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THE NEEDS FOR AND BARRIERS TO LABORATORY TEACHING AT THE COLLEGE OF EDUCATION, UNIVERSITY OF GARMIAN: A CASE STUDY OF BIOLOGY, CHEMISTRY AND PHYSICS DEPARTMENTS

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ABSTRACT

The experimental science is one of the human sciences that uses interaction and observation and to gain insight. Experimentation and laboratory activities make teaching more realistic and scientific. They activate learners' various senses, lead them towards developing skills, and practical learning. The methodology employed in the present research is applied (based on the objective), and descriptive-survey (based on the data collection). This research aims to investigate the necessity of, and obstacles to, laboratory teaching. The statistical population includes all professors and assistant-lecturers in physics, chemistry, and biology departments of teacher training faculty at Garmian University in the academic year of 2016-2017. The population consisted of 50 people. Due to limited number of population, all of the professors took part in the survey. A questionnaire was used to collect the data. Cronbach's Alpha was used to estimate the reliability of the questionnaire. The obtained α=0.74 attests the reliability and validity of the questionnaire. The results indicated that more than 80% of the lecturers deemed laboratory teaching necessary. There is an item (no. 2) on the questionnaire denoting that laboratory teaching facilitates understanding. This item got the highest score (66%). Item no. 1 also received the second highest score (64%). It states that laboratory teaching facilitates learning. The questions no. 5 and no. 6 got the lowest scores (4%). They indicate that, based on the lecturers' opinion, laboratory does not play a crucial role in growth of creativity, and learners' readiness for their future jobs. As a whole, the process of laboratory teaching requires cooperation and coordination of three group interacting together, i.e. learners, teachers, and authorities. Each group can play a destructive or constructive role in education and teaching.

Keywords: obstacles and necessities, teaching, laboratory, experimental science.

INTRODUCTION:

Realization of knowledge-oriented social development depends on high-quality education, among other things. Universities will be efficient educational centers if students experience diverse educational situations, e,g. designing experiments to observe and feel the educational concepts and learning material in the classrooms. There are numerous definitions for laboratory. It is a place where practical experiments are performed by the teacher to convey the concepts to learners. Practical exercises include experiments and any other activities leading learners towards scientific skills. It may be designed for scientific studies in a building, at a university, on a field, along the river, or in open spaces (Igwe, 2003). Laboratory is so important to teachers that Baird (1990) reckons it as a basis for teaching experimental science, and development of knowledge and skills. It also helps students develop a scientific approach towards phenomena. White (1996) believes that laboratory activities create skills that are applicable in daily life and boost creativity and innovation. They prolong the retention of learnt concepts, as well. Based on Feedman (1997), the traditional teaching methods do not meet the contemporary requirements. Abandoning rote learning and challenging students' minds through appropriate practical activities, as well as adopting an interdisciplinary approach towards acquisition of experimental science, encourage the students to be active learners and develop the sense of cooperation. John Dewey, philosopher and educational psychologist, says "What a learner experiences is the highest and most prominent prerequisite of learning". Learners' engagement in practical activities and experiments increases their fervent and inclination towards learning. It facilitates learning by combing different types of material and designing educational and experimental devices. Experimentation, as an auxiliary prop, is effective in conveying complicated theoretical concepts. These activities aim to educate researchers who are able to answer more complicated questions (Lunetta, 1998). On the other hand, motivating learners to remain active in science classes (physics, chemistry, and biology) is a big challenge, even for experienced professional teachers (Lunetta, 1998). Learners' participation and laboratory activities can help teachers, to this end. There are numerous reasons to emphasize the importance of experimentation in teaching science lessons:

1. Experiments help a learner develop the skills required for a scientist. These skills include planning, close observation, precise recording of data, clear and unbiased representation of the information, proper presentation of results, and finding logical relations among variables.
2. Experiments facilitate understanding of scientific facts and concepts.
3. Experiments make learners active thinkers about the goals of the experiment. Consequently, instead of drowning learners in a one-way data stream provided by the teacher, they actively engage in exchanging information with the teacher.
4. Experiments make scientific facts more tangible.
5. Experiments make science courses more interesting and exciting.
6. Experiments develop the skills intended by the course, educational objectives like development of scientific communication, literacy, and utilizing information technology and telecommunications (Bybee, 2000). Omiko (2015) states that manual experience leads learners towards inquiry spirit, acquiring scientific skills, and proper perception of tools and material. Society employs the university students based on their experience and skills at the laboratory. To boost the effectivity of the laboratory, students not only need to know experimentation procedures, but they also need to realize the importance of the laboratory experiments in understanding the scientific concepts. Omiko (2007) mentions five set of education objectives attainable through laboratory teaching:

1. Skills: manual, inquiry, research, planning and communication skills
2. Mastery: developing theories, hypotheses, and models
3. Cognition: critical thinking, problem solving, analysis, and synthesis
4. Nature of science: scientific investment, scientific approaches, diverse scientific methods, and interplay between science, technology, etc.
5. Scientific orientation: curiosity, risk-taking, objectivity, precision, self-confidence, perseverance, satisfaction, accountability, concession, and cooperation.

