THE LEVEL OF UNDERSTANDING OF THE NATURE OF SCIENCE FOR PHYSICS TEACHERS AND THE RELATIONSHIP OF THAT EXPERIENCE WITH ACADEMIC QUALIFICATION

Dr. Monther Bsharh Alswelmyeen

Dr. Abeer Rashed Al olimmat

Al-Balqa' Applied University, Princess Rahma University college, Jordan

Abstract

This study aims to determine the level of the understanding of the nature of Science for physics Teachers and its relation with experience and Academic qualifications. The application of test was applied on a sample chosen randomly consists of (52) physics teachers in Jordan.

The study results revealed a low level of understanding of the nature of science in physics teachers and the lack of significant differences in understanding the level of the nature of science as a whole due to the variable of teaching experience, and also found statistically significant differences in the assumptions of science and for the longest teaching experience. the study also showed statistically significant differences in determining the level of understanding of the nature of science, due to the academic qualification and in favor of a higher qualification.

The study recommended the need for the inclusion of issues and attitudes a appropriate educational programs in pre-service teacher preparation, and held training sessions for them during their service, in order to enable them understand the nature of science, and finally emphasis on the role of educational supervision in this area.

Keywords: Nature of science, learning and teaching, science teaching

Introduction

The conceptual structure for a learner is considered as one of the basic factors which affect the influence of learning, in terms of an individual's cognitive structure of the subject

that enables him to act and use the knowledge, alternate and generates new knowledge of it, creating clairvoyance of new relationships among the elements, it enables the subject to employ the knowledge in solving problems which increases the effectiveness of his knowledge improving his mental abilities becoming capable of having that knowledge and using it when needed. (Charles, 2000)

As the preparation of an individual to participate in the development of science and technology, which became a basic requirement of a successful Science teacher is not limited to the properties of his knowledge of scientific knowledge but extended properties to include cognition, good nature of science, has pointed out by (Muslim, 1981; Zaitoon, 1988) That the behavior of an educational science teacher is influenced to a large extent by his understanding of the nature of science being primarily responsible in the implementation of the science curriculum. Especially since modern curriculums for science have become focused on the direction that is providing the science as a subject and a research method. The behavior of the teacher, in practice teaching activities, teaching methods and the choice of means and appropriate activities and evaluation methods and others in the classroom. The manner of scientific education has confirmed that the nature of science and its preparation are the essential factors and the cornerstones of teaching science. This includes the nature of structure of synthetic science, methods, processes, ethics, methods in research, and thinking. It has appeared in the United States in several reform efforts to raise the level of scientific culture to the level of understanding of the nature of science for students and teachers alike. Such as the project called NSF (National Science Foundation) in response to these global trends and given the importance shared by the nature of science is contributing in a fundamental way to the development of scientific thinking skills and problem solving (Abdel Majied, 2004), Many countries have sought to include the subject of the nature of science in their curricula. Jordan has cared greatly about this topic in its framework for the systematic science and mathematics of basic education (Ministry of Education, 48:1988) There are various definitions of the nature of science, but they agree on the importance of methods and techniques that are of basic scientific knowledge and the integration between the material and the way the so-called scientific knowledge and the scientific method (Lederman, 1992; Zaitoon, 1991)

Ades and Awad (2009) has conducted a study aimed to determine the level of understanding of the nature of science among the students of the tenth grade in schools south of Hebron, the study finds that the level of student's understanding of the nature of science was average, and the lack of statistically significant differences in the level of understanding

of the nature of science is attributable to the genus student. While significant differences are attributed to the level of achievements of students with excellent grades.

Al-Shuali also conducted a study (2008) aimed to determine the level of knowledge of teachers chemistry in Sultanate of Oman to the nature of science and its relationship with variability of the sexes and teaching experience. The results showed a low level of performance of chemistry teachers on the understanding of the nature of science and the fields of sub-study. The study also showed no statistical significant difference due to the variable sex of the teacher or teaching experience variable. Al-Hajari also (2006) conducted a study aimed to determine the level of understanding of science teachers in the Sultanate of Oman to the nature of science and its relationship to their practice classroom. The results revealed that the performance of science teachers for grades (5th – 10th) based on the understanding of the nature of science was low compared to the level of education accepted and which have been identified as (80%) The results showed superiority parameters on teachers in the level of understanding of the nature of science also indicated no statistical significant differences at the level of (0.05) in the classroom practices of teachers and their level of understanding of the nature of science.

