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To Terminate the Challenges Faced by Science Teachers in Practical Work

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Abstract

Practical work and real objects are very significant materials for supporting the science educational process. Today with expanding knowledge and science information, practical work is very important for teaching science successfully. Consequently, this study was conducted to terminate the challenges faced by science teachers in practical work. It reports to observe the facility of schools in using science laboratory and utilizing science materials in their instruction process. Besides, the study targets to find out the obtainability and capability of laboratory tools in basic schools. This quantifiable enquiry was conducted with the involvement of science tutors in the KRG basic schools. Furthermore, with the purpose of gather and estimate the essential data an examination questionnaire which consisted of 10 objects was used and 250 science tutors were nominated to take a part in this research. Besides, in order to analyze the percentages, standard deviations, means, frequencies, T-test. In addition, SPSS program version 20 was used and the quantifiable data was analyzed descriptively. The finding results indicate that most basic schools are not provided by laboratory tools and more than half of the participant teachers are facing difficulties in relation to availability to laboratory aids and materials, absence of science training courses, the teachers had the strong desire to integrate practical work in to their teaching process and several governmental and practical problems still require to be solved. Otherwise, the study showed differences among instructors' opinions on using laboratory according to their year of experiences.

Keywords: practical work, science lesson, tutors' skills, laboratory and basic study;

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1. Introduction

The huge shift from traditional to constructivist approaches in science education context has turned this field of research on teachers' conceptions of teaching and learning into a valuable avenue that may shed light on their educational practices. Nowadays, many researchers around the world are very interested in giving more light on this issue. In addition, I found that an enormous governmental work is needed to be done by The Ministry of Education to change the way of teaching of science teachers instead of doing research and finding the problems as I was expecting, as a teachers' trainer. The purpose of this paper is to find out whether this was a lack of teacher's skills of working inside the laboratory or it is a specific problem related to KRG educational system. Baillie and Hazel (2003) suggest that before considering assessment for a laboratory class, teachers need to consider a set of aims and objectives for the lab and the subject overall which leads to desired outcomes in students' learning process. These will be the knowledge, skills and attitudes which you would like the student to achieve, rather than a series of factual contents. Typically, in this research, I will try to answer the following question: are the primary schools supported by laboratory rooms, do all teachers have enough information to use real objects and laboratory instruments? Do all teachers participate in any teaching courses or not? The political changes that occurred in all parts of Iraq after 2003 along with the transformation to democracy opened the door for technology when the new teaching style required a reform of the educational system based on a new educational philosophy. This philosophy was done by government in 2008. Especially, science, English and maths subjects. In 2007, Kurdistan Region Government put The Ministry of Education and education system aside and step by step started to change the science, English and maths curriculums and course books from the old ones to new ones. In many countries, practical work plays a significant role of teaching and learning science and considerable time and money are both spent on teaching science through practical work and it is, therefore, important to clarify the aims of practical work (Abrahams & Saglam, 2010).

2. Literature Review

Experts divided teaching aids into four main categories, audio aids, visual aids, audio-visual aids and interactive or multi-Sensory aids (Sambasiva & Vijaya, 2012). Also utilizıng five senses like sight, hearing, taste, smell and touch may help students learn better. Visual aids and materials can assist learners and students to think better with crystal clear information and ideas; they can provide positive thinking and sense of direction. According to Jenny, Catherine and Robert (2008), multisensory teaching techniques and aids or Realia are useful means used to help students learn and clarify information through more than one organ sense. Most teaching-learning techniques and activities are done using either sight or hearing senses, without using sense of touch (manipulative materials). Reys (1971) defines manipulative materials as some tools, three-dimensional objects and substances that the students, learners and pupils can touch, feel and handle. Moreover, anything that learners can move physically and mentally in order to find out or realize his/her knowledge and information. Furthermore, science subject laboratory is the main factor of successful teaching technique which supports the idea related to science concepts. On the other hand, because science subject is empirical means depending on practic work or labrotory. It is based on observation (direct and/or indirect); it leads to find out more about the natural world and surroundings. Scientific claims are based on sensory data. Science goes hand in hand with things and concepts that can be measured or counted; things that can be perceived with five senses, with or without the assistance of different instruments or tools. According to many researches, since 1946 Edgar Dale illustrate cone of experience. Summarizing the percentages that are described in the Dale cone which were cited in