Almroth (2015) reviewed the studies devoted to the role of practical activities in science teaching and concluded that such kind of activities are required to achieve the intended goals in schools and universities. These goals includes motivation, educational skills, concept-acquisition skills, development of methods and scientific perception. Montes and Rockley (2002) claim that few people question the necessity of laboratory activities in schools and universities. A laboratory-based teaching approach in schools and universities utilizes methods in which students and university students are allowed to experience learning, along with understanding of concepts, and via scientific activities they get engaged in the process of knowledge accumulation. One of the

problems in educational system of Iraqi Kurdistan is its emphasis on rote learning. This deters students in schools and universities from scientific activities and weakens cooperation and group work. At present, there are challenges and problems on the way of developing laboratories in Iraqi Kurdistan.Three educational groups, who form the population of the study, are from teacher training faculty. Without proper laboratory classes, they will not be able to teach at laboratories. This will lead future students towards rote learning, as well. Despite the importance of laboratories in teaching and education, they are ignored in schools and universities of Iraqi Kurdistan. Based on the above, the present study aims to investigate the necessity of and obstacles to use laboratories in teacher training faculty of Garmian University.

METHODOLOGY:

The research method is applied (based on the purpose) and descriptive-survey (based on data collection). The statistical population includes all professors and assistant-professors at physics, chemistry, and biology departments of teacher training faculty of Garmian University in the academic year of 2016-2017. There were 50 lecturers and all of them were selected by census for survey due to limited number of participants. A questionnaire was utilized. It was devised by the researcher and consisted of three sections. First part dealt with demographic information of subjects including age, educational group, gender, and record of service. The second and third sections comprised the main parts of the questionnaire and each contained 10 questions. The first 10 questions stated the necessity of laboratory utilization in positive sentences, and lecturers chose from five options provided based on the Likert Scale (from 5 completely agree to 1 completely disagree). The last 10 questions similarly investigated the obstacles to use laboratory. Three choices were available to the subjects: Yes, No, and Undecided. Hooman (2010) states the most necessary and practical reliability measures are face and content reliabilities, based on expert opinions. Consequently, the devised questionnaire was reviewed by a number of experienced experts, and some adjustments were made based on their opinions to make sure of its reliability and validity. On necessity dimension,we decided on the cut point as follows: based on total scores of first 10 items, the minimum agreement score was set on 40. Cronbach's Alpha was used to estimate the reliability of the questionnaire. It was administered to 30 lecturers in the above department. After deletion of two statements, α=0.74 was obtained which attested the reliability of the questionnaire. Thus, the internal reliability of the items is acceptable. After data collection, the relevant data were statistically analyzed. SPSS-22 software was used to provide the descriptive (frequency, mean, and percentages) and inferential data (variance, and correlation). Confidence coefficient was set on $p<5\%$ in all calculations.

RESULT:

The descriptive data of participants are reported as frequencies in table 1. As a whole, the age of subjects varied from 25 to 61 years old. 8% of the samples were female and the remaining 92% were male. Physics, biology, and chemistry were taught by 34%, 42%, and 24% of lecturers, respectively. Their records of service varied from 2 to 37 years. 16%, 60%, and 24% of the sample hold B.A., M.A., and Ph.D. degrees, respectively. The overall results obtained from the necessity dimension of the questionnaire are presented in figure 1.

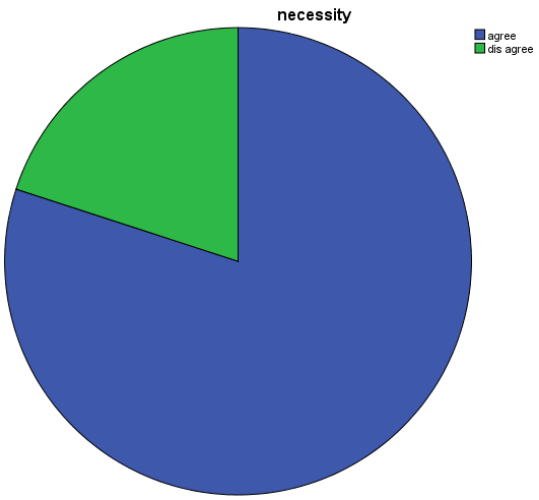

Figure 1: percentage of agreement and disagreement with necessity of laboratory teaching