The aim of the study of Obeidat (2005) is to determine the level of growth trends of science and level of understanding of the nature of science and the relationship between them among the students of the Faculty of Education at the University of Jordan revealed the results of the study. The level of scientific attitudes and understanding of the nature of science was weak when compared to accepted standard education, as well as the lack of significant statistical differences (0.05) in understanding the nature of science among students in the first year and fourth year, and the results show a significant correlation (0.01) between scientific students' attitudes, and their level of understanding of the nature of science.

Ryder and his colleagues (Ryder and his colleagues, 2003) study is to determine the extent of teaching teachers how to develop the scientific knowledge, study results showed the presence of some of the experiences that support students' understanding of how evolution of scientific knowledge in the sciences, like statement by students themselves and including how students should learn about the evolution of scientific knowledge in various activities, and linking several scientific topics to represent how the evolution of knowledge. Teachers also showed experience with regard to the contributions of students in classroom discussions. Aldbai (2001) conducted a study aimed to determine the level of understanding of the nature of science to science teachers and students of the Department of Scientific at the secondary level in Yemen. The findings revealed that the level of understanding of science teachers in

secondary schools of the nature of science was average, and the understanding of high school students (scientific section) of the nature science was low.

The Tulaimat study (2001) has aimed to define a vision of science teachers in Egypt for science and nature of science. The study results showed that science teachers lack the vision and sufficient awareness of the nature of science.

In a study conducted by Al-Hadabi (2000) was to identify the level of understanding of the nature of science among students of science teachers at Sanaa University, results showed a low level of understanding of the nature of science at the sample level (48.8%), which is less than the acceptable level educationally (50%).

It is obviously clear from the above studies that the behavior of educational science teacher is influenced to a large extent by the understanding of the nature of science. It has been confirmed by all previous studies on the importance of understanding of the science teachers of the nature of science because of its positive impact on the classroom practice and creating scientific culture to them and to their students. Researchers have benefited through reviewing these studies to enrich the theoretical framework of this study and to determine the dimensions of the nature of science that suit science teachers in general and physics in particular. As studies have reported the methodology of studying the terms by identifying the problems, the selection, design of study tools, is choosing the variables, statistical methods, discussion, interpretations and others.

Study Problem and It is Questions

The nature of science is the basis of the survey and scientific discovery. The recommended project (2061), "Science for all Americans" the need to enter themes that are not common in traditional approaches, such as; the nature of the scientific project, how they relate to science, technology, and society all together, and called upon the project also to familiarize students on science and technology (Retherford & Ahlgren, 1990).

It is the premise of understanding the nature of science that has become one of the most important goals of science education. This study came to determine the level of understanding of the nature of science in physics teachers in Jordan and its relationship to both teaching experience and academic qualification. The study has attempted to answer the following questions:

1. What is the level of understanding of the teachers of physics in Jordan to the nature of science?

2. Does the level of understanding of the teachers of physics in Jordan differ to the nature of science according to the qualification of the teacher?

3. Does the level of understanding of the teachers of physics in Jordan differ to the nature of science according to the teacher's experience of teaching?

Study Objectives

The purpose of this study was to determine the level of understanding of physics teachers in Jordan to the nature of science. This study also seeks to achieve a set of objectives which are:

1. Determine the level of understanding of physics teachers in Jordan to the nature of science and its sub-dimensions.

2. Detection of an academic qualification of the teacher in the level of understanding of the nature of science.

3. Detection of an experienced teacher teaching in the level of understanding of the nature of science.

Importance of the Study

This study gained significance through the goals that have been achieved, which determine the level of understanding of physics teachers in Jordan to the nature of science. It may lead other researchers to study other topics related to the nature of science in an effort to improve the performance of teachers and building appropriate curricula.