many published studies: learners or students generally remember 90% of what they have learned by having activities done by themselves, 70% of students by oral and writing activities, 50% by audio-visual activities, 30% by visual activities, 20% of what they have learned from audio activities and 10% of what they have learned by reading textbooks (Dale, 1970). By the end of 12th grade, students, learners and pupils should have gained sufficient knowledge or concepts of practice work, crosscutting concept, and core ideas of science as to participate in public discussions on scientific related issue, to be magnificent consumers of scientific ideas related to their daily life, and to continue to learn more about science throughout their lives. It is especially critical to note that the above targets are for all students, not just those who look for careers in science, engineering and technology or those who would like to complete their study (MA, PhD) (NRC, 2012). The schools' science laboratories are considered by education researchers and scientists as a unique resource that can kindle students' interest in science, make them more passionate in science and develop new understanding of science concepts. Experiments and practical work in a school laboratory can also help students gain more ideas or information about the nature of science that are really important for their understanding of scientific knowledge (Hofstein & Lunetta, 2003). As this study was specifically done to find out whether there had been any changes to teachers' opinions about the aims of practical work and experiments in the laboratories. Usta (2013) suggests that using teaching aids and materials or experiments during teaching process has vast advantages. In other words, education means and practical work giving multi-learning backgrounds which will support the learning process in the future. According to Rasul, Bukhsh and Batoolc (2011) instructions, three-dimensional tools, and aids can make the learning process easier by helping students to use all their senses, to help students learn without memorization so that they will be able to observe the lesson by themselves. On the other hand, Bianchi (2002) suggests that using radio/TV programs and educational video are interesting teaching aids especially for learning languages and also for connecting subjects to the real life by giving some examples which exist in the classrooms that help students learn properly. The radio/TV programs, educational video and local environmental aids are more common and successful teaching resources in the most part of the world.

2.1. Practical Work and Real Objects

It is acknowledged by some researchers that it is a better way to use the term of practical work to represent teaching and learning activity that, to some extent, gets students more involved in using and touching the objects and observing the materials related to their field of study. On the other hand, they don't prefer to use the term of laboratory work instead of practical work simply because the location is not important for doing this kind of activity that needs involving students' five senses. In addition, the practical work as mentioned might be done in schools' laboratory, inside the classes or at home by using real objects (Millar et al., 2003). Many research mentioned that the technique of practical work as a teaching method first came to use last century in Britain. Furthermore, the idea was supposed to find something that had not been in use before, not just repeating the same experiments in the schools laboratories as a way of proving the theory. It was stated by Moeed (2010) that Atkin and Black (2007) admit that the pendulum swung between the inclusion of practical work inside the labs and an emphasis on learning and teaching scientific ideas, concepts and theories.

- Practical work is divided into three stages mentioned as the following:
- The Discovery Approach
- The Process Approach
- Investigation Approach (Moeed, 2010)

Once more, Millar (2009) declares that the discussion that follows any practical activities or work is vital for increasing understanding, and both of them are so closely related that it does not seem right to separate them. Millar supplements that the role of practical work or activities in the teaching and learning science content is to help students to make relations between two "domains" of knowledge. Besides, practical work and activities are meant to deal with real objects and materials. They can be used by taking examples of our real life and environment to fit the learning process, we can refer to this technique by the term "Realia".

3. Method

3.1. Model of the study

A descriptive study has been used or utilized to examine whether science teachers use laboratory, educational tool and materials in teaching science. Survey method is a part of the descriptive designs which afforts to examine the attitudes through the answer of the participants (Jackson, 2009). And this survey method was used in this research study and quantitative data was collected through the use of questionnaire as the main tool for descriptive study design then the data was statistically analysed to answer the research questions.

3.2. Participant

The research was applied in 2016 - 2017 academic year in the basic schools in Erbil city KRG government. The population of this study consisted of 250 science teachers only in the centre of Erbil city. The participants' background information consisted of three groups according to their gender, qualification and years of teaching experience. Also they were selected from seventh, eighth and ninth grads form basic school. Thus, a total of 250 questionnaires were answered and returned back to the researcher. The first group of participants were divided into two categories according to gender differentiation. 87 male teachers and 163 female teachers. The second group of participants were put into three categories depending to qualification. There were 238 teachers having a bachelor's degree and 12 teachers having a master's degree. On the other hand, the third group of background information of participants were put into three categories depending to the years of teaching experience in teaching science. There were 24 teachers with one to five years of experience and 105 teachers with five to 10 years of experience while 121 teachers over 10 years of experience.

