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A Systematic Comparison of Students Attitudes Toward Practical Work in Chemistry Department Faculty of Education, Zawia -University of Zawia

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ABSTRACT: This comparative study aims to compare the attitude toward lab work. It includes two student groups in Chemistry Department, Faculty of Education - Zawia, University of Zawia- Libya. The study includes first four semesters (FFS) students, and last four semesters (LFS) students. Their attitudes were assessed via a Google Forms online questionnaires, where sent to each group separately. The number of responses sent to the researcher was 61 for FFS and 52 for LFS. The study was carried out in the fall and spring semesters of the academic year 2023-2024. A qualitative research approach was adopted. There was a substantial difference in the percentage of questionnaire responses between the FFS group and the LFS group. This outcome supports the positive attitude toward working in chemical laboratories and highlights the benefits, which include helping students develop as professionals and gain confidence. These changes take place over the lab courses, reaching their highest point during the graduation semester when a qualified teacher produced, who after that imparts information to their students.

Keywords: lab work, attitude, first semesters, last semesters, lab skill improvement.

INTRODUCTION

Chemistry is one of the most important sciences that study matter and its interactions. Since everything in our environment, including our bodies, medicines, and daily life, is affected by matter and its interactions, the connection between the abstract meaning and the applied meaning of science is realized through the practical application of theoretical lectures, and this connection is reflected in the chemistry laboratory. It is a space where students perform experiments under controlled conditions. Practical work is known to have a wide range of objectives that can result in a variety of positive learning outcomes, such as improvements in affective and cognitive functioning [1]. Research has indicated that the affective purposes are to increase student motivation and engagement, while the cognitive purposes are to teach scientific inquiry principles, teach specific practical skills, improve theoretical understanding, and develop higher-level skills and attributes [2]. Working in chemical laboratories is a major area of concern for many students taking chemistry and allied courses. Many research studies have highlighted students' perspectives on working in laboratories in general and chemistry laboratories in particular. In the last couple of decades, a number of studies on students' perceptions associated with working in chemical laboratories have emerged. Taking into consideration the importance of the laboratory experience and its impact on students' understanding of chemistry, the overall aims of these studies were to qualitatively explore and describe the thinking of chemistry students related to working in chemical laboratories [3].

Chemistry laboratories provide students with opportunities to gain hands-on experience with concepts learned in the classroom and to investigate in more depth the principles of chemistry. Depending on the level of expectation and implementation of laboratory activities, students can be highly motivated and develop cognitive skills, problem-solving skills, and a deeper understanding of the subject taught. On the other hand, laboratory work can also be quite intimidating and uninteresting to

students, so they may feel depressed, learning may subside, and misconceptions may arise [4]. Traditionally, chemical laboratories have been divided into general, analytical, inorganic, organic, and physical and biochemistry laboratories, according to their functions. For many students, especially in first-year courses, it provides the first real experience of chemistry as an experimental science. Research has shown that when practical work is conducted in the manner consistent with a constructivist philosophy of learning, it can result in the development of higher quality chemical understanding and enhances overall quality of learning. While practical work is widely advocated, it be acknowledged that the benefits derived are only realized when it is conducted in the 'best possible' environment. It has been observed those students' attitudes towards practical work can significantly affect how they approach learning in a course as well as how much they actually learn [5].

The most anticipated practical results of the research is that the differences in student attitudes, motivations, and critical thinking conditions that identified will serve as our primary guidelines for organizing and carrying out practical classes that align with the discipline's objectives as well as the students' professional. Additionally, the analyzing of data with a comparative psychological interpretation, adding to it an analysis of the information about the practical classes in the scientific and personal plans, so that attitudes and entities can change constructively with competent [6]. This study aims to compare the attitude towards working in a chemistry laboratory between students in the first four semesters (FFS) and last four semesters (LFS). From the results of this comparison, it is possible to know the extent to which the students' laboratory abilities have developed over the years of study. The objective of this study was to obtain feedback on student attitudes as a basis for determining how and what changes can be made to improve their overall experience, how laboratory work contributes to the development of their skills, and the extent of their readiness to work in laboratories in the future.

RESEARCH METHODS

Method of Qualitative Analysis

This study used a descriptive qualitative approach to learn more about the attitudes of students regarding practical work in chemistry department during the academic year 2023–2024 It was conducted based on replies to an online Google form questionnaire. The answers are then subjected to a qualitative analysis. This means that the researchers deduce patterns, themes, and meanings from the text of the responses rather than utilizing statistical techniques to evaluate numerical data [7].