Determinants of the Study

• Physics Teachers of Ninth Grade Schools in the Capital Amman, has been the adoption of this level as the row that begins with Science calve (Biology - Chemistry - Physics - Earth Sciences).

• The second semester of the academic year 2008/2009 primary school.

• Procedural Definitions

As used in this study some of the terms that require a procedural definition according to the context of the actions that have been used, namely:

• Teaching experience: the number of years during which the teacher teaches science, has been divided for a long experience (5 + years) and a short experience (less than five years), including teaching experience for the academic year 2008/2009.

• Understand the nature of science: the performance of the teacher's nature test of science in all fields, and is measured primarily as obtained in this test.

The study population and it is sample

The study population of all teachers of physics registered at the Second Directorate General of Education in Amman for the academic year 2008/2009 and totaling (60) teachers of both sexes. The study sample consisted of (52) teachers of both sexes, answered the study tool and representing a rate of (87%) of the study.

Study Tool

The researchers used the test developed by Al-Sheikh referred to in Al-wahr (1992) In Jaber (1997) as a tool to measure the level of understanding of science teachers to the nature of science, which is composed of 40 paragraphs of multiple-choice type.

The 80% degree has been identified as the touchstone acceptable level of understanding of the nature of science, so as to estimate whether the teacher has scientific knowledge acceptable regarding the nature of science or not. As indicated in several studies of this degree (Muslim, 1981; Al-Ayasrh, 1985; Al-Wahr, 2001; Al-Hajri, 2006). This is equivalent to the degree of 32 out of 40.

The Results of the Study and Discussion

To answer the first question "What is the level of understanding of physics teachers in Jordan to the nature of science?", Has been calculated averages and standard deviations and percentages of teachers' performance on the test overall and sub-areas, as shown in Table (1).

Table (1) Averages and standard deviations and percentages and grade the performance of Physics Teachers on total test and it is sub-areas

Rank	Percentage	standard Deviation	.Arithmetic Average	Number of Paragraphs	Area
4	**%35.50**	**1.25**	**2.13**	**6**	**.** Axioms of Science
3	**%39.40**	**2.72**	**5.52**	**14**	Science outputs
1	**%45.30**	**3.40**	**7.25**	**16**	**.** Science operations
2	**%45**	**0.95**	**1.80**	**4**	Ethics science
	%41.77	**4.66**	**16.71**	**40**	Total test

As seen from the table above, the average performance of Physics Teachers in the total test was (16.71) which is equivalent to 41.77% of the total score on the test. While the average performance on the fourth sub-areas of the (2.13, 5.52, 7.25, 1.80), and these averages are equivalent (35.5%, 39.4%, 45.3%, 45%) of the total score for these areas in order, therefore the higher performance on the test was in the third area (of science), then the fourth area (the ethics of science), then the second area (outputs science).Finally, the first area (the axioms of science).

To determine whether there were statistically significant differences in the rates of teachers' performance on the overall test and fourth fields sub areas and the educational accepted level (80%) of the total score on the test or total fields sub test was used (T) for one sample between the averages performance of teachers and the acceptable level educationally, as in Table (2).

Table (2) Test results (T) of the differences in the averages arithmetic of the performance of Physics Teachers test macro and sub-fields and educational accepted level

(the level of significance (at α = 0.05)	value (t)	Standard deviation.	. arithmetic average	. educational accepted level	Number of paragraphs	**Area**
***0.000**	**15.34**	**1.25**	**2.13**	**4.8**	**6**	Axioms of Science
***0.000**	**15.02**	**2.72**	**5.52**	**11.2**	**14**	Science outputs
***0.000**	**11.67**	**3.4**	**7.25**	**12.8**	**16**	. Science operations
***0.000**	**10.56**	**0.95**	**1.80**	**3.2**	**4**	Ethics science
***0.000**	**23.66**	**4.66**	**16.71**	**32**	**40**	Total test

The educational acceptable level for the test or area= number of test paragraphs or area (100/80)

Seen from the table above that there were statistically significant differences at (α = 0.05) between the total average performance test of Physics Teachers in all four areas and sub areas as compared with an acceptable level educationally, and in favor of educational accepted level, indicating a low understanding of the nature of science in Physics Teachers. The arithmetic average of the performance of teachers to test (16.31) which is equivalent to (40.78%) note that the average education accepted for the purpose of the study was (80).