3.3. Data collection tool

In this study a questionnaire has been used as a material for collecting the data. The questionnaire consisted of three parts. In the first part, there were questions about background information of participants which aimed to collect data about demographic information of the respondents. In this respect, they were asked to indicate their gender, qualification and years of teaching experience. In the second part, there were 10 Yes/No question statements which respondents asked about possibility of using teaching material in the class or laboratory that the study aimed to investigate. The last part consisted of four sub-questions. Two of them selected questions to ask the teachers about availability of teaching devises and materials in their laboratory. In addition to that, two open-ended questions were made by the researcher to investigate teacher's opinion towards using other additional teaching means and materials in the classrooms.

3.4. Data analysis

The quantitative analysis of data was conducted by using Statistical Package for Social Sciences (SPSS 20.0 for windows). The data was analyzed quantitatively. The descriptive statistic was used to find out the frequencies and the percentage among the different group of questionnaires demographic information within each variable. By using the same test, the mean, meaningful differences and standard deviations were calculated. On the other hand, Independent sample T-Test was used for comparing two groups according to gender and qualification. As well as for comparing more than two groups, One-Way ANOVA was used for defining the differences among groups subsequently for analyzing the significant differences of each group according to years of teaching experience by using Post Hoc-LSD Test.

4. Finding

The results of the research for the opinion of the science teachers on the use of teaching aids and materials in the classrooms or laboratory during teaching the subject showed that a high percentage of the respondents have not used educational materials and aids in their teaching process. The questions were designed to find out the science teachers' opinions towards the possibility of using teaching materials and laboratory. In statement one, which is to find whether the teachers have always used teaching aids in their teaching process, (85.1 %) of the respondents (Mean = 1.14, SD = 0.35) answered "No" to this statement and (14.0 %) of them answered "Yes". This outcome shows that a majority of the science teachers who teach in the Erbil basic schools, in general, haven't used teaching aids and materials in their classrooms every time. Like the first question, (86.0 %) of the teachers (Mean = 1.14, SD = 0.34) replied "No" to the second question, which state that, are you keep any teaching resources and tools in a dossier for next year, whereas (14.0 %) of them replied "Yes". This means most of the teachers do not keep any teaching means or tools in a dossier, and this is also evidence of the lack of using teaching aids by teachers. Most of the teachers, (98.3 %), have a proper whiteboards for teaching (Mean = 1.98, SD = 0.12). According to much research and published articles whiteboards are one of the most commonly and traditionally used teaching aids, but they are not sufficient tools for supporting learning process if it is used without other teaching tools and materials. Also, many researches talk about the advantages and disadvantages of whiteboards. Then, the data was collected in the fourth question, showed that, (95.9 %) of the respondents (Mean = 1.04, SD = 0.15) do not use data show in their teaching process. And respectively, in question fifth, (77.7 %) of the respondents (Mean = 1.22, SD = 0.41) do not use means from local environmental. Results of question sixth shows that, (67.8 %) of the teacher responded "Yes" (Mean = 1.32, SD = 0.46), and (32.2 %) responded "No". These results show that the majority of the science teachers don't have this ability to develop teaching means and tools by themselves or they don't find resources to produce. After that, (28.1 %, Mean = 1.71, SD = 0.45) of the teachers replied "Yes" and (71.9 %) replied "No" for the question "Do you always use the teaching materials in your class teaching?" According to Gulbahar and Guven (2008), having access to all types of teaching materials will help teachers to find various ways of modifying their instructions and information to fit the diversified needs of learners. For the eighth question, "Have you attended a training course regarding the usage of teaching means and instruments in the lab?" (92.6 %) don't attend any training courses regarding the usage of teaching means (Mean = 1.07, SD = 0.26), while (7.4 %) attended the courses. Koehler and Mishra (2005) state that some teachers are not skilled in using teaching means and devises, they cannot also use new technology to enrich the learning and teaching experiences. Moreover, the majority of teachers are afraid of using computers. Therefore, taking training courses are very important to develop teaching skills. In addition, a majority of the respondents (95.0 %) suggests that there is no coordination between their schools and other schools regarding the usage of technology in education (Mean = 1.04, SD = 0.21) while (5.0 %) of the respondents replied "Yes" for the question 9. This finding shows that there is no administration supporting those schools. Finally, (90.9 %) of the respondents replied "No" and (9.1 %) replied "Yes" (Mean = 1.09, SD = 0.28) that they use schools' laboratories in their schools. Aktamis and Acar (2010) argued that the self- regulation learning skills of students have a huge difference before and after taking their courses in the laboratory especially in science subject. Moreover, student's knowledge and information were increased after they took courses in the laboratory.

