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Essential Factors Influencing Preparation of Physics Laboratory in New Curriculum: Photo Voice Study

Essential Factors Influencing Preparation of Physics Laboratory in New Curriculum: Photo Voice Study

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Abstract. This research was stimulated by the situation of Indonesian curriculum especially in physics that requiring the balancing between basic competence of knowledge and skills. Currently, the main problem is the basic competence of skills become the second orientation, therefore, it should be more attention. Physics laboratory is the essential room in supporting the implementation of new curriculum, K13. Through a qualitative study, this research used interview process to pre-service and in-service physics teachers in East Java Indonesia. Totally, 4 in-service physics teachers and 9 pre-service-physics teachers were invited in the semi-structured interview process by utilising photo voice approach. The research captured seven factors as well as the attitudes towards new physics curriculum, which categorised into: practical application, curriculum content, academic anxiety, need analysis, globalisation effect, assessment effect, and government policy. Meanwhile, each factor was implicated to other factors.

1. Introduction

Through a previous research, the first author explored the attitudes towards a New Physics Curriculum that resulting seven dimensions: "government policy, need analysis, assessment effect, globalisation effect, curriculum content, practical application, and academic anxiety" [1]. On the other hand, Indonesian new curriculum (K13) required the implementation both basic competences of knowledge and skills together. Permendikbud No. 21 of 2016 concerning Basic and Secondary Education Content Standards which contain the Level of Competence and Core Competencies in accordance with certain levels and types of education. Core Competencies include spiritual attitude, social attitude, knowledge and skills [2]. For knowledge domain, it is a well-implemented since previous curriculum due to the routine activities of physics teachers. As a proof, the evaluation during the process of learning is focused of this domain. In contrast, competences of skills usually assessed in practical examination after the student reach ninth grader for junior high school and twelfth graders for senior high schools. One of the reasons is about the existence of laboratory. This gap becomes concern in this research.

In fact, school laboratories are very important to support the teaching-learning process in schools. Nowadays, school laboratories are not only science laboratories [physics laboratories], there are also social studies, language and computer laboratories. However, it should be noted that the condition of the physics laboratory needs to be given special attention by the school management. The reason is, there are some problems that are often faced in physics laboratories. From the results of observations in some Senior High Schools in East Java, the fact is that the existence of physics laboratories in schools is sometimes not used as a function of place to carry out practical activities for students and management of related laboratories seem to be less than optimal. Some examples are the physics

laboratories used as classrooms and as a place for other activities that are not related to physics. Realizing the importance of facilities and infrastructure such as physics laboratories in supporting learning activities in schools, good management is needed by the school staff so that the utilisation of laboratories is carried out effectively.

Physics laboratory is the essential room in supporting the implementation of new curriculum. A laboratory is a place used by people to prepare something or carry out scientific activities. To explore the essential factors influencing the physics laboratory into K13, the study take into account the exploration more deeply. Finally, the research question of the study is "to what extend do pre-service and in-service physics teachers of experiencing the factors influencing preparation of physics laboratory in new physics curriculum?"

2. Methodology

Through a qualitative study, this research used interview process to pre-service and in-service physics teachers in East Java Indonesia [3-4]. Totally, 4 in-service physics teachers and 9 pre-service physics teachers were invited in the interview process by utilising photo voice approach [5-8]. Their roles in the research are being member of participatory action research (PAR). We used a pseudonym of author name for ethical academic. The distribution of participant is depicted in Table 1.

Table 1. Participants of the research.

Pseudonym	Status	Age
Jono	in-service physics teacher (ISPT)	27
Tini	ISPT	42
Arif	ISPT	24
Yuni	ISPT	24
Rahayu	pre-service physics teacher (PSPT)	20
Suci	PSPT	20
Harti	PSPT	19
Fais	PSPT	20
Firda	PSPT	20
Hendra	PSPT	20
Lydia	PSPT	21
Siti	PSPT	20
Ais	PSPT	20

Through the-semi-structured interview process, the participants were assigned their response of factors relating to preparation of laboratory though a photo-captured then giving the description with some sentences [9-10]. The data analysis process used in this research was manual coding, in which the theme was categorised into the appropriate theme according the research question and previous findings. Photo voice is one of the many participatory studies applied in education [5,7,8]. This technique was first introduced as Photo novella by Wang and Burris in 1994, is a methodology that allows individuals to reflect the strength of their community [7]. One of the goals of the photo voice technique is to develop critical reasoning from participants [5].

3. Results and Discussion

Based on the data analysis process, this research resulting seven factors/ themes as follow.

a. Theme 1: Practical application

The following are some experiencing of participants in relating to the theme practical application.

