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Submission date: 24-Jun-2024 12:32PM (UTC+0700)
Submission ID: 2407691067
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Word count: 2857
Character count: 15130

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https://doi.org/10.1063/5.0155479

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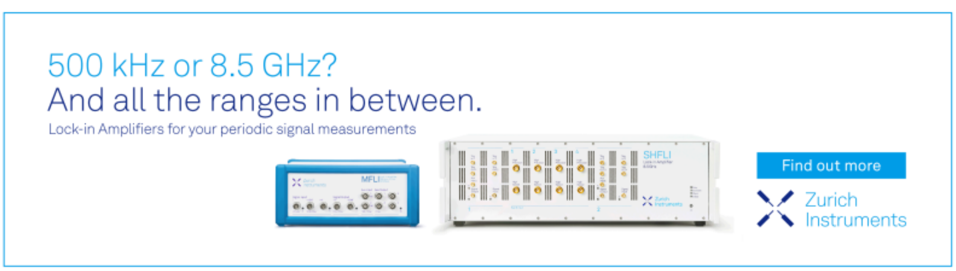

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Provision of TPACK Ability for Junior High School Teachers in Designing Practicum Module

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Abstract. Changes in the paradigm of education led to the birth of reforms in the learning activity sector. In practicum-based learning, learning activities that were initially only aimed at clarifying theories turned into activities that train students' abilities to think like scientists. This study summarizes the efforts we have made to improve the ability of teachers to design practical-based learning activities. The results of the study conducted showed that the teacher knowledge of practical-based learning was at a good level with an average of 76.91. This study is expected to be an initiation in terms of developing the ability to develop practicum modules. The hope is that teachers can further develop practicum modules that empower higher-order thinking skills.

INTRODUCTION

The learning paradigm with the emergence of digital technology has changed. The approach to learning that focuses on students (student center), causes the function of teachers in the classroom to also experience adjustments. The current teacher is no longer functioned as a learning resource that provides knowledge to students. Currently, the teacher functions as a facilitator who helps students to understand the learning content [1–3].

The teacher as a facilitator is expected to be able to help students understand the lesson by using a synthetic approach consisting of observing, asking, trying, concluding, and communicating. Therefore, teachers need at least two forms of basic competencies that must be mastered so that learning using a scientific approach can run optimally, namely professional competence and pedagogic competence [4–6]. Professional competence consists of the abilities to 1) Master the material, structure, concept, and scientific mindset that supports the subjects being taught, 2) Master the SK and KD subjects being taught, 3) Develop creatively taught learning materials, 4) Develop professionalism in a sustainable manner by taking reflective actions, and 5) Utilizing ICT to communicate and develop themselves. While pedagogic abilities consist of abilities to 1) Master the character of students from the physical, moral, social, cultural, emotional, and intellectual aspects, 2) Mastering learning theory and educational learning principles, 3) Developing curriculum related to tutored subjects, 4) Organizing educational learning, 5) Utilizing ICT for learning purposes, 6) Facilitating the development of students' potential to actualize their various potentials, 7) Communicating effectively, empathically, and politely, 8) Conducting assessments and evaluations learning processes and outcomes, 9) Utilizing the results of assessment and evaluation for the benefit of learning, and 10) Taking reflective actions to improve the quality of learning [7].

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International Seminar on Mathematics, Science, and Computer Science Education (MSCEIS) 2021
AIP Conf. Proc. 2734, 110002-1–110002-6; https://doi.org/10.1063/5.0155479
Published by AIP Publishing. 978-0-7354-4696-0/$30.00

However, the results of the study stated that teachers still do not have a deep understanding of physics content (teaching materials), even some teachers experience misunderstandings and misconceptions. [5,6,8–10]. Similar findings also occur in the preparation of lesson plans, teachers know the components of the scientific method which are often referred to as 5M, but do not understand well what it is to observe, ask questions, explore and others [11–13]. This situation is suspected to have something to do with the habits they have been doing in planning and implementing physics learning which tends to be informational using the lecture method.

Lesson plans in physics lessons do not only refer to theoretical learning that focuses on students' cognitive aspects but also psychomotor aspects which are generally trained in experimental-based learning. [14]. Experimental-based learning at the secondary school level is intended to equip students so that they are familiar with the procedure for finding a concept. In the case of making lesson plans for experimental-based learning, a combination of content understanding (professional competence) and understanding of learning situations (pedagogic competence) is required.

This article discusses the efforts we have made to improve teacher competence in terms of pedagogic knowledge and content. Thus, teachers are expected to be able to design learning better and optimize the function of the facilitator.