4.1. Teachers' Perceptions on Using Practical work According to their Gender

The second problem of the research study was about to see "Are there any significant differences between teachers and their gender in using educational aids and materials." The Independent T-test results about significant relationship between science teachers gender that participants in this study and their responses to the statements were examined and shown in table 1. Over and above to that descriptive statistics, number (N), mean (M), standard deviations (SD), T-test and significant relationship is clarified.

Table 1. Significant T-test Results of Teachers' Perceptions on using practical work According to their Gender

Gender	N	M	SD	T	Sig.(2-tailed)
Male	87	1.35	0.184	1.69	0.093
Female	163	1.29	0.178		

The data obtained in table 1 indicates that there are not statically significant at ($P \leq 0.05$) level, the opinion of the male teachers (Mean = 1.65, SD = 0.177) and female teachers (Mean = 1.71, SD = 0.179) with the T score (1.74) bear similarities and the means are close to each other. This may be male and female science teachers faced same problem and obstacles in using teaching materials and laboratory in Erbil basic schools. Aldbsy (2012) in a research conducted at Damascus universities found that the use of educational materials in the education process is important for the male and female teachers at the same level. In addition, abstaining from instructional materials and aids is due to lack of availability of those tools in schools or the inability to use new technology by teachers so their responses were close to each other and did not show any statistically significant differences. On the contrary, Zhou and Xu (2007) elaborates that male teachers more presumably use instructional technology in learning and teaching process than female ones.

4.2. Teachers ' Perceptions on Using Practical work According to their Teaching Experience

Regarding the teachers' questionnaire responses in relation to the years of their professional experiences, the analyses of the questionnaire data revealed the following. The participant science teachers of this study were classified into three groups as shown in table 2. 24 teachers with 1-5 years of teaching experience, 105 teachers with 5-10 years of teaching experience and 121 teachers with over 10 years of teaching experience.

Table 2. Significant ANOVA Results of Teachers' Perceptions on using practical work According to their Teaching Experience

Teaching Experiences	N	mean	SD
1 - 5	24	1.351	0.165
5 - 10	105	1.312	0.166
Over 10	121	1,296	0.198
Total	250	1.308	0.182

Then, the results of the Post-hoc Test showed that there are no significant differences between teachers' perceptions towards probability of using teaching aids and materials in their classrooms and laboratory in relation to their teaching experiences. Because the teachers between one to five years of teaching (Mean= 1.35, SD= 0.165) shared their views close to group five to 10 years of teaching (Mean= 1.31, SD= 0.166). But it is revealed a little different view compared with group over 10 years of teaching (Mean= 1.29, SD= 0.198) with an F score (0.465). This may be due to younger teachers have more experience in new using teaching aids and materials. They may also think that students understood and concentrated in the classrooms or laboratories better with educational aids as shown in table 2 and 3. But in fact, all groups may have same problems and obstacles in using teaching aids or may be due to the similarity of the problems, which are faced by science teachers in Erbil province, such as unavailability of instructional materials and aids in the schools, luck of educational facilities like equipment and new technology devises. New educational aids or materials are difficult to use. Frequently, it is too complicated and not available in mother tongues. Also, teachers, in general, are not trained or supported by the ministry of education to use new teaching aids and new educational technology (Yildirim, 2008).

