

Systemic approach effect on achievement of Tafila schools students in science

Dr. Zeid Al-bashaireh

Curriculum and instruction department

Faculty of educational sciences

Mutah University

Jordan

E-mail: bashareh@mutah.edu.jo


Abstract

The study aimed to determine the effect of teaching by systemic approach in fifth grade Tafila province students' achievement in science. The sample consists of 42 male and 34 female students, chosen from two schools, one male and the other female. They were randomly distributed into four groups. Two experimental (taught by systemic approach) and others controlled (taught by conventional approach). To achieve the study aims, educational program on the environment unit have been administered according to systemic approach and a test and valid multiple choice exam was used. The findings of the study reveals that there were significant statistical differences in the students achievement of science in favor of experimental group and the female students. No significant statistical differences were seen in the interaction between the method of teaching and the students gender. Based on the results of the study, several recommendations have been suggested, such as using systemic approach in teaching other school subjects and different students levels. It is also recommended to study the effect of teaching by systemic approach to compare the students' science achievement with other methods of teaching.

Introduction

The world today is characterized by scientific and technological progress. New scientific innovations have influenced almost all economical social and educational aspects. Therefore, the role of educational organizations is very important in helping learners to make use of these changes. Learning -with all its forms and levels-is a base for development and going along with scientific progress. The primary function of science education is to supply society with scientifically literate citizens. Those who can understand the ideas behind the modern instruments and materials that we used in our daily life. The future of science education must reflect a flexibility to adapt to rapidly changing world needs. It is our thesis that a systemic view of science with regard to principles and their internal (to science) interactions as well as the interactions with human needs will best serve the future world society. In order to achieve that; Fahmy and Lagowski (2000) pointed out that educational process based on the application of "systemics" which they believe, will affect both teaching and learning. The use of systemics, in their view, will help students begin to understand interrelationships of concepts in a greater context, appoint of view that ultimately should prove beneficial to the future citizens of a world that is becoming increasingly globalized.

Fahmy and Lagowski (2000) laid the basis for the development of the Systemic Approach (SA) to Teaching and Learning. Their interest in developing the SA strategy arose from the recognition of the increasing globalization of a wide spectrum of human activities such as economics, media, politics, and entertainment. Through the use of a systemic approach, they believe it is possible to teach people in all areas of human activity—economic, political, scientific, as well as ordinary citizens—to exhibit a more global view of the core science relationships and of the importance of science to such activities. systemic means an arrangement of concepts or issues through interacting systems in which all relationships between concepts and issues are made clear. Many studies indicates that applying Systemic Approach in the process of teaching can improve the output of that process (Zaitoon, 2001). Systemic Approach is defined by Zaitoon (2001) as the whole that is constituted from a set of components which are interrelate by a mutual relationships. These components work together to achieve a specific goals, is located specific boundaries, is influenced by the surrounding environment and influences it. According to Fahmy and El-Hashash (1999) it means components that have a dynamic interrelationships, where each component is considered a subsystem that interacts with the whole system. It is believed that the analytic and the systemic approaches are more complementary than opposed. The following table compares, one by one, the traits of the two approaches (De Rosnay 1997).

Analytic Approach	Systemic Approach
<input type="checkbox"/> isolates, then concentrates on the elements	<input type="checkbox"/> unifies and concentrates on the interaction between elements
<input type="checkbox"/> studies the nature of interaction	<input type="checkbox"/> studies the effects of interactions
<input type="checkbox"/> emphasizes the precision of details	<input type="checkbox"/> emphasizes global perception
<input type="checkbox"/> modifies one variable at a time	<input type="checkbox"/> modifies groups of variables simultaneously
<input type="checkbox"/> remains independent of duration of time; the phenomena considered are reversible.	<input type="checkbox"/> integrates duration of time and irreversibility
<input type="checkbox"/> validates facts by means of experimental proof within the body of a theory	<input type="checkbox"/> validates facts through comparison of the behavior of the model with reality
<input type="checkbox"/> uses precise and detailed models that are less useful in actual operation (example: econometric models)	<input type="checkbox"/> uses models that are insufficiently rigorous to be used as bases of knowledge but are useful in decision and action (example: models of the  Club of Rome)
<input type="checkbox"/> has an efficient approach when interactions are linear and weak	<input type="checkbox"/> has an efficient approach when interactions are nonlinear and strong
<input type="checkbox"/> leads to discipline-oriented (juxtadisciplinary) education	<input type="checkbox"/> leads to multidisciplinary education
<input type="checkbox"/> leads to action programmed in detail	<input type="checkbox"/> leads to action through objectives
<input type="checkbox"/> possesses knowledge of details poorly defined goals	<input type="checkbox"/> possesses knowledge of goals, fuzzy details

Students'

Several studies have been conducted in the Arabs world and a proud comparing teaching by ST and other teaching methods and strategies, In Germany, *Michael S. & Claudia E. (2005)* conducted a study on Preparing Teachers for Interdisciplinary Teaching and Learning – A Systemic Approach to Complex Problem-Solving. A study has been carried out for 5 consecutive semesters involving N= 452 students and N=37 academic staff. Research was organized as practice-oriented research as presently discussed in literature (Schallies 2004). Outcomes were analysed by participant observation, interviews, evaluation of students portfolios. Results of the research project clearly indicate a systemic relationship between students abilities at the level of operations (ie. abilities to organize practical teamwork) and students abilities at the level of professionalism (ie. to use professional knowledge for decision making) and reflection competencies. The intricate link between these two levels is a systemic one: the objectives of individual learning are at the same time pre-requisites for successful learning and progress. Also, acquisition of new competencies apparently occurs in a sequential way.