Figure 1. A snapshot of my school physics laboratory [Rahayu].

"Physics laboratory is a place to prove or test the truth of a physical theory with empirical reality data (both quantity and quality)". [Arif]

"For experiments to be carried out in a laboratory, the laboratory must be equipped with adequate equipment. This means that the tools available must have functions that support the implementation of the laboratory. What is needed as tools that work well, measure which must be measured and the measurement of the measured quantity must be trusted. Procurement of tools in a laboratory must be adjusted to the objectives of the laboratory itself". [Rahayu]

According to Richard (2013: 116), the physics laboratory functions are as follows: a. strengthen understanding of the physics concept, both for students (participants in the laboratory collaboration) or for physics teachers; b. foster interest, inspiration, motivation and confidence in learning IPA; c. strengthening the imagination of students and all individuals involved in science laboratory activities, triggering inspiration, and can develop the creativity of participants in conducting experiments on science learning materials; d. practicing experimental skills; e. developing the ability of researchers to make decisions in judgment theory or experimentation; and f. a forum to correct opinions or misconceptions about lessons or theories in the Natural Science [11].

b. Theme 2: Curriculum content

Regarding the theme of curriculum content some participant gave their arguments.

3.2	Menerapkan prinsip-prinsip pengukuran besaran fisis, ketepatan, ketelitian dan angka penting, serta notasi ilmiah	4.2	Menyajikan hasil pengukuran besaran fisis berikut ketelitiannya dengan menggunakan peralatan dan teknik yang tepat serta mengikuti kaidah angka penting untuk suatu penyelidikan ilmiah
3.3	Menerapkan prinsip penjumlahan vektor sebidang (misalnya perpindahan)	4.3	Merancang percobaan untuk menentukan resultan vektor sebidang (misalnya perpindahan) beserta presentasi hasil dan makna fisisnya
3.4	Menganalisis besaran-besaran fisis pada gerak lurus dengan kecepatan konstan (tetap) dan gerak lurus dengan percepatan konstan (tetap) berikut penerapannya dalam kehidupan sehari-hari misalnya keselamatan lalu lintas	4.4	Menyajikan data dan grafik hasil percobaan gerak benda untuk menyelidiki karakteristik gerak lurus dengan kecepatan konstan (tetap) dan gerak lurus dengan percepatan konstan (tetap) berikut makna fisisnya
3.5	Menganalisis gerak parabola dengan menggunakan vektor, berikut makna fisisnya dan penerapannya dalam kehidupan sehari-hari	4.5	Mempresentasikan data hasil percobaan gerak parabola dan makna fisisnya
3.6	Menganalisis besaran fisis pada gerak melingkar dengan laju konstan (tetap) dan	4.6	Melakukan percobaan berikut presentasi hasilnya tentang gerak melingkar, makna fisis dan

Figure 2. K 13 contains two competencies which are taught at the same time; the left column of knowledge, the right column of skills [Jono].

"Based on the picture we know that, KD 3….represents the competence of knowledge, meanwhile KD 4…implies the competence of skills, so why laboratory is important in successful of KD 4". [Jono]

"……One of the reasons why a test is carried out on a model or theory in a laboratory, because events, natural and surrounding phenomena are difficult to find and cannot be observed closely, and are difficult to observe because of the limited time or too fast for the individuals". [Ais]

If talking about idealism, then physics learning should emphasise the content and its process, namely learning that emphasizes more on the way of thinking science to observe the circumstances around, then think of the relationship of the consequences, then do modeling and finally be able to do engineering in the work. If it is simplified, learning physics is essentially recognizing naturals around then making a product formulation in the form of formulas and correct attitudes towards these phenomena [12].

c. Theme 3: academic anxiety

Turning to the theme of academic anxiety, some participant gave their arguments.

Figure 3. My dream of a virtuial physics laboratory [Hendra].

*"My school **does not have a laboratory** but has **a dream** of optimizing a virtual laboratory"* [Hendra]

Figure 4. The condition of my lab [Yuni].

*"….this is the condition of my laboratory; **I am very worried about it**, especially before the practical exam or even school accreditation"* [Yuni].

d. Theme 4: need analysis

The following are the participant opinions in relating to the need analysis of physics laboratory.

"In our opinion, the physics laboratory is useful due to the reasons as follows: a). The laboratory can be a container, that is a place, a building space with all kinds of equipment needed for scientific activities. In this case laboratories are seen as hardware. 2). Laboratories can be a media tool where teaching and learning activities are carried out. In this sense, the laboratory is seen as software in scientific activities. 3). Laboratory can be interpreted as a center of information. With the facilities and infrastructure that are owned by all laboratories, scientific activities and experimentation can be carried out. In terms of performance, the laboratory is a place where work activities are carried out to produce something. In this case in the technical field, laboratories here can be interpreted as workshops" [Fais and firda].