Table 1: descriptive data of participants

	Sex		Age		teaching experience		degree of education		
	Female	Male	Average	Standard deviation	Average	Standard deviation	Bachelor	master degree	Doctorate
Physics	2	15	34.94	7.87	9.71	7.8	2	11	4
Chemistry	1	11	35.08	6.10	8.33	9.24	2	8	2
Biology	2	19	32.90	5.13	7.76	3.28	4	11	6

The information obtained from item-to-item analysis of both necessity of and obstacles to laboratory teaching are presented in table 2. As evident in figure 1, more than 80% of lecturers believed that laboratory teaching was necessary and agreed with statements contained in the questionnaire. The item-to-item analysis of questions revealed the most important necessity items and obstacles, in lecturers' opinions. It can be seen in table 2 that the highest laboratory-necessity score relates to item 2. 66% of the lecturers completely agreed that laboratory teaching facilitated understanding. Item 1 stands second, and 64% of the lecturers completely agreed that laboratory teaching facilitated learning. The lowest scores regarding the necessity of laboratory teaching relate to items 5, and 6, each with only 4% of complete agreement. They indicated that, in lecturers' opinion, laboratory did not play a crucial role in growth of creativity and students' readiness for future career. As a whole, it can be concluded from the first part of the questionnaire that, in lecturers' opinion, laboratory teaching is a must. The second part of the questionnaire studied the obstacles to laboratory teaching. 76% of lecturers thought of time wasted at the laboratory as the main obstacle. The high cost of laboratory (72%) and overpopulated laboratory classes (68%) were other significant obstacles. 80% of respondents believed that limited laboratory time and courses in curriculum reduced the utility of laboratories.

Table 2: percentages of answers to questions in necessity and obstacles sections

Part I (Necessity)	Completely Agree	Agree	Undecided	Disagree	Completely Disagree	Part II (Obstacles)	Yes	No	Undecided
Learning Facilitation	%64	%32	%4			Limited Practical Courses	%20	%80	%20
Better Understanding of the Material	%66	%30	%8			Inappropriate Location of Laboratories	%32	%60	%32
Increasing Participation	%40	%52	%8			Lack of Equipment and Insufficient Facilities	%48	%44	%48
Better Recall	%36	%56	%8			Old Laboratory Equipment	%17	%76	%17
Growth of Creativity	%40	%28	%28	%4		Limited Weekly Sessions	%16	%80	%16
Readiness for Teaching Career	%32	%44	%20	%4		Over-populated Classes	%68	%38	%68
Growth of Scientific Thinking	%40	%44	%16			Disturbance in Class-management	%28	%68	%28
Interest in Learning	%40	%56	%4			High Cost of Laboratory Teaching	%72	%20	%72
Less Fatigue	%16	%20	%56	%8		Waste of Precious Time	%76	%24	%76
Increased Self-confidence	%36	%48	%16			Lack of Sufficient Text-books for Practical Courses	%52	%40	%52

Great difference in number of male and female participants (5 women, and 45 men) voided any comparison between members of either sex. Anyway, all female instructors (100%) in our study believed that laboratory

teaching was necessary.To investigate the relation between the educational group and degree, based on total scores of laboratory necessity and obstacles, Levene Test was applied to examine the equality of variances (p>0.05). Then, ANOVA was used to test the variances. The relevant results are presented in table 3.

Table 3: ANOVA results to study the relation between educational group and degree based on total scores in both parts of the questionnaire

		Sum of Squares	Degree of Freedom	Mean of Squares	F	Significance
Educational Group	Necessity	1.39	2	0.69	0.03	0.96
	Obstacle	3.40	2	1.70	0.42	0.65
Educational Degree	Necessity	45.36	2	22.68	1.18	0.31
	Obstacle	16.87	2	8.24	2.27	0.11

As can be seen in table 3, based on the obtained F value, there were no significant differences between lecturers from three different educational groups regarding laboratory teaching necessity and obstacles (p=0.96, 0.65>0.05). The same value also indicates that there are no significant differences in lecturers' opinions about necessities and obstacles to laboratory teaching. Table 4 reports the relevant results.