And this result agreed with the results of the studies: (Hassanein, 1982; Ziutoon, 1988; Jaber, 1997; Al-Hadabi, 2000; Al-dbai, 2001; Tulaimat, 2001; Obidat, 2005; and Al-Hajari, 2006), and varied as a result to the current study with the results of the study of (Lederman, 1986).

To answer the second question, "Does the level of understanding of the physics teachers to the nature of science in different academic qualification?", The arithmetic average was extracted for the performance of teachers to the overall test and sub-areas according to the variable qualification, as in Table (3).

B.A+ Educational Qualification	**B.A**	Academic Qualifications
2.52	**1.78**	Axioms of science
6.44	**4.67**	Science products
9.20	**5.44**	Science operations
2.08	**1.56**	ethics of science
20.24	**13.44**	total Test

To find out the significant differences between the averages a T-test was used for independent samples on macro test and it is fourth sub-areas, and to identify significant differences resulting from scientific qualification variables, as in Table (4)

Table (4) Test results (T) of the differences in the arithmetic average of the performance of Physics Teachers test macro and sub-fields, according to the academic qualification variable.

.) α = (0.05	Value of T.	Degree offreedom.	.Averages	.Number	. Educational qualification	.Area
*0.031	2.215	50	1.78	27	B.A	Axioms of science
			2.52	25	. B.A+ Educational Qualification	
*0.018	2.457	50	4.67	27	B.A	. Science products
			6.44	25	. B.A+ Educational Qualification	
*0.000	4.687	50	5.44	27	B.A	Science operations
			9.20	25	. B.A+ Educational Qualification	
*0.046	2.049	50	1.55	27	B.A	ethics of science
			2.08	25	. B.A+ Educational Qualification	
*0.000	7.687	50	13.44	27	B.A	total Test
			20.24	25	. B.A+ Educational Qualification	

It is clear from the results of Table (4) that there are significant differences in test axioms of science is attributable to qualified academic in favor of (BA + qualified education), as the value (2.215) "T" which is statistically significant at the level (0.05 = α), also found statistically significant differences in test outputs science attributable to qualified scientific favor (BS + qualified education), as the value of ((2.457) "T" which is statistically significant at the level (0.05 = α), and also found statistically significant differences in test science processes attributable to qualified Scientific favor (BS + qualified education), as the value (4.687) "T" which is statistically significant at the level (0.05 = α), and the existence of significant differences in testing the ethics of science attributable to qualified scientific favor (BS + qualified education), reaching value (2.049) "T" which is statistically significant at the level (0.05 = α), and the presence of statistically significant differences in performance on the test as a whole due to a qualified scientific favor (BS + qualified education), as the value (7.687) "T" a statistically significant at 0.05 = α).

This result can be attributed to the nature of the academic courses offered by institutions of higher education by the service to obtain a bachelor's degree, so that it is focused on educational content, and the level of achievement of students, without interest to the nature of science, as well the student at that point pay much attention on the collection of knowledge for the purposes of graduation. While after bachelors the student becomes more interested in how to study and access to information in addition to the difference in

educational situations that are exposed at each grade level according to the possibilities available from laboratories and teaching aids and learning resources in the workplace or in the institutions to prepare them, as well as differences in the curricula taught at the stage of studying educational qualification after bachelor.

