Preliminary Study on the Development of Project Based Learning Inorganic Chemistry Practical Instructions

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ABSTRACT: This study aims to conduct a preliminary study in developing project-based learning practicum instructions in Inorganic Chemistry courses. This study uses a survey method, where data is obtained by conducting a survey through the Google form platform. Participants in this study were 41 students who took inorganic chemistry courses at the chemistry education study program at Sriwijaya University. The results of this study indicate that it is necessary to develop project-based learning practicum instructions for inorganic chemistry, as teaching materials in inorganic chemistry courses that apply project-based learning models in the current new normal era. The characteristics of students show that students feel happy, more motivated and feel more creative when participating in project-based learning.

Keywords: project based learning, practical instructions, course, inorganic chemistry

INTRODUCTION

At present we have entered the 21st century, where industrial development in the world is at during the 4th industrial revolution (4IR) or better known as the industrial revolution 4.0. Period This is marked by the presence of new technologies that integrate the digital, physical and world biology which is embodied in the form of computer devices, robots, autonomous vehicles, digitalization and various forms of artificial intelligence, so that in this era humans, equipment and machines are designed to be able to communicate using internet technology [1] . Changes in this era of course must be accompanied by changes in the world of education. Because education is the main solution for preparing generations who are ready to compete in the industrial revolution 4.0. Changes in education are also needed so that the educational process is aligned with the circumstances and needs of students in the industrial era 4.0 [2].

Proper research integration for developing teaching practice and effective learning is important requirements for lecturers professionals in the learning environment during industrial revolution 4.0 [3] . Standing learning model on lecturers is no longer relevant to the era globalization, where information can easily accessible. One of the learning that is not centered on the lecturer is project-based learning. Based Learning Projects as learning that use projects as media in the learning process to achieve competence attitudes, knowledge and skills [4] . The emphasis on learning lies in the activities of students to produce products by applying the skills of researching, analyzing, creating, arriving by presenting learning products based on real experiences [5] .

Based on the results of field observations, prior to the pandemic, practicum activities in the chemistry education laboratory were carried out by students by conducting experiments in groups with at least 8 experimental titles carried out for 1 semester for each practicum subject, so there were many titles that could not be carried out due to limitations. tools and materials, which is the effect of each group doing the same work at one time. This is an old method that is not in accordance with the current situation, which is the recovery period after the Covid-19 pandemic, or better known as the new normal era, so activities in the laboratory cannot be carried out in full, because students will work in a difficult laboratory. maintain a safe distance health protocol. Students are still limited in practicum activities in the laboratory, so new practicum method ideas are needed for students, which are more innovative, interactive, inspiring, fun, challenging and motivating students to actively participate, as well as providing sufficient space for initiative, creativity and independence in accordance with talents, interests, and physical and psychological development of students [6]. And also by changing the

practicum method, the limitations of these tools and materials are no longer a barrier to practicum activities in the laboratory.

Actions taken to control the spread of COVID-19 have forced most activities to shift to an online environment. Education is no exception. In the vast majority of cases, the transition is well under way, and online education is proving to be a good alternative to the traditional model. However, in the case of hands-on courses, the situation is quite different because students do not acquire the abilities that they would gain through practical experience. The project-based learning (PjBL) approach has been evaluated at the Chemical Sciences Department of the Universidad La Salle Mexico as an alternative to practical courses. Two different experiences are depicted. The structure and implications are explained, as well as student and teacher appreciation. It was observed that the strategy showed good results, demonstrating qualitatively that students adapted course knowledge, and although students struggled to adapt to work, they were motivated. PjBL has proven to be effective in developing soft skills such as communication, teamwork, and problem and conflict solving[7].

In PjBL, students direct their own learning, develop creativity, and work together to solve problems. The experience gained in completing projects can make learning more meaningful and relevant to the current and future lives of students [5]. So that students do not need to do practicums with many titles as before, students are given the opportunity to direct their own practicum, starting from determining the title, objectives, procedures, to working in groups to carry out the experiment in 1 semester. This is in accordance with the expert's statement [8] which states that Project-based learning is complex tasks, which are based on challenging questions or problems, which involve students in design, problem solving, decision making, or investigative activities; provide opportunities for students to work autonomously for long periods of time; and finally produce a tangible product or presentation. The students work in real terms, as if they exist in the real world that can produce products realistically [9]. Complete practicum experience but not violating health protocols like this is in accordance with learning practical courses in the new normal era.

However, at this time, project-based practicum instructions are not yet available in the chemistry education study program, FKIP Sriwijaya University. Existing practicum instructions still use the old method, where practicum instructions are like cookbooks, students have been given instructions starting from the title, objectives, procedures, and only carry out experiments according to the procedures in the practicum manual. This is not in accordance with project-based practicum, where students create their own practicum [8] . Based on this, to ensure that the development of practicum instructions needs to be carried out, a preliminary study is carried out to analyze student needs.

METHOD

This research method is a survey method, which uses a questionnaire as an instrument for data collection. The goal is to obtain information about a number of respondents who represent a certain population [10]. In survey research, information is collected from respondents using a questionnaire. Generally, the definition of a survey is limited to research where data is collected from a sample of the population to represent the entire population. Thus survey research is research that takes samples from one population and uses a questionnaire as the principal data collection tool [11].