METHOD

This research activity was carried out simultaneously with community service activities carried out using the in-house training method with a lesson study pattern. In-house training with a lesson study pattern is carried out by implementing three stages which include Plan, Do, and See [15,16]. The plan stage is planning learning with academic exploration on the topics and learning tools used. Each teacher at this stage is asked to prepare, develop, and operate various practical instructions (cookbook, inquiry, problem solving laboratory, and higher order thinking laboratory).

The do stage carries out learning that refers to the lesson plan and the tools provided, and invites colleagues to observe [17]. The teacher then presented one of the practical instructions that he had made. Observation focuses on the ongoing learning process, not to find fault with the model teacher in implementing practical instructions. The see stage carries out reflection through various opinions/responses and discussions with observers/observers [18]. Reflection is carried out jointly between the model teacher, lecturer (servant), and the teacher who was present at the time of the practicum. The see stage is carried out to provide suggestions and input to improve the quality of learning [19].

The subjects in this study were junior high school science teachers in Sumedang district who were included in the Science Teacher Deliberation (MGMP). The training was carried out for six months. The data in this study is the ability of the teacher at the end of the training (post-test) as seen Table 1.

TABLE 1. Research Instruments

No	Question
1	Which characteristic distinguishes HOT-LAB from the other three models is….
2	State the overall systematics of the HOT-LAB model!
3	The stages of exploration activities in the HOT-LAB model practicum is....
4	The orientation built in the HOT-LAB model practicum activity is….
5	The appropriate HOT-Lab stages to fulfill 4C Skills is….
6	The characteristics of the Real-World Problem in HOT-LAB is….
7	The systematics that distinguishes the HOT Lab (Higher Order Thinking Laboratory) Practicum from the PSL (Problem-Solving Laboratory) Practicum is….
8	Pre-Lab activities at the HOT Lab (Higher Order Thinking Laboratory) Practicum carried out by students is....
9	the stages that students must do in the Lab Session activity at the HOT-LAB Practicum is….
10	The measurement stage in the HOT-LAB model practicum is...
11	The characteristics of laboratory cookbooks is...
12	The systematics of laboratory cookbook practicum instructions is...
13	The characteristics of the problem-solving laboratory are...
14	The systematics in the problem-solving laboratory practical instructions are...
15	The main characteristics of the cookbook/verification/traditional practicum are...
16	The circuit that produces the greater replacement resistance is…. Explain with proof, is an example of a practicum final project!
17	Practicing science process skills and higher order thinking skills is one of the characteristics of the practicum model….
18	The purpose of the laboratory activity is….
19	Real laboratory is...

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No	Question
20	Generating and maintaining interest, attitude, satisfaction, openness, and curiosity in science is one of the characteristics of….
21	The type of practicum that only proves existing material so that the results of the practicum will be the same is the definition of….
22	Practitioners' attitudes that often lead to mistakes are...
23	The weakness of the cookbook model practicum is…
24	The systematic report whose contents are to answer all the objectives in the practicum is….
25	The introduction to the cookbook practicum model aims to…

The research data were analyzed descriptively quantitatively. Teachers' abilities are grouped into three categories based on Table 2.

TABLE 2. Classification of Teacher Achievement

Interval	Category
$X > \bar{X} + SD$	High
$\bar{X} + SD \geq X > \bar{X} - SD$	Middle
$X < \bar{X} - SD$	Low

RESULT AND DISCUSSION

The target of implementing the training program is a tangible result that will be felt by the trainees, namely an increase in abilities and knowledge related to practical instructions. The results of measuring the ability of teachers after participating in the training are shown in Figure 1.

```
Frequency    Stem &  Leaf

     6,00 Extremes    (=<52)
     1,00        6 .  0
     1,00        6 .  8
     4,00        7 .  2222
     3,00        7 .  666
    20,00        8 .  00000000044444444444
     3,00        8 .  888
     3,00        9 .  222
     1,00        9 .  6
     2,00       10 .  00

 Stem width:      10,00
 Each leaf:        1 case(s)
```

FIGURE 1. Post Test Score

Figure 1 shows the data from the teacher's post-test results through a stem-and-leaf plot. It can be seen that the range of your teacher's scores is between 68 to 100 which shows that the final ability of the teacher is not so low regarding the making of practical modules and lesson plans in physics experimental learning from a total of 44 teachers who responded, the average teacher's ability was at a score of 80 to 84 which was included in the high category. The standard deviation of the measurement obtained is 15.64 which shows that the variation possessed by the teacher group is relatively low with 15.64% of the maximum score. The grouping of teachers' abilities with high, medium, and low categories is shown in Figure 2.

