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The Extent to Which the First Three Grades Teachers Use Problem Solving Approach in Teaching Sciences and the Effective Factors in it at Jerash District in Jordan

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Abstract

The study aimed to investigate the extent to which the first three grades teachers use problem solving approach in teaching science and the effective factors in it at Jerash district in Jordan. The sample of the study which was selected randomly consisted of 98 teachers (35 males, 63 females) out of 500 male and female teachers of the first three grades at Jerash District in Jordan was chosen. A questionnaire was used to collect data. Results revealed apparent differences between the means of the number of the teachers' use of the content of the first part's items of the questionnaire as item 14 " during teaching science, I keen to clarify the scientific concepts to the students" got the highest mean with (4.77). So, this result showed the teachers' inability to implement the problem solving approach in teaching sciences where items (1, 5, 6, 7, 11, 26, 28, and 29) revealed that the student did not participate in the activities of problem solving approach. Moreover, the school's environment did encourage the use of problem solving approach in addition to teachers' lack of mastering the problem solving approach.

Keywords: Problem Solving, First three grades, Teaching according to problem solving approach.

1. Introduction

Science as a subject verses method in school sciences has remained an argumentative issue for more than century. As many people called for the necessity of integration between the sciences content and the scientific method but the curricula of sciences focused on one of those aspects.In the higher basic and secondary grades, the sciences are presented as a part of knowledge that interprets out understanding to the physical world surrounded us without paying attention to the methods that create this knowledge, while in the lower basic grades the focus is more on the science processes and less on the cognitive content and in both cases there is no support to the critical thinking, inquiry and problem solving skills. So the movements of reforming the modern sciences curricula proposed teaching sciences through presenting educational experiences to the students enable them to take part in the inquiry processes that help them to learn the basic scientific concepts, to develop their thinking skills, and to be familiar with problem solving process which is represented by forming the problem, distinguishing evidences, proposing interpretations and getting into the appropriate solution to the problem , and this is possible when the teachers use different teaching methods especially those which are based on the inquiry and problem solving (Cooley, 2006). Bani Yasin conducted a study (2013) aimed at identifying the efficiency of problem solving approach in the sciences' application on the achievement and developing creative thinking skills of the moderated second grade female students at Saudi Arabia. Results showed statistical significant differences between the means of the two groups' grades in favor of the experimental group.

And Downing, Ning & Shin conducted a study (2011) aimed to explore the impact of problem –based learning on student experience and meta-cognitive development of the academic education students. Results revealed a noticeable development in the meta-cognitive thinking skills in favor of the experimental group.

Education based on problem solving is distinguished for its concentration on the learner, one subject and following up specific steps. It includes sufficient information that enable the learner to propose the inquiry experiment to reach the solution and in this way it differs from education based on inquiry which may not be learner centered as it is in the guided inquiry and it may not have one subject. Moreover, it may include one step that summarizes many steps of the scientific method but both approaches assume that the teacher is capable to present educational environment that enable the students to solve the problem. They are similar in their concentration on the guided teaching towards the student, the cooperation in learning process rather than individualism and their confirmation on the integration between the content and the method instead of having them separated (Cooley, 2006).

Nevertheless inquiry and other expressions as critical thinking, exploration and the scientific method are usually used as synonyms to problem solving for sharing similar effect of instruction; for example inquiry as it is mentioned in the national standards of the scientific education showed the method which scientists use to study the real world including taking notes, forming problems, selecting sources of information, planning for conducting the experiments and reconsidering knowledge in light of experimental evidences, collecting,

analyzing and interpreting data, proposing solutions and interpretations, conclusions and so this method requires different patterns of thinking and it is linked with the scientific method in knowing the physical world (Jimenez, and Diaz, 1997), or with what is known as the academic approach which Wolnugh, cited in Kirschner & Huisman (1998) called it Inquiry using the practical performance or the experimental inquiry where scientists, during the process of solving the problem, follow a practical seminar... including at least the following procedures:

- Studying the case and confessing of having real problem that needs a solution.
- Identifying the problem.
- Looking for alternative solving strategies.
- Evaluating alternative solving strategies.
- Selecting appropriate solving strategy.
- Starting solving the problem.
- Evaluating the solution and deciding whether there is a new problem requires another solution.