Study Questions

1. Are they any different attitudes toward practical chemistry between the first four semester's students and the last four semester's students?
2. Do students have positive attitudes towards working in chemistry laboratory?

Formation of Attitudes

Attitude refers to a set of emotions, beliefs, and behaviors toward an object, person, thing, or event. It is a hypothetical construct used by social psychologists to understand and predict the behaviors of humans [8]. An attitude may be defined as a predisposition to respond in a favorable or unfavorable manner with respect to a given attitude object [9]. The formation of a positive attitude to denominational natural science is of great importance not only as an instrument to develop professional orientation of students but also for providing mental health. The applied importance of chemistry is determined by its adequacy, which allows solving specific future professional tasks in a better, faster, and easier way [10]. A few factors that can be used to assess how students' attitudes toward practical chemistry are formed. Alteration in the framework of an optimistic, emotionally dense mindset about the practice-focused element and the development of motivational-cognitive interest. Additionally Future professionals' professional approach to hands-on instruction. Furthermore, students' cooperation with one another is subordinated to the shared educational goal while they complete their experimental work and practical instruction [11].

RESULT AND DISCUSSION

Result of Qualitative Analysis

To analyze the data and provide answers to the study objectives, percentages were employed. 113 responses were send to the researcher, including 61 for the FFSand 52 for the LFS. There are 25 yes/no questions, 2 multiple-choice questions, and 1 opinion question in the questionnaire.

Table 1 and Table 2 we can see significant percentage different between FFS and LFS responses where first-semester students clearly have a negative attitude toward working in the laboratory based

on the results of the questionnaire and a comparison of the tables. One possible explanation for this could be a lack of exposure to chemicals and laboratory environment during high school. In the last semesters, students obtain -confidence about their ability to operate the laboratory in an effective manner, and therefore their attitudes shift and progress towards the positive. In question four, the percentage of the responses of the two groups 58.30, 80.30 for FFS and LFS respectively. There are differences in the way that students comprehend chemistry lab prior to, during, and following laboratory sessions. Students envisioned a more social and creative aspect of science prior to laboratory opportunities which later evolved into either a technical or bureaucratic view [12]. While question 6 shows a significant change in percentage of response, 40.00 FFS and 97.00 LFS. It means that the students who work in the chemistry lab for a long get used to the laboratory setting and pick up different strategies that help them with their overall skills. The development of practical abilities is not solely a means of learning chemistry, as laboratory work is also important to the way chemistry is taught. Various studies have indicated that learning chemistry through practical work can ensure an understanding of some chemistry concepts and positively influence students' attitudes towards practical chemistry. It can be understandable from the responses of the each group in question 9.

Q 1: Are they any different attitudes toward practical chemistry between the first semester's students and the last semester's students?

TABLE 1. Questionnaire answers sent by students in the first four semesters (FFS)

No	Questionnaire Questions for FFS	Percent of Answers (%)	
		Yes	No
1	Do you feel excited about chemical work?	80.55	19.45
2	Did you dread the chemical lab before you started working there?	60	40
3	Did you work on chemistry projects throughout your high school years?	73	27
4	After your experience in chemistry lab, did you change your perspective?	58.3	41.7
5	Do the chemical lab technicians provide you clear explanations?	81.1	19.9
6	Do you think your practical skills have improved because of working in chemistry lab?	40	60
7	Do you have obstacles and hurdles in your line of work at the laboratory?	62.2	37.8
8	Do you adhere to the lab technician's academic advice?	91.9	8.1
9	Do you believe that working in the chemical lab improves your theoretical knowledge of academic subjects?	65.9	34.1
10	Do you usually have the necessary equipment and materials to complete your laboratory experiments efficiently?	74	26
11	Do you believe that your career will benefit from your expertise in laboratory work?	84.6	15.4
12	Do you find it challenging to operate the tools and equipment in the lab?	32.4	67.6
13	Do you do laboratory experiments by yourself while being supervised by technicians?	51.4	48.6
14	Do you think that working in the lab has given you the chance to put theory into practice?	89.2	10.8
15	Do you have any medical conditions that prevent you from working well in the lab?	13.5	86.5
16	Do lab workers provide attention to students with health problems?	81.1	18.9
17	Before you begin working in the laboratory, do you take part in the preparation of experiments?	77.1	22.9
18	Do you receive the necessary warnings when a dangerous substance is present in the experiment?	91.9	8.1
19	Have you participated in exhibitions or workshops related to the chemistry laboratory?	54.1	45.9
20	Do you utilize simulation software or other computer programs to make sense of complicated experiments?	27.5	72.5