Table 4: results of Pearson Product Correlation to study the relation between age and teaching records, based on total scores in both parts of the questionnaire

		Number	Correlation	Significance
Age	Necessity	50	0.24	0.08
	Obstacles	50	-0.04	0.74
Teaching Record	Necessity	50	0.42	0.00
	Obstacles	50	0.01	0.92

The study of relation between age and total necessity score reflected that although a positive relationship was evident between age and laboratory-teaching necessity, it was not statistically significant (p=0.08>0.05). To determine the existing obstacles, an insignificant negative relation was observed between age and fewer laboratory teaching obstacles, as well (p=0.74>0.05).

A positive and significant relation was observed between teaching records and laboratory teaching necessity (p=0.00<0.05). In other words, with an increase in teaching experience, lecturers increasingly felt the necessity of laboratory teaching. A similar relation was observed regarding obstacles. With an increase in teaching records, more laboratory teaching obstacles were felt, but this relation was not statistically significant (p=0.9>0.05).

CONCLUSION:

The present study aimed to study the obstacles to and necessity of laboratory teaching at teacher training faculty of Garmian University. The findings showed that most of lecturers considered laboratory teaching as a must, but some obstacles were identified as well, including financial problems, and wasting the useful tuition time. As mentioned earlier, the main objective of laboratory activities is to make students familiar with the nature of scientific approaches including observation, data collection, data organization, and logical conclusion. Not only the scientific activities deepen and enrich learning experience, but they also make students acquainted with stages of scientific discovery to rediscover and re-experience the learning material (McComas, 1997). Based on our findings in figure 1, lecturers at three department of biology, chemistry, and physics of teacher training faculty of Garmian University, considered laboratory teaching a must (over 80%). Table 2 shows that laboratory teaching significantly facilitates students' understanding and acquisition. It seems that the objectives of practical and laboratory teaching are to facilitate learning, simplify the lessons, and activate the learners' minds. Here, the lecturer as a mentor leads students towards thinking and active learning instead of mere raising of a problem and solving it. Our findings are in line with literature, since previous studies accept that laboratory teaching and resultant scientific studies lead to real acquisition instead of rote learning. It provides opportunities for problem solving through critical thinking and boosts the

capacities, capabilities, and skills (Omiko, 2007). The findings show that wasting the useful time, high teaching-costs, overpopulated classes, insufficient resources, and lack of laboratory equipment are some of the obstacles on the way of laboratory teaching. We did no find any study devoted to obstacles of laboratory teaching in Iraq, but similar studies in other countries support our findings (Farajolahy-Adl et al., 2011, Baderian et al., 2009). At present, there are obstacles in Iraqi Kurdistan which deter proper use of laboratories including: 1. Economic problems: They affected all organizations, and the regional government cannot allocate sufficient budget to relevant organizations esp. the ministry of science. 2. War and terrorism: Although Iraqi Kurdistan is not directly affected, they have indirect impacts upon educational programs and procedures. 3. Economic payoff: It discourages lecturers and administrative from laboratory activities. 4. Poor administration: The laboratory activities are not based on modern scientific principles and patterns. 5. Scoring: The marks obtained for laboratory activities are not so significant in the final scoring. 6. Shortages: There is a shortage of facilities, instruments, and appropriate buildings. If we ignore the role of laboratories in educational progression of students, we will face such consequences as lack of scientific perspective, and deficiencies in skills like problem solving, scientific inquiry, scientific research, etc. Some of the recommended procedures to improve laboratory activities include special focus and allocating more time and scores to them than theoretical courses, and forming laboratory classes with fewer students. Proportionate payment of salary and fringe benefits based on scientific level of lecturers is also recommended. Some of the items are directly related to higher education system, e.g. cultural promotion of education as a means for obtaining knowledge and wisdom rather than a mere credentialism requirement. Based on the results, no significant difference was discovered in lecturers' opinions about the necessity of and obstacles to laboratory teaching. No meaningful difference was also observed based on age and total score of laboratory necessity in table 4. The relation between lecturers' teaching experience and the total score of laboratory necessity was significant, however. That is, more experienced lecturers assigned higher scores to the need for laboratory teaching. It seems that seasoned lecturers are more familiar with the obstacles and importance of laboratory teaching. These necessities and obstacles are more evident for lecturers who are directly interacting with learners. In a nut shell, teaching process in laboratories require coordination and cooperation of three engaging parties: learners, lecturers, and authorities. Each may play a crucial role in improvement or deterioration of teaching process. The present study suffers from several limitations. For instance, limited number of participants makes generalizations from the results difficult. Thus we recommend future researchers to survey a greater number of people, esp. the university students who are direct recipients of laboratory teaching. Finally, we would like to thank all biology, physics, and chemistry lecturers at Garmian University who participated in the present study

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