This result is consistent with the results of the study of: Hassanein, 1982; Ziutoon, 1988; Al-Hadabi, 2000 the; Aldbai, 2001), and the result of this study with the results of a study of Attar, 1993; Al-Hajari, 2006)

To answer the third question, "Does the level of understanding of the physics teachers to the nature of science in difference to teaching experience?", Was extracted arithmetic average for teachers' performance on the test overall and sub-areas according to the variable teaching experience, as in Table (5)

Table (5)

Long Experience	Short Experience	.Teaching Experience
2.60	**1.75**	**Axioms of science**
6.04	**5.10**	**Science production**
7.82	**6.79**	**Science Operation**
1.96	**1.69**	**Ethic Science**
18.43	**15.34**	**total Test**

To find out the significant differences between the averages were used t-test for independent samples on overall test and four dimensions in order to determine significant differences resulting from the variable teaching experience, as in Table (6)

Table (6). Test results (T) of the differences in the arithmetic average of the performance of Physics Teachers on the overall test of the nature of science and its sub-areas according to the variable teaching experience

) α(0.05 =	T value	Freedom degree	Average	Number	Teaching Experiences	Area
*0.014	2.55	50	1.75	29	Short experience	Axioms of science
			2.60	23	Long experience	
0.220	1.24	50	5.10	29	Short experience	Science Production
			6.04	23	Long experience	
0.285	1.08	50	6.79	29	Short experience	Science Operation
			7.82	23	Long experience	

0.319	**1.006**	**50**	**1.69**	**29**	**Short experience**	**Science ethic**
			1.96	**23**	**Long experience**	
***0.016**	**2.494**	**50**	**15.34**	**29**	**Short experience**	**Total Test**
			18.43	**23**	**Long experience**	

It is clear from the results of table (6) that there exists a significant differences in the test total attributable to experience teaching in favor of (longer experience) as the value of T is (2.55) which is statistically significant at the level (0.05 = α), and also the existence of significant differences in the test total in favor of (longer experience) which the T value is (2.494) which is statistically significant at the level (0.05 = α), and the lack of statistically significant differences in tests outputs of science, science processes, and the ethics of science are attributable to experience teaching in which the T values are(1.006, 1.08, 1.24) consequently which are not statistically significant at the level(0.05 = α).

This can be explained by the teacher's superiority with longer experience in assumptions of science to having taught the course many times. Each time becomes more aware, and familiar with the assumptions of science. This generated a desire of self-developed structure of knowledge. Except for the visits of the educational supervisor and the meetings with the teachers to make them more concerned about this aspect. This result can be explained by the teacher's long experience, the teacher realizes the importance of science assumptions.

The lack of significant differences in testing products of science, and science processes, and the ethics of science due to experience teaching, this can be interpreted as a result to the scarcity of training courses received by the teacher in-service which relates to the understanding of the nature of science and its practical-based methods and processes. It might be perhaps that the weak curricula in highlighting these dimensions in the nature of science clearly. The lack of interest in evaluation methods and oversight in measuring the dimensions of the nature of science is the reason for the lack of proper understanding of the nature of science in these areas and teaching practices.

These results can be interpreted that some teachers with short experience seeking to prove their presence, should acutely cooperate with those who are more experienced, thus enriching their knowledge about the products of science, and science processes, and the

ethics of science. In addition to the visits of the educational supervisor who must emphasize that, although it does not contain the evaluation form for any items related to the nature of science, and agreeing with this result partly with the results of studies of both: Hassanein, 1982; Al-Arafeen, 1985; Zaitoon, 1981; Attar 0.993, Al-Sharqi1995; Jaber, 1997; Aldbai, 2001; Tulaimat, 2001; Al-Hajri, 2006), This result differs with the conclusion of a study charged (1984).

Recommendations and proposals

Proceeding from the results that emerged from this study, the researchers recommended that:

• Include topics and attitudes appropriate in the educational programs in pre-service teacher preparation as well as in the study after bachelor in a way that will help them in understanding the nature of science and highlighting the classroom practices during the mini-teaching and education process.

• Targeted training sessions for teachers of science in general, including physics teachers, dealing with topics that develop their understanding of the nature of science, in addition to interesting teaching methods and techniques that will enable them to highlight this understanding in their teaching practices in the classroom.

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