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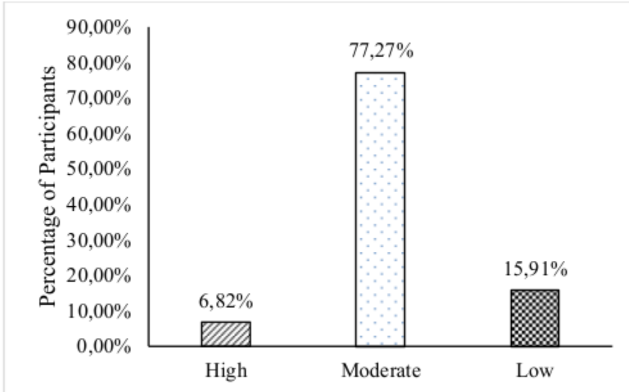

FIGURE 2. Teacher Competences

Based on Figure 2, in general, teachers have an understanding in the medium range, which is 77.27% or a total of 34 people. This is quite good considering that the types of practicums are relatively large and need to be adjusted to the availability of resources in their implementation. There are some participants who have high competence (6.82%) and there are some participants who have low ability (15.91%). Furthermore, the final ability of the teacher can be described based on each practicum model used as shown in Figure 3.

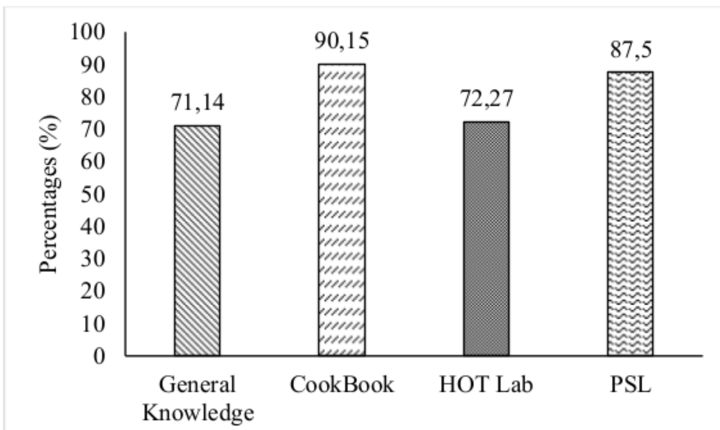

FIGURE 3. Teacher Competences on Each Stages

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Based on Figure 3, the percentage of teacher abilities in each model is relatively high. On questions related to general knowledge of laboratory activities, teachers are judged to have low abilities. Furthermore, knowledge about the cookbook practicum model is in the high category. As well as for teacher knowledge related to the PSL and HOT Lab practicum models are in the medium category. This happens because of the tendency of teachers to use the cookbook practicum model more often [20–22].

Practicum model can be used as a new learning method that can improve students' higher-order thinking skills [23–29]. In addition, various practicum models can also be implemented for research activities and scientific publications. Teachers can use various practicum models for writing classroom action research as well as for writing papers to be published in scientific journals which are very useful as one of the requirements for promotion and class [30–32].

Based on the findings in this study, several recommendations are proposed as follows: 1) The resulting model practicum guide can be used by teachers to conduct classroom action research and write papers that will be published in an accredited national journal. 2) The practicum model can be further developed for other science content so that the treasury of practical instructions for science practicum activities becomes more complete. Furthermore, in the application of practicum-based learning, there are several things that must be considered, namely: 1) There is a need for the availability of adequate tools and materials for all concepts covered in all science materials to be practiced, and 2) There is a need for the availability of Information Computation Technology (ICT) devices that sufficient to support practical activities.

CONCLUSION

Based on the results of data processing and analysis of community service based on study programs related to the Training of Making Practicum Model Instructions to Improve Students' 21st Century Skills, the following conclusions can be drawn: 1) The professional competence of teachers who are members of the IPA MGMP Sumedang Regency has increased, especially related to the material which KI KD can be put into practice. 2) The pedagogic competence of the teachers who are members of the Science MGMP in Sumedang Regency has increased, especially related to the mastery of organizing science practicums that are oriented towards developing 21st century skills. 3) Implementation of HOT-Lab model practicum instructions in improving 21st century skills (critical thinking skills, creative, communication skills) and collaboration) students are strongly influenced by students' understanding of the material to be practiced.

ACKNOWLEDGMENTS

The author expresses his appreciation and thanks to the Research and Publishing Center of UIN Sunan Gunung Djati Bandung for providing financial support for the publication of this article.

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