There is different understanding and incompatible definitions for problem solving; for some people it means the individual's tendency towards inquiry and his involvement in high thinking process in order to access into knowledge and it includes two processes which are retrieving information from memory and apply it properly in solving the problem. It is a cognitive guided process which gets benefit of previous knowledge and cognitive strategies as it happens with the integration with the behavior which is an indicator for it and it is also considered a process because it includes practical use of the previous knowledge. While Gott and Dugn cited in Pekmez, Johonson, and Gott, (2005) showed that during problem solving process there is a need to data to answer a question that depends on procedural and conceptual knowledge.

Problem solving, according to the most scientific educationists, plays an important role in teaching and learning sciences. And developing the students' capabilities in solving problems is considered one of the goals of scientific education. The movements of reforming the sciences curricula advocate of the model based on inquiry and problem solving in teaching and learning sciences through the students' scientific activities. Therefore, there are many innovative sciences curricula and methods of teaching it that are designed to build capabilities of problem solving because they help in achieving goals of teaching sciences in particular developing the students' scientific thinking skills (textbook of science in the general education) and helping them to understand sciences, in addition to making them realize the importance of sciences in their life. These goals can be achieved when the teacher from an active situation to the problem during his teaching through presenting educational experiences enhance students' achievement and their scientific thinking and problem solving skills as the students cannot develop thinking and problem solving skills unless they are involved in qualitative activities that enhance such skills (Shepardson, 1997). Children learn

better when they involve efficiently in their learning and the teachers have to be facilitators to their students' work in line with direct teaching which is necessary for providing information and pieces of advice to students particularly the weak ones.

Many national reports and studies showed limitation in the teachers' success in achieving these goals. The teachers are not trained and not qualified to teaching using problem solving approach and they have weak understanding of the cognitive content of the textbook which affect their teaching using problem solving. Additionally, they did not take part in the problem solving activity during their school and university education (Blosser, 1988) and even their attitudes towards teaching sciences using teaching based inquiry and problem solving are weak. Therefore, there was scarcity in using teaching strategies that enable the students to practice and develop problem solving skills. Most of the time is spent using methods of teaching as lecture, discussion, and scientific shows. The science teacher and his cognitive content and teaching strategies in addition to his attitudes towards teaching sciences and his desire to develop it is considered the most important factor in achieving goals of teaching sciences using problem solving approach and at the same time he is the basic obstacle in achieving these goals. Based on this, the current study aims to identify the extent to which the first three grades teachers use problem solving approach and the factors that affect this use hopefully, it helps in finding out the reasons for the teachers' lack of use of problem solving approach in teaching sciences.

2. **Problem of the** Study & **Questions**

The problem of the study is represented by investigating the extent to which the first three grades' teachers in Jerash in Jordan use the problem solving approach in teaching Sciences and the factors that affect it.

The studies which the researchers reviewed showed weakness in the first grades teachers' use of problem solving approach in teaching Sciences as (Pizzini, et al, 1989 & Lee, et al., 2000).

And unless the sciences subjects include problem solving approach, they seem to be worthless or meaningless for the students. Based on this, the study seeks to develop an instrument has the psychometric rules and apply it on a sample of the first three grades teachers of sciences in the basic stage so as to answer the following questions:

1- To which extent do the first three grades' teachers in Jerash District in Jordan use the problem solving approach from their perspective?

2- What are the factors that affect the decisions of the first three grades 'teachers at Jerash District in Jordan of using the problem solving approach in teaching sciences from their perspective?

3. The study's objectives

The study sheds light on the status of the first three grades' teachers' use in Jerash District in Jordan of the problem solving approach in teaching Sciences and the effective factors in it through investigating the teachers' use of this approach in teaching sciences and obstacles facing this use from their perspective.

4. Significance of the study

The significance of this study lies in the importance of the first three grades teachers' perspectives about the education process in general and teaching sciences for these grades and the importance of methods of teaching that are used for these grades in particular in addition to the obstacles facing this use. Moreover, this study may check the extent of the application of the reform and development attitudes in the field of teaching sciences and taking related decisions. The study also is considered significant for addressing an important issue which is problem solving approach in teaching Sciences for its great role in achieving the goals of teaching sciences which were announced by the movements of reform and development in the field of teaching and learning sciences. The study is distinguished for addressing the first three grades which represents the most critical stage in the students' life. Finally, this study, according to the researcher knowledge, is the first local one and one of the Arab few studies that addresses this subject using qualitative and quantitative methodologies together.

5. Limits of the study

- Items of the instrument used in the study
- The sample which consisted of a number of the first three grades' teachers in Jerash District in Jordan for the year 2010-2011, was chosen randomly.

