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MICROSCALE LABORATORY: CREATING EFFECTIVE LEARNING ENVIRONMENTS TOWARD STUDENT TEACHERS IN PRIMARY EDUCATION

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Abstract **Research shows traditional university laboratories often do not give opportunities for the development of some student-centered targets for practical work. By using microscale techniques, students can carry out the experiments using the same route that scientists use. In this study, we discuss microscale laboratory effects on primary student teachers' attitudes towards science education.**

Keywords:**student-teachers, primary education, attitudes, microscale laboratory.**

I. INTRODUCTION

Science education, understanding the nature of science and possessing scientific attitudes toward science are important for everyone, specially for the young and the next generation. Investigating the science teaching attitudes of the student teachers who are responsible for teaching science in schools is important because the importance of promoting and developing students' attitudes toward science is crucial. Science teacher candidates have to understand the nature of science [1]. Motivation, positive attitude, and engagement in practical work for success in science are important [2]. Interest in school science remains an important subject as it is linked to achievement and the intention to follow studies about all field of science [3]. The role of practical work in science education has been well cited in most science education. Practical lessons provide students the opportunity to interact with their teachers and each other on a less formal grade than normal lessons.

Towards the end of the twentieth century, more various alternatives had been introduced to comfort effective learning in university laboratories. These included pre-laboratory experiences, films, video experiments, computer based pre-laboratories, post laboratory exercises and computer simulations [4]. At the school level, there have been many lists of aims and objectives offered in the literature [5-8]. They all tend to refer to skills and techniques as well as skills related to the conduct of experiments in a scientific way. Some have emphasized affective aims strongly [8,9] while others have emphasized other aims [10]. However, traditional university laboratories often do not give opportunities for the development of some of these skills. The development of powers of observation, measurement, prediction, explanation, designing of experiments are dependent on effective practical work [11]. Therefore, micro-scale chemistry has been a part of laboratory practice and teaching, at college and university levels [12]. Micro-scale chemistry refers to an approach or technique for carrying out experiments on a reduced scale using small quantities of chemicals and often (but not always) with simple equipment [13]. Micro-scale chemistry involves scaling down chemical reagents to an absolute minimum than those used in traditional laboratories, and shifting from glassware to modern polymer or plastic materials [14]. This technique enhances cost savings, time savings, safety in laboratory, air qualitty, and environment-friendlines [15]. In this research, due to importance of primary education, we compared the number of instances of micro-scale laboratory in a primary education class in the Farhangian University in Iran. The micro scale kit was used and found successful results.

II. RESULTS AND DISCUSSION

Improving teaching and learning materials in the universities and colleges and encouraging pre-service science teacher education are important [15]. Laboratories are one of the characteristic features of education in all fields of science. Laboratory can be assumed as established student knowledge, or concerned with the relation between theory and Reality. Laboratory experience is a valuable and section of education but not without challenges. However, the absence of the laboratory experience may leave students with understanding of science that are very succinct and theoretical. On the other hand, it is important to enhance scientific thinking during learning in primary school. In this, there is a need to prepare primary student teachers for their time in the class as well as develop follow-up activities [16]. University student teachers' reactions to practical work are often not positive and this may reflect a lack of any clear purpose for the experiments. Primary

student teachers go through the experiment without program. They are concerned for their future students. One reason is that student teachers were not well understood that how much have time to practice. Also, Safety is an important part. The value of practical work must be severely limited by the students' safety [11]. Since the 19th century, educational laboratories in chemistry were based on carrying out experiments with many quantities of compounds. But into the 1980' s, with continuing economic pressure in education and increased environmental awareness, the need to carry out practical work on a reduced scale, in order to save materials, time, and ease disposal problems became important. The traditional laboratory experience can be enhanced by applying the micro tools and setting the laboratory learning in a context of micro-scale laboratory method. The aim is to move towards laboratory experiences which stimulate and challenge, allowing students to see chemistry, physics and biology as a science, at work.

The Potential of micro-scale chemistry laboratory in elevating teaching and learning of primary student teachers is known. Experiences from Teacher Training classrooms in Iran demonstrate that student teachers enjoy it because microscale kit engages them for practical work and they gain confidence in their own ability to work with small amounts of chemicals. To assess the student teachers experiences and opinions about the micro-scale chemistry education based science lessons, student teachers were invited to respond to a questionnaire at the end of the spring semester. The questionnaire consisted of 6 query. The questionnaire indicates student teachers' views in relation to learning chemistry, active participation, enjoyment of chemistry, and laboratory learning skills with the microscale method. The questions focused on what student teachers liked and/or disliked about the microscale method, and whether they understood any difference between micro-scale chemistry education based lessons and the traditional chemistry lesson.

