesis based on the identification of problems that have been done in the worksheet that has been provided |
| **Stage III:** Experiment | ✓ Guiding students doing virtual experiment | ✓ Doing virtual experiment using students worksheet ✓ Fill in the data of experiment result |
| **Stage IV:** Analyzing the data | ✓ Guiding the student to do data analysis | ✓ Conduct data analysis in accordance with the guidelines in the Student Worksheet |
| **Tahap V:** Communicating the results of Data analysis | ✓ Guiding the discussion ✓ Provide reinforcement of concepts that are less appropriate during the | ✓ Make a presentation in front of the class to deliver the results of data analysis ✓ Conduct question and answer based on the data presented |
In this training program, virtual experiment activities are used in the inquiry phase. Virtual experiment is carried out to be accordance with 21st century learning principles, named work tool. It is one of the indicators of ICT literacy. In addition, based on the results of study, it was founds that the virtual experiment activities were also effective in increasing understanding and mastery concept of the students (Zacharia, 2008a; Zacharia, 2011b; Olympiou, 2011; Myneni, 2013; Sullivan, 2017). The results of Siswanto’s research (2018) also found that virtual experiments which built in inquiry learning gave same effectiveness with inquiry learning using real experiments. A description of the activities in virtual lab inquiry-based learning can be seen in Table 1. Data discussion will be carried out at each stage.

Table 1. Learning Steps Teacher’s Activity Student’s Activity

| Learning Steps | Teacher’s Activity | Student’s Activity |
|----------------|--------------------|--------------------|
| question and answer and discussion activities | 21st century learning principles; (3) teachers are able to carry out teaching simulations practice in the classroom as well and in accordance with 21st century learning principles. | |

The second stage is input. At this stage, the educational background of the teacher will be analyzed. The analysis was carried out on the questionaire by the teacher on the question "what is the educational background of the teacher / teacher?". The results of the analysis can be seen in Figure 2. Based on the findings, science teachers who have a science educational background are only 2%. In fact, there are 2% of science teachers who fill other types of educational background. After analyzing the educational background of the teachers, at this stage the design of the program is then carried out. The program is designed in 4 stages of activities, such as: providing material about 21st century learning principles, providing material about the preparation of learning tools, assistance in developing learning devices, teaching simulation practice in the classroom.

On the first activity (providing material about 21st century learning principles), the team provided material on 21st century learning principles in general, followed by virtual lab inquiry-based learning. This activity is carried out in 2 meetings, 100 minutes for each meeting. The second activity (providing material about the preparation of learning tools), the team provided material on the preparation of the Learning Implementation Plan, ranging from formulating learning objectives and indicators, to designing learning activities to be carried out in the classroom. In addition, here will also be explained techniques for making Student Worksheets that are able to facilitate student experimental activities in the form of virtual labs. All activities were carried out for 2 meetings, where each meeting was held for 100 minutes.

From these problem findings, the program was then carried out with the aim to improve teacher understanding and skills of 21st century principles of learning, which include the preparation of learning tools and practice simulations in the classroom. Based on the formulation of these objectives, the indicators of achievement are then described. Indicators of achievement are: (1) teachers have good skills in preparing lesson plans which accordance with 21st century learning principles; (2) teachers are able to arrange worksheets that are in line with the classr...
with assisting the teacher in making learning devices. Assistance is carried out through face-to-face communication and electronic media (e-mail). All assistance activities in the preparation of learning tools were carried out for one month. The last activity is teaching simulation practice in the classroom. After the teacher has finished compiling the learning kit, a teaching simulation is carried out in the classroom. Simulation activities carried out during the learning process 1 time, by taking 3 samples of teachers and other teachers as participants to see the implementation process.

![Chart showing educational background of science teachers at Junior High School in Magelang City](chart.png)

Figure 2. Educational Background of science teachers at Junior High School in Magelang City

The third stage is process. At this stage, an analysis of the feasibility program is carried out both by the instructor and by the teacher. The evaluation was carried out by 3 observers. The results of observations can be seen in Table 2. Based on the observations result, the instructor conducts all activities in the program in accordance with the plans that have been prepared. Furthermore, overall teacher involvement for face-to-face meetings is also above 87%. At the online tutoring stage, all teachers also conduct the mentoring process, albeit with different intensities. In the final stage, namely the simulation of learning, the teacher who was sampled also succeeded in practicing the virtual lab inquiry-based learning process in accordance with the learning syntax. Therefore, it can be concluded that the activity process was carried out well.

| Stages of Activities Conducted                  | Achievements | Instructors | Teachers | The number of participants | %   |
|-----------------------------------------------|--------------|-------------|----------|----------------------------|-----|
| Providing material about 21st century learning principles |              | Yes         | No       | 46                         | 100%|
| 1st day                                       |              | √           |          | 46                         | 100%|
| 2nd day                                       |              | √           |          | 40                         | 87% |
| Provide material about the learning tool preparations |              | Yes         | No       | 42                         | 91% |
| 1st day                                       |              | √           |          | 42                         | 91% |
| 2nd day                                       |              | √           |          | 42                         | 91% |
| Assistance in Developing Learning Devices      |              | Yes         | No       | 10                         | 22% |
| Guidance frequency ≤ 3 times                  |              | √           |          | 10                         | 22% |
| Guidance frequency between 3 – 6 times         |              | √           |          | 20                         | 43% |
| Guidance frequency ≥ 6 times                   |              | √           |          | 16                         | 35% |

Table 2. Achievement Program of Observations Result
The last stage is product. At this stage, the activities program will be analyzed. The analysis of the achievement is carried out by analyzing the teacher questionnaire that has been adjusted to the indicators compiled. Tabulation of data entry can be seen in Table 3. Based on the table, it can be concluded that in general the objectives of the implemented program have been achieved.

Table 3. Goal Achievement of the Program

| List of Statements                                                                 | Percentage of teacher answers |
|-----------------------------------------------------------------------------------|------------------------------|
| I have understand with the concept of 21st century learning                       | 87% 13%                      |
| I have skill in preparing lesson plans which accordance to 21st century learning principles | 89% 11%                      |
| I am able to arrange worksheets that facilitate students to work in accordance with the skills needed in the 21st century | 96% 4%                       |
| I am able to make learning practices according to 21st century learning principles | 87% 87%                      |

**CONCLUSION**

Based on research, it can be concluded that in general the virtual lab inquiry-based learning workshop program in the city of Magelang to prepare science teachers in the 21st century is well implemented. The aim of the program has been achieved. This is indicated by the achievement of achievement indicators has been reached, namely (1) teachers have good skills in developing lesson plans that are in accordance with 21st century learning principles; (2) teachers are able to arrange worksheets that are in line with 21st century learning principles; (3) teachers are able to carry out simulations of teaching practice in the classroom well and in accordance with 21st century learning principles.

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