6. Procedural definitions:

- First three grades: They are the first three basic grades which are preceded by kindergarten stage which becomes one of the stages of education in Jordan.
- The problem: A question that has no answer unless a scientific inquiry activity is used (Lee, Tan, Goh, Chia and Chin, 2000).
- Problem Solving: A process includes the application of information and specific skills to achieve the goal Lee, et al., 2000). And in this study it means the process that requires from the students to apply practical and cognitive skills and planning and implementing scientific inquiry to find solutions or decide which the solutions are the best for the study's questions.

Teaching according to problem solving approach: using teaching strategies that develop or enhance the students' ability to solve the problem and thinking skills. It requires the students' displaying of higher thinking skills : asking related questions, discovery, forming hypotheses, planning for inquiry, expecting results, experimentation, collecting and evaluating data, coming up with conclusions, expressing ideas, evaluating others ideas and looking for alternative interpretations (Pizzini, et al, 1989).

7. Theoretical Frame and Previous Studies

Gredler (2009) argued that it is necessary to place problem solving in an historical perspective to grasp a true understanding of the relationship between the creative problem solving process and the teaching and learning process.

Bagceci and Kinay (2013) conducted a study aimed at search teachers' skills of how to solve problems in terms of some variables. The population of this study includes all teachers who have taught in 2011-2012 in Gaziantep, Turkey. As a tool for data collection problem solving inventory developed by Heppner and Peterson (1982) and adapted to Turkish have been used. The results of this study showed that, there has been a significant differentiation in evaluative approach according to educational level and hasty approach and self-confidence approach according to service time. It is suggested that the Ministry of National Education should promote postgraduate education and also should organize in-service education to improve problem solving abilities of teachers.

Cameron (1985) stated that problem-solving skills can be enhanced. This is possible through the learning of the principles of decision making and practice in utilizing the techniques. It is better to teach how to arrive at the solution than to teach the solution.

Ali and Eyüp (2010) conducted a study aimed at considering the effects of representations used in the definite integral on pre-services teachers' problem-solving achievement. The research is a case study having qualitative paradigm with 45 pre-services teachers from a mathematics teaching department in a state university has been conducted. This study used multi-method approach to collect the data. The data were analyzed and interpreted through classification method and descriptive statistical techniques. The findings indicate that the skills of pre-services teachers in using multiple representations within the process of solving certain definite integral problems were not sufficient as required.

8. Method & Procedures

8.1 Methodology

The study used the descriptive approach which describes the phenomena as it is in reality by collecting data from the educational field and analyzing to come up with results.

8.2 Population & sample of the study

The sample of the study which consisted of 98 male and female teachers (35 males, 63 females) who teach the first three grades in the directorate of education of Jerash District in the first semester for the year 2010-2011, was selected randomly. The sample of the study represents 20% of the population of the study which is consisted of all the male and female teachers of these grades in the District for the same year which are estimated by 500 male and female teachers.

8.3 Tools of the study

A questionnaire was developed based on the content of the items of the tool used in the study of Chin, Goh, Chia, Lee, and Soh, (1994) and the study of Lee, et al., (2000). The questionnaire was developed to achieve the study's objectives according to the following stages:

- The questionnaire was translated and its items which were reformed, were distributed into two parts; the first one focused on the status of using problem solving method in science by the teachers of the first three grades as every item addressed a behavior done by the teacher or the student in the science class which can enhance students' problem solving and high thinking skills. The items teacher has to determine the frequency of this behavior during teaching sciences using the fifth dimension grading. And this part includes 29 items distributed to three fields: tasks, nature of the problem in the inquiry activities and the time which is spent in the classes of sciences to implement the inquiry scientific activities. While the second part focused on the factors that affect the teachers' decisions in using problem solving approach in teaching the sciences. It includes 13 items addressed the difficulties which the teacher may face during teaching sciences using problem solving approach. He was asked to determine to which extent the content of the item matches his situation through responding by "yes" or "no" and the teacher can comment on the items. The items of this part focused on difficulties concerning the students' characteristics, the teacher personal characteristics, time, the support of school and the colleagues, physical facilities, available resources and class management.
- The questionnaire was applied on a sample consisted of 13 male and female teachers out of the original sample. It was displayed to three academic members in the Educational College at the University where the researcher works. After correcting and analyzing the respondents' answers and taking into account the arbitrators' notes and suggestions, most of the items were reformed linguistically, items related to the nature of the problem in the inquiry activities were excluded to be used in the interviews while the other fields in terms of content, pattern and number of items kept unchanged. The final copy of the questionnaire consisted of two parts; the first one includes 29 items with five dimensions and the second one includes 13 items (yes/no answers)

8.4 Statistical methods

After correcting the respondents' answers, data was analyzed using (SPSS) to calculate means and the standard deviations of the respondents' answers and arrange them ascending.