Participants in the study were obtained using a non-probability sampling method, where at first the participants were selected using purposive sampling, namely students who took part in inorganic chemistry course 1 in the odd academic year 2022/2023 , and continued with voluntary sampling techniques, namely voluntary taking of participants, so that the participants in this study consisted of 41 students .

The instrument used in this study was a questionnaire. Data were analyzed using SPSS Version 16.0 application, to analyze several statistical tests, namely descriptive percentages . Percentage is to provide an easy picture in comparing or knowing the most data in percentage units (%) [11]. Descriptive analysis of percentages can be calculated using the following formula [12]:

$$\mathrm{Dp} = \frac{\mathrm{n}}{\mathrm{N}} \mathrm{x}100\%$$

Information:
Dp : Descriptive Percentage
n : Sum of Earned values.
N : Sum of all values

RESULT AND DISCUSSION

In this study, an initial-end analysis was carried out, an analysis of the characteristics of the students and also an analysis of the concept. The research results for each analysis are described as follows:

a. Front-End Analysis

Preliminary analysis was carried out by interviewing lecturers in inorganic chemistry practicum courses. Based on the results of the interviews, it was found that in the inorganic chemistry practicum course, the project-based learning model was used. The use of this learning model is carried out because project-based learning is in accordance with the new normal conditions after the Covid-19 pandemic, where in this learning model students are not required to be able to attend directly to the laboratory because the initial learning steps can be carried out from each student's residence. After that, students can go to the laboratory to conduct trials. This is based on PBL having various objectives including the development of students' positive attitudes, critical thinking skills, cooperation, and independent learning abilities [14].

The final analysis was carried out by giving a questionnaire to students. Based on the results of the questionnaire filled out by 41 students, the results are shown in Figure 1.

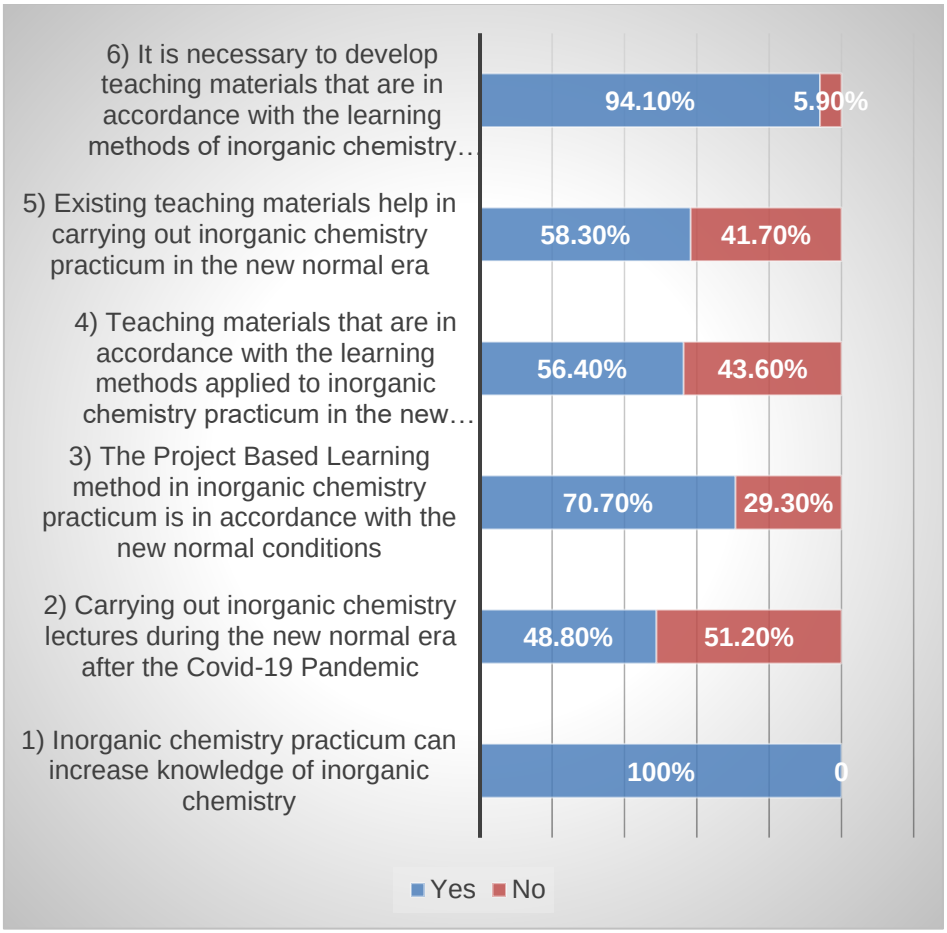

FIGURE 1. Results of Needs Analysis

The results of the needs analysis show that in the inorganic chemistry practicum courses that use the project-based learning model, appropriate teaching materials are needed to assist students in completing learning. This is in accordance with the expert opinion which states that it is time now for every teaching staff, in this case the lecturer, to make teaching materials (books) for students not only to use, read, and study them, but to create a product, namely teaching materials so that they can make it easier for students to learn and understand lecture material which will later affect the improvement of their learning outcomes [15].

b. Analysis of Student Characteristics

Analysis of student characteristics was carried out by interviewing and giving questionnaires to students. Based on the results of interviews with supporting lecturers, it was found that students were active and carried out learning well.