Table 3. Significant ANOVA Results of Teachers' Perceptions on using practical work According to their Teaching Experience

Sum of Squares	df	Mean	Square	F	Sig
Between Groups	0.310	4	0.16	0.465	0.62
Within Groups	3.951	246	0.33		
Total	3.982	250			

4.3. Availability of Teaching Aids and Materials in Erbil Basic Schools

Table 4 illustrates the availability of teaching aids and materials in the schools according to teachers' responses. The frequency and percentage results of selecting and unselecting items show that there is a lack of most teaching aids, materials and scientific devises in the schools except some traditional aids such as Calculators, Photographs & Images, and Three-dimensional Models, which exist in many schools. This unavailability and lack of those aids are evidence for probability of un-using educational materials and tools by science teachers in selected Erbil basic schools.

Table 4. Distribution of Availability of Teaching aids & Materials in the Schools

N	Teaching aids & Materials	Selected		Unselected	
		Frequency	Percentage	Frequency	Percentage
1	Overhead projector	-	-	250	100
2	Camera	-	-	250	100
3	CD player	230	92	20	8
4	TV	-	-	250	100
5	Video player	-	-	250	100
6	Computer	27	10.8	223	89.2
7	Slide Projector	3	1.2	247	98.8
8	calculator	112	44.8	138	55.2
9	Data show	97	38.8	153	61.2
10	Educating Movies	19	7.6	229	91.6
12	Audio CD	230	92	20	8
13	Slides	-	-	250	100
14	Illustrations	163	65.2	87	34.8
15	Transparency	-	-	250	100
16	Photographs & Images	196	78.4	54	21.6
17	Real Samples	124	49.6	126	50.4
18	Three-dimensional Models	43	17.2	207	82.8

5. Conclusions and implications

Regarding the results about challenges faced by science teachers in practical work, during giving lessons in the classroom, several conclusions have been gained. First of all it was determined from the survey that a majority of science teachers of basic schools in province of Erbil followed a single type of teaching aids and materials in their practical work or did not use useful materials throughout their teaching experiences. It has been concluded that using various educational aids and materials will make teaching science more challenging, engaging and effective as a schools subject in the coming years. On the other hand, the results show that textbooks and course books are mostly used by science teachers in their daily teaching process. The teachers had negative attitudes towards using teaching aids and materials in the teaching process. It is worth mentioning that these negative

attitudes are not because of having opinions about practical work by saying these are unnecessary techniques for teaching, because they have not been updated with modern methodologies as well as having a lack of laboratory equipment in most basic schools, particularly the specialist type which related to science subject like laboratory equipment and needs, real objects and three dimensional models are limiting the use practical work techniques. According to the responses, they faced a lack of new technology materials and devices like data shows, laptops, computers, overhead projectors, electronic illustrations, DVD and CD players, screens and cameras. For these reasons, they cannot use new educational methods in their teaching process, and they cannot modernize the use of technology. When looking at the results obtained through the questions, they can indicate that most teachers are unable to produce and develop teaching aids. If teaching aids are not always existing, the teachers can produce some basic supporting aids and tools from local environments as a part of practical work, but also many schools faced a lack of coordination and cooperation between teachers and schools' administrators and between teachers in the same school or other schools. Likewise, most teachers are not comfortable or trained to use teaching aids and materials due to absence of training courses and seminars for improving teaching skills, experience and new techniques. Moreover, Insufficiency in repairing and checking teaching devices and tools if they are existing in the schools leads to an unsuccessfully teaching process. Also, the school's administration has not encouraged teachers to use the educational aids due to a lack of budget and funding. On the other hand, a lack of having proper labs and new rooms supported by new technology in many schools is the most fatal factor that leads teachers to unwillingness in using teaching aids in their practical work. Moreover, not having enough time to prepare teaching aids is an extra barrier teacher have faced in their teaching process. Because the allotted time for each normal period at basic schools is 40 minutes, it is very difficult for teachers to organize this time to teach the textbooks and use practical work at the same time. Science teachers say that one of the main obstacles of using teaching aids and new technology is the insufficiency of teachers' skills and knowledge to prepare materials and aids based on new technology. This finding shows that equipping schools with teaching means is not enough for reaching educational goals. Supplying teaching aids, materials, new technology and new educational devices into classrooms requires supporting and innovating in the other sides of teaching like training courses. Finally, supporting teaching by practical work is a must that goes hand in hand with the need of providing teachers with some training courses so that teachers can get inspired ideas for activities that make the process of learning and teaching more successful and enjoyable.

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