9. Results & Discussion

1- First: to answer the first question "To which extent does the first three grades' teachers in Jerash District in Jordan use the problem solving approach from their perspective ?", the ratios of the teachers' estimations of the number of using problem solving strategy as it is illustrated in table (1).

Table 1. Means, standard deviations and ratios of the respondents' estimations for the number of using problem solving approach

N	Item	Ratios of number of teachers' use of the content of items in the first part of the questionnaire in teaching sciences					M	Std
		Always (almost in every class)	**Usually** (Almost once a week)	**Sometimes** (Almost once in every two weeks)	**Rarely** (Once a month)	**Never** (Non)		
1	In the science class, the students carry out scientific activities that are not mentioned in the textbook or in worksheet prepared for them.	12.2	23.5	36.7	20.4	7.10	3.13	1.10
2	While the students are carrying out scientific activity, I guide them to identify the problem which they intend to study by themselves.	21.4	27.6	29.6	12.2	9.2	3.40	1.22
3	During the scientific activity, the students make a list of questions about the subject of the activity.	10.2	19.4	33.7	19.4	17.3	2.86	1.22
4	Students implement the scientific activity by following the specific regulations in the textbook.	44.9	32.7	18.4	2.0	2.0	4.16	0.94

5	The students design scientific experiments with or without my little help.	9.2	30.6	28.6	26.5	5.1	3.12	1.07
6	During the scientific activity, the students determine the necessary materials and tools to implement it by themselves.	22.4	20.4	21.4	23.5	12.2	3.17	1.35
7	Before implementation of the scientific activity, the students form the hypotheses about its results.	8.2	25.5	26.5	26.5	13.3	2.89	1.17
8	The students conduct the scientific experiments to check the facts and the scientific generalizations which were given to them.	17.3	26.5	16.3	29.6	10.2	3.11	1.29
9	The students carry out the scientific experiments to clarify the scientific concepts.	18.4	20.4	22.4	30.6	8.2	3.10	1.26
10	The students interpret the results which they come up with.	16.3	19.4	35.6	20.4	8.2	3.15	1.17
11	After doing the scientific activity, the students display the problem, procedures, results, deductions and discussions.	18.9	25.5	19.4	30.6	6.1	3.19	1.23
12	The students implement the scientific experiments within small cooperative groups.	32.7	42.9	13.3	6.1	5.1	3.92	1.08
13	During the activity implementation, the students ask questions about the procedures so as to develop and adjust them.	25.5	35.7	15.3	18.4	5.1	3.58	1.20
14	During teaching science, I keen to clarify the scientific concepts to the students.	80.6	15.3	4.1	0.0	0.0	4.77	0.51
15	In sciences class, I carry out scientific experiments in front of the students.	50.0	40.8	8.2	1.0	0.0	4.40	0.68
16	I give my students the floor to discuss in between the science class.	19.4	43.9	35.7	1.0	0.0	3.82	0.75
17	In the sciences class, the students carry out the scientific experiments and practice the scientific activities	13.3	35.7	33.7	17.3	0.0	3.45	0.93

	by themselves.							
18	I teach sciences through reading from the textbook.	22.4	24.5	33.7	17.3	2.0	3.47	1.09
19	I teach sciences using the software, videos tapes and other audio and visual equipment.	4.1	16.3	21.4	28.6	29.6	2.37	1.19
20	I spend a time with the students in filling what is needed in the science book and worksheets.	16.3	46.9	23.5	12.2	1.0	3.65	0.93
21	I make oral and short writing exams in the class of sciences.	26.5	43.9	18.4	8.2	3.1	3.83	1.02
22	I take my students to the science lab to teach them lesson based on the computer.	6.1	11.2	14.3	32.7	35.7	2.19	1.22
23	In groups, the students' male projects in the sciences.	13.3	27.6	34.7	21.4	3.1	3.27	1.04
24	The students visit the school garden or other places to gather samples for investigation.	22.4	34.7	27.6	11.2	4.1	3.60	1.08
25	I adapt teaching sciences to teach problem solving.	12.2	34.7	39.8	12.2	1.0	3.45	0.90
26	My students spend time in practicing scientific activities that develop their problem solving skills.	20.4	25.5	34.7	18.4	1.0	3.46	1.05
27	The students practice the scientific activities mentioned in the textbook that enhance skills of problem solving and develop their higher thinking skills.	29.6	28.6	34.7	7.1	0.0	3.81	0.95
28	I get benefit of activities which are not mentioned in the sciences textbooks during my teaching.	14.3	27.6	39.8	14.3	4.1	3.34	1.02
29	The students do scientific activities that I planned to enhance skills of problem solving and to develop their high skills of thinking.	17.3	29.6	28.6	19.4	5.1	3.35	1.13