Additionally, according to participants, through laboratory, students could create scientific attitude, they will get clarity of concepts, visualization of concepts. As a medium to foster critical reasoning at students in schools, they are able to reason and think scientifically, so that they will become world scientific candidates.

e. Theme 5: globalization effect

The following section is the participant opinions in relating to globalization effect that affected to the preparation of physics laboratory to new curriculum.

"...in the industrial era 4.0, all objects around us can be used as physics laboratories". [Tini]

"...for example, learning physics from nature is an example of a physics laboratory from the contextual setting". [Harti]

"STEM-based physics learning can also be done outside the classroom, for example in museum, tourism site, attractions, techno parks, or science centres". [Suci]

"Students can use virtual physics laboratories from PhET or facilities on their android as a form of internet application of things (IoT)".[Lydia]

In regards to globalization, the word of place is the main concern of the physics laboratory should be. The place in question can be a closed room commonly referred to as a laboratory building or laboratory room, it can also be an open place such as a garden, forest, or universe. The existence and condition of a laboratory depends on the intended use of the laboratory, the role or function to be given to the laboratory, and benefits to be taken from the laboratory. Various laboratories recognized today include industrial laboratories in the world of business and industry, hospital laboratories and clinical laboratories in the world of health, research laboratories in the world of science and technology, as well as laboratories in universities and in schools in the world of education. In the following description, it will only be stated about the physics laboratory in the school [13]. The laboratory is a place where experiments and investigations are conducted [14].

f. Theme 6: assessment effect

The following part is the participant opinions in relating to assessment effect that affected to the preparation of physics laboratory to new curriculum.

At present, even though the skills test for KD 4 is rarely conducted by teachers, in fact every school always does a practical exam at the end of the year after national examination [Siti].

Figure 5. A practical examination of physics for twelfth grader [Siti].

Many factors that cause the shift of the laboratory as a place to observe, find, and solve a problem into a classroom [15]: lack of ability to manage school laboratories; and lack of understanding of the meaning and function of school laboratories and its implications for the development and improvement of the science learning system. The synchronization of the existence of school laboratories is considered to be burdensome so that it is rarely used as it should be. The ability and mastery of teachers on equipment and use of materials is still inadequate. Lack of quality and quantity of laboratory personnel is inadequate and the material resulted in not every student having the opportunity to learn to conduct an experiment.

g. Theme 7: government policy

"One of the standards of education is the standard facilities and infrastructure in which physics laboratories must be satisfied to meet the demands of the curriculum". [Harti]

Meanwhile, Jono gives his opinion in terms of government policy.

"In my opinion, to succeed in curriculum 13, especially in physics, the government must facilitate laboratory facilities to meet quality standards". [Jono]

All the themes above have a closed relationship each other and can be conceived through Figure 6.

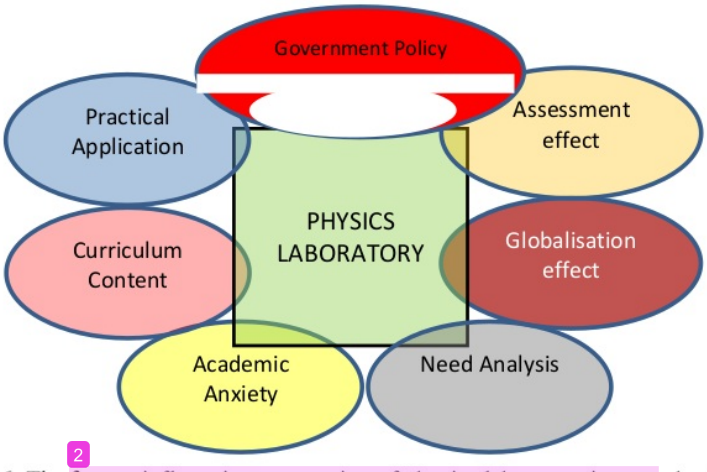

Figure 6. The factors influencing preparation of physics laboratory in new physics curriculum.

4. Conclusion

The research captured seven factors influencing preparation of physics laboratory in new physics curriculum, which categorised into: practical application, curriculum content, academic anxiety, need analysis, globalisation effect, assessment effect, and government policy. Meanwhile, each factor was implicated to other factors. By capturing the picture and giving the meaning through a photo voice project, the participants aware the essence of meaning in qualitative research. They took into account their position as being member of participatory action research.

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