A total of 27 primary student teachers, aged between 21-23 years in Teacher Training university in Rasht participated in the study. Selection of the students was based on those who had shown interest to participate in the study established during the research. Participating student teachers were those who had passed the science education classes. The assessment of students' perception of the effectiveness of the micro scale kit and the results are shown as follow:

1-After working with the micro-scale kit, using traditional equipment for laboratory exercises:

1) Did not need any 2) Needed minimal 3) Needed some 4) Needed much

✓ *Only 29 percent of student teachers feel that they should utilize traditional equipment.*

2-Would recommend that microscale kit be designed for each of the science fields:

1) Strongly agree 2) Agree 3) Disagree 4) Strongly disagree

✓ *92 percent of student teachers liked that microscale kit to design for each of the science fields*

3-I feel that the micro-scale kit helps my students to understand the nature of science:

1) Strongly agree 2) Agree 3) Disagree 4) Strongly disagree

✓ *81 percent of student teachers agree with it.*

4- Microscale kit should be bigger than current system, For easier to use and follow:

1) Strongly agree 2) Agree 3) Disagree 4) Strongly disagree

✓ *55 percent of student teachers agree with it.*

5-The microscale kit is a great way to assess students' knowledge of lab working:

1) Strongly agree 2) Agree 3) Disagree 4) Strongly disagree

✓ *74 percent of student teachers agree with it.*

6- The microscale kit was very confusing on how to use, doesn't let you choose the steps you wanted:

1) Strongly agree 2) Agree 3) Disagree 4) Strongly disagree

✓ *81 percent of student teachers disagree or strongly disagree with this matter.*

Interviews with some student teachers revealed that the students saw the purpose of the micro-scale laboratories clearly and considered them valuable. This method revealed very clearly that all aspects of the micro-scale laboratory experience must be seen as a whole.

The benefits of micro-scale in the context of developing countries are exemplified by a small number of studies [13,15]. Among the findings from literature, increase of student laboratory skills, more focus on understanding of the concepts, more opportunity for discussion and reflections, easy and fun experiments for students are seen [15]. These principals reflect the ideas of Denis Diderot, the French philosopher, who outlined three principal means of acquiring knowledge available to us: observation of nature; reflection; experimentation. Observation collects facts; reflection combines them; experimentation verifies the results of that combination [17]. All of these illustrate the need to decide what the aims are for using laboratory work in the teaching of science for primary student teachers. Using the micro scale kit, there is opportunity to make science real, to illustrate ideas and concepts, to expose theoretical ideas to empirical testing and to stablish part of nature of science. There is opportunity to use equipment and chemicals, to learn safety manners, to learn specific techniques, to measure accurately and to observe carefully. There is the opportunity to learn how to make experiments which offer real insights into science phenomena. There are numerous useful skills to be gained: team working, reporting, presenting and discussing, time management, developing ways to solve problems.

Microscale can allow laboratory manuals to be reduced in length. It can encourage the laboratory planning process to focus on what is really important and to ensure that the students share these understanding. Of greatest importance, it

can allow understanding to increase simply by reducing danger.

The key is to have safe tools. While student teachers in primary classes are worry, there needs to be an opportunity to handle safe equipment and chemicals, to learn safety procedures, to master specific techniques, to observe carefully. Also, It is important to make science real and exposing ideas to tentative testing [11].

Finally, microscale method was guaranteed to present the possible use of micro-scale kit to practical work in order to create an active learning environment based on low equipment and to improve teaching and learning of primary student teachers in Iran.

III. Conclusion

The traditional laboratory experience can be enhanced by applying the micro tools and setting the laboratory learning in a context of micro scale laboratory method. Many student teachers felt that the micro scale laboratory were valuable and better prepared their future students to understand nature of science correctly. In this method, students can normally work in small groups, carry out experiments using micro-scale laboratory apparatus, and are engaged in a variety of distinctive activities. This form of experiment, which is useful, particularly for primary education, has attracted the attention of student teachers. It is recommended that further work can be carried out with the micro-scale laboratory experimental, so that it can be spread in all fields of science.

Further investigations focusing on type of tools, application and full scope of related problems to microscale laboratory are currently underway.

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