Notes from the table (1). Results revealed apparent differences between the means of the number of the teachers' use of the content of the first part's items of the questionnaire as item 14 " during teaching science, I keen to clarify the scientific concepts to the students" got the highest mean with (4.77). So, this result showed the teachers' inability to implement the problem solving approach in teaching sciences where items (1, 5, 6, 7, 11, 26, 28, 29) revealed that the student did not participate in the activities of problem solving approach..

The highest arithmetic average (4.77 and item (22) go at my request to the computer lab to give lessons on the list of Science computer-reaching got the lowest mean (2.19). It is clear from these results through there was still need more and more training teachers on how to use problem solving approach in teaching science these results agrees with study of Bagceci, and Kinay (2013)

Second: to answer the second question: "What are the factors that affect the decisions of the first three grades' teachers at Jerash District in Jordan of using problem solving approach in teaching science from their perspective?", ratios for items representing factors that affect the teachers' decisions of using problem solving approach in teaching sciences were calculated and table (2) illustrated this

Table 2. Ratios of the teachers' perspective to every item's content representing a factor affects teachers' use of problem solving approach in teaching sciences

No.	Item	Ratio of the teachers who consider the content of the item an effective factor in their use of problem solving approach or not	
		Yes	No
1	I am not sure of my knowledge of the use of solve problem solving in teaching sciences.	41.8	58.2
2	I do not use much problem solving approach in teaching sciences because my specialization is far away of sciences.	43.9	56.1
3	I do not use problem solving approach in teaching sciences a lot because I feel my scientific knowledge is insufficient.	46.9	53.1
4	My students do not make scientific activities that are not mentioned in the textbook because I think doing so requires my continuous guidance to them.	70.4	29.6
5	I tend to have the things which the students learn and the activities they do to be clear and specific.	53.1	46.9
6	I feel uncomfortable in case there were unintended results in the activities implemented in the science class	65.3	34.7
7	One of the reasons that prevent my students to do inquiry activities is their lack of capability to solve a problem.	83.7	16.3
8	One of the reasons for shortage of the number of inquiry activities done by the students in the sciences class is their weak motivation towards learning.	62.2	37.8
9	Lack of use of the problem solving approach in teaching sciences refers to the long time which the activities take.	40.8	59.2
10	My little use of problem solving approach in teaching sciences	61.2	38.8

	due to my belief that the priority should be given to the textbook.		
11	Insufficient time to prepare materials and the necessary tools for the scientific activities and there was no lab are considered as an obstacle for using problem solving approach in teaching sciences.	84.7	15.3
12	Narrow classes and small labs which are not equipped with the necessary things to do the scientific activities are considered an obstacle facing using the problem solving approach.	81.6	18.4
13	There were problems concerning school schedule that did not allow me to teach using problem solving approach.	49.5	51.0

Results in Table (2) indicated that item (11) achieved the highest mean "Insufficient time to prepare materials and the necessary tools for the scientific activities and there was no lab are considered as an obstacle for using problem solving approach in teaching sciences" also item (7) One of the reasons that prevent my students to do inquiry activities is their lack of capability to solve a problem. Followed by items (12,4,6) It is clear from these results that the physical environment of the school does not encourage the use of oriented problem solving in addition to the lack of training students to use it and not engaging in activities the quality of their own, these results agrees with the studies Shepardson (1997) and Ali and Eyüp (2010).

Recommendations

In light of the results which showed that, the school's environment did encourage the use of problem solving approach in addition to teachers' lack of mastering the problem solving approach this study recommends the following.

1. Reconsider the training provided for teachers within the educational development program of the programs towards the knowledge-based economy, so as to be more sustainable in terms of time, cost and expertise provided to teachers.
2. Provide a supportive environment for the use of physical oriented problem solving in schools.
3. Put the accountability of the post-training program for teachers to achieve high quality of education in Jordan.

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