Based on the results of the questionnaire, the results were as presented in Figure 2.

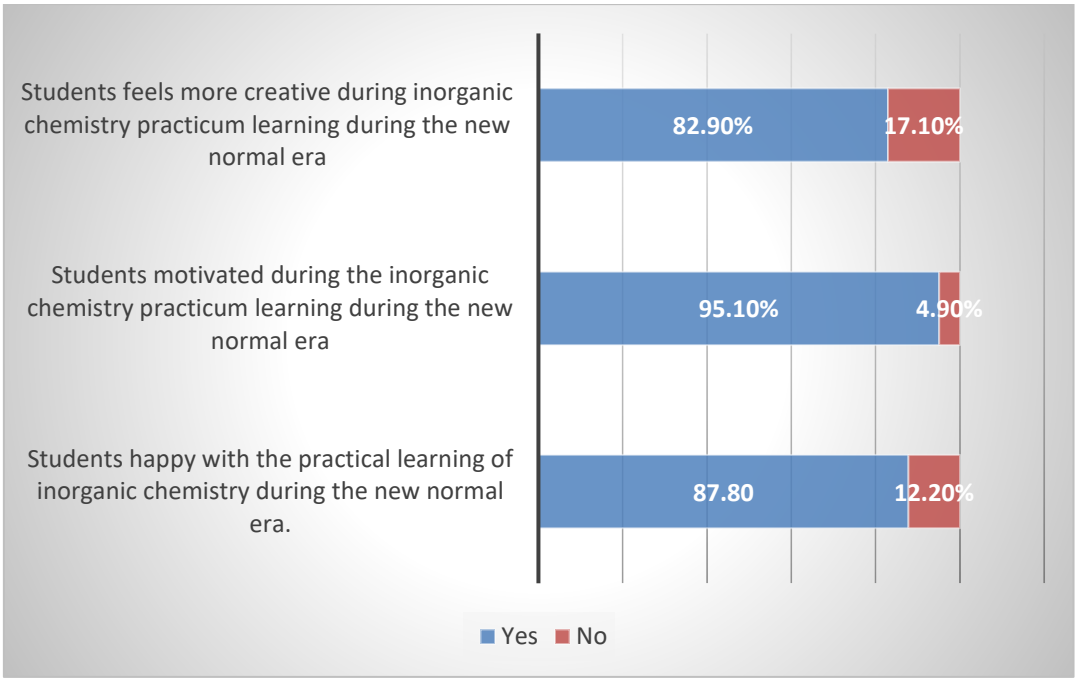

FIGURE 2. The result of student characterictic analysis

The results of the analysis of student characteristics show that students feel happy, motivated and also feel more creative when carrying out project-based learning practicums. This is in line with research results which show that project-based learning motivates students to learn independently to find information on their own from various sources, such as expert teams, the surrounding environment, the media and the internet, and students are motivated to work with teams to produce creative ideas which are then realized. in a product [16]. The results of other studies also show that the application of Project-Based Learning in learning can increase students' interest in learning, creative behavior, and the ability to cooperate [17].

c. Concept Analysis

The practicum instructions that will be developed in the inorganic chemistry course are Project Based Learning practicum instructions, where the syntax of the learning model consists of stages 1) Planning a Project, 2) Initial research phase to obtain information, 3) Initial Development and Evaluation of Product Prototypes , 4) The second research phase (implementation of practicum), 5) Development of the Final Presentation (Report), and 6) Publication (Presentation) [18] .

Activity 1 is the introduction and planning of the project. At this stage, the discovery of problems that exist around life. The problem is formulated into a problem formulation. Furthermore, from the formulation of the problem, the problem solution project plan is determined. Activity 2 is preliminary research. In this study, students collected information from various big data sources. These sources can be in the form of videos, narratives or documents from trusted sources. Activity 3 is the initial development and evaluation. At the development stage, students determine objectives, tools and materials as well as practicum procedures based on the sources they have obtained. At the initial evaluation stage, the results of student development are assessed and commented on by experts (lecturers) to determine if it is feasible or not. Activity 4 is the second research phase, where in this phase practicum is carried out after obtaining the lecturer's approval. The results of practicum activities are recorded and documented with photos and videos. Activity 5 is compiling the development of the final presentation, or better known as making a report. And the last activity is publication. In the case of publication, this can be done by presenting the results of the practicum in front of the lecturers and other students, and also uploading videos of the practicum implementation on the video upload platform.

CONCLUSION

The results of this study indicate that it is necessary to develop project-based learning practicum instructions for inorganic chemistry , as teaching materials in inorganic chemistry courses that apply the project-based learning model in the current new normal era. The characteristics of students show that students feel happy, more motivated and feel more creative when participating in project based learning.

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