No	Questionnaire Questions for FFS	Percent of Answers (%)	
		Yes	No
21	Do you believe that working in the lab has improved your capacity to write reports and interpret data?	62.2	37.8
22	Do you believe that your ability to make decisions is improved by working in a laboratory?	64.9	35.1
23	Over the course of the first and last semesters, did your laboratory skills improve?	55.9	44.1
24	Have you ever solved an issue in your daily life—a housekeeping problem, for instance, or a different one—using laboratory experiments?	38.9	61.1
25	Do you think you will be able to explain chemical experiments to school students?	86.1	13.9

TABLE 2. Questionnaire answers sent by students in the last four semesters (LFS)

No	Questionnaire Questions for LFS	Percent of answers (%)	
		Yes	No
1	Do you feel excited about chemical work?	84.55	15.45
2	Did you dread the chemical lab before you started working there?	61	39
3	Did you work on chemistry projects throughout your high school years?	70	30
4	After your experience in chemistry lab, did you change your perspective?	80.3	19.7
5	Do the chemical lab technicians provide you clear explanations?	85.1	14.9
6	Do you think your practical skills have improved because of working in chemistry lab?	97	3
7	Do you have obstacles and hurdles in your line of work at the laboratory?	55.3	44.7
8	Do you adhere to the lab technician's academic advice?	80.9	19.1
9	Do you believe that working in the chemical lab improves your theoretical knowledge of academic subjects?	95.9	4.1
10	Do you usually have the necessary equipment and materials to complete your laboratory experiments efficiently?	70	30
11	Do you believe that your career will benefit from your expertise in laboratory work?	96.6	3.4
12	Do you find it challenging to operate the tools and equipment in the lab?	14.4	85.6
13	Do you do laboratory experiments by yourself while being supervised by technicians?	88.4	11.6
14	Do you think that working in the lab has given you the chance to put theory into practice?	90.2	9.8
15	Do you have any medical conditions that prevent you from working well in the lab?	4.5	95.5
16	Do lab workers provide attention to students with health problems?	89.1	10.9
17	Before you begin working in the laboratory, do you take part in the preparation of experiments?	77.1	22.9
18	Do you receive the necessary warnings when a dangerous substance is present in the experiment?	92.9	7.1
19	Have you participated in exhibitions or workshops related to the chemistry laboratory?	76.2	23.8
20	Do you utilize simulation software or other computer programs to make sense of complicated experiments?	57.5	42.5
21	Do you believe that working in the lab has improved your capacity to write reports and interpret data?	95.2	4.8
22	Do you believe that your ability to make decisions improved by working in a laboratory?	94.7	5.3

No	Questionnaire Questions for LFS	Percent of answers (%) Yes	No
23	Over the course of the first and last semesters, did your laboratory skills improve?	99	1
24	Have you ever solved an issue in your daily life a housekeeping problem, for instance, or a different one using laboratory experiments?	80.9	19.1
25	Do you think you'll be able to explain chemical experiments to school students in the future?	94.1	5.9

Q 2. Do students have positive attitudes towards working in chemistry laboratory?
The answers for both groups FFS and LFS from the questionnaire shown below:

1- A scale of 1 to 5, how do you evaluate your experience in the laboratory?

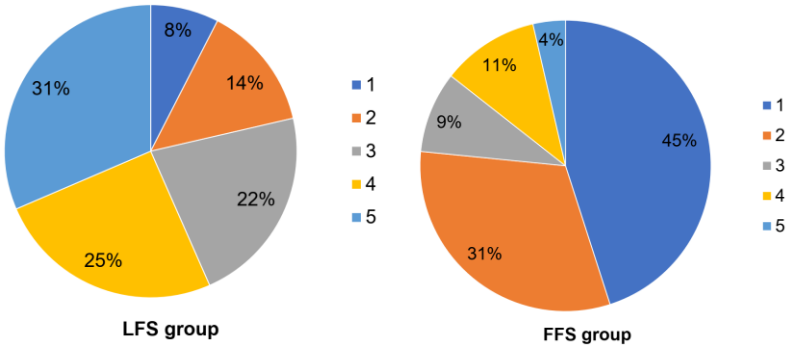

FIGURE 1: The evaluation of student's lab experience

2- What aspects of laboratory activity affect your attitude?

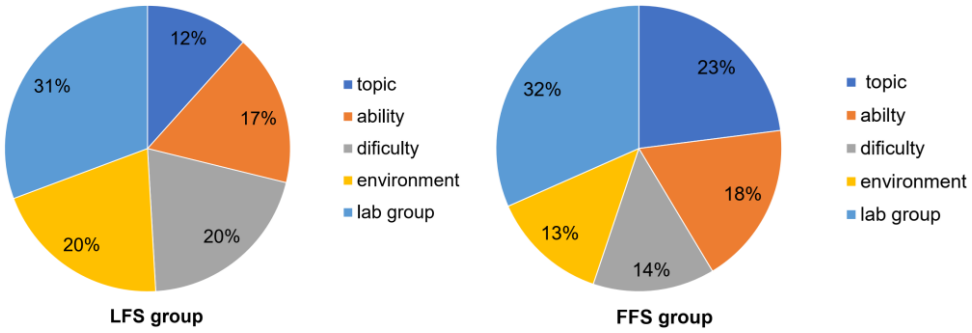

FIGURE 2: Factors affect student's attitude toward the lab work

3- What is required for a chemistry laboratory to operate as intended?

The most common answers are:

- Appropriate direction from lab technicians
- Accounting for individual variations
- Some safety and protective equipment
- Allow adequate time to carry out the experiment

The questionnaire responses number: 11, 12, 19 and 20 also show a very significant different in the percentage (Tables 1 and 2). From these results, we can comprehend that the development of practical abilities is not solely a means of learning chemistry, as laboratory work is also important to the way chemistry is taught. Various studies have indicated that learning chemistry through practical work can ensure an understanding of some chemistry concepts and positively influence students' attitudes towards practical chemistry. Laboratory work prepares students for career opportunities in research, development, and industry, providing them with essential skills and knowledge. First semesters students

face fears in operating laboratory equipment and using equipment, but they learn quickly and conducting chemical experiments becomes easier. The percentage of answers shows the difference between FFS and LFS .Student participation in chemistry laboratory exhibitions and workshops has a significant impact on student learning and acquisition of presentation skills, and these participations play a major role in the students' positive attitude toward working in the laboratory. LFS use technology more than FFS, and this helps them in understanding complex laboratory experiments and reduces their negative attitude towards working in the laboratory.

A clear difference can be observed in the percentage of responses 21, 22, 23, 24 and 25 for the groups under study. This concludes that the students can hone their critical thinking, creative, and problem-solving skills through laboratory activities. They gain knowledge on how to plan experiments, evaluate data, and make judgment calls supported by facts. Laboratory work has an impact on developing the decision-making skills of Chemistry Department students, and this ability results from the effort and continuous focus while conducting laboratory experiments. When you work in the chemistry laboratory, you can notice that students' skills are constantly developing. Difference in the percentage of responses is very noticeable. The students' experience in conducting chemical experiments and their understanding of the nature of chemicals in the laboratory helps them solve some daily household problems such as cleaning and food preservation. Students in the final semesters in chemistry laboratory have highly competent laboratory skills that enable them to deal with and explain practical experiments well to school students in the future. This skill obtained during the study years.

The answers to the multiple-choice questions showed that the students' attitude toward working in the chemical laboratory is affected by the group accompanying the student, the type of experiments he conducts, the laboratory environment, which includes the supervising lecturer and laboratory technician, and the nature of the chemical lab. According to the students' responses, the chemistry lab needs some requires in order to run effortlessly. The adequate guidance from laboratory workers is required, also consideration of individual differences. Utilization of safety and protective gear and allocate sufficient time to complete the experiment is very important to complete laboratory work well and give satisfactory results.

CONCLUSION

This study summarized that students' skills develop after working in the laboratory for a long time. The percentage of questionnaire responses in Tables 1 and 2 shows the difference in percentage between the two groups, which changes the attitudes towards laboratory working for those student groups. Laboratories are thought of as instructional resources that are best suited to help students hone their practical problem-solving abilities. When lab exercises are conducted well, they foster a deeper comprehension of scientific ideas, inspire students, contextualize their learning, and help them acquire the qualitative abilities required. Student attitudes and views on chemistry have a direct impact on their capacity to solve problems, participate in the area, feel satisfied, and achieve well academically. In order to draw exceptional students to professional programs in chemistry, we must offer a stimulating learning environment in addition to cutting-edge laboratories.

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