In Jordan Alqarareh (2006) studies the effect of teaching by ST in the acquisition of six grade students in science from Tafila basic cycle schools . The sample of the study consisted of 72 male students, divided into two groups: experimental taught by ST and control taught by traditional way of teaching. The results of the study showed that the experimental group students' acquisition on scientific concepts is better than the control group. At the same time, AlGadiri (2006) studied the effect of teaching by ST in the acquisition of fourth grade students in scientific concepts. The sample of the study consisted of 160 male and female students from Irbid governate schools. The sample divided into four groups. Two groups experimental taught by ST and other groups control taught by traditional way of teaching. The results of the study showed that the experimental group overcome the control group in the acquisition on scientific concepts. No statistical differences were attributed to students gender or to the interactions between the methods of teaching and the students gender.

In Egypt, Fahmy and Lagowski (1998) conducted a study Systemic approach in teaching and learning carboxylic acids and their derivative. The study was conducted at six secondary schools at Cairo and Geza governates. The sample consisted of 270 students, divided into two groups. The results of the study showed statistical differences between the achievement of the two groups in favour of the experimental group At the university level, Fahmy and Lagowski (2000). studied Systemic Approach in Teaching and Learning Aliphatic Chemistry at pharmacy and science collages in tow Egyptian universities. The sample was divided into two groups: experimental taught by ST and other groups control taught by traditional way of teaching. The results of the study showed that the experimental group overcome the control group in the achievement of science. At the university level also, Al-Bashaireh (2007) investigated the effect of suggested program on environmental education based on systemic approach on faculty of educational sciences students' achievement at Mu'tah University. The study sample composed of (113) male and female students.

They were chosen from the students who were registered for environmental education course, first semester of scholastic year 2006/2007. Two sections were chosen. One group was taught by systemic approach program, while the other group taught by conventional method. The study tool were, systemic approach program which tested for its validity, and an achievement test consisted of (50) multiple choice items was used to achieve the study aims. The reliability and the validity of the exam were tested. The results showed that there were statistical significant differences at the level ($\alpha = 0.05$) on the achievement of the students on the post test in favor of those whom were taught by systemic approach program. No statistical significant differences at the level ($\alpha = 0.05$) were found attributed to student's gender or educational level. The study recommended more studies to be conducted on the effect of the systemic approach program on teaching other subjects and courses in the collage.

The Statement and the Questions of the Study

Science achievement is one of the most serious problems that encounter students in both general and higher education. It is considered as a social and educational problem because it leads to a great loss of human potentials and materialistic wealth. Academic achievement received considerable attention from researches in education and psychology at all levels of teaching for the purpose of improving it. Academic achievement is the basic criterion for passing from one educational stage to another or from an academic level to a higher one. It is also the information that a learner remembers of the subject matter in a semester. It is believed that achievement is related and affected by the teaching methods and approaches.

Systemic approach in learning and teaching considered one of the modern ways of organizing the content and process through which various educational experiences were uses in the form of systemic way. It shows the interrelationship and overlap and interaction between its components and the structure of knowledge and assist the learner to link new learning and previous learning to organize the information in a network organization, which can retained within the structure of knowledge and facilitate the process of calling and their application in different life situations. Thus, SA work to develop and increase interaction within the classroom environment and outside the school, including working to achieve the objectives of the educational system of high efficiency and effectiveness. Because of the lack of studies conducted in Jordan on science teaching by SA, this study was conducted to determine the effect of teaching by systemic approach in fifth grade Tafila province students' achievement in science. More preciously, the study aimed to answer the flowing questions:

1. Are there any significant difference at ($0.05 \geq \alpha$) in the students' achievement of science attributed to the method of teaching used (conventional or SA).
2. Are there any significant difference at ($0.05 \geq \alpha$) in the student's achievement of science attributed to the students gender (male , female).
3. Are there any significant difference at ($0.05 \geq \alpha$) in the student's achievement of science attributed to the interaction between the teaching used and the students' gender?

The Objectives of Study

The study aimed to determine the impact of teaching by SA in fifth grade Tafila province students' achievement in science and prepare a recommendation to the Department of the school curriculum in the Ministry of Education the need to shift from the linear approach in the presentation of scientific knowledge to the systemic approach, the fact that this trend is consistent with the nature of science and its knowledge.

The Importance of Study

The importance of study stems from its subject (using SA in science teaching at the basic stage and in accord with the Ministry of education trend in Jordan to make use of all the teaching and learning methods to improve students' achievement in science. The importance of the study also comes from the subject of the study (unit of environment), since environment is very important issue today and it affect all people all over the world. The environment affect the life of the human and it has an interactive relationship with human rights and a direct impact on their life and health. The results of study may assist the authors in the design of the curriculum in teaching positions and facilitate the process of learning and teaching. And making the teaching and learning more exiting for students and more attracting. Because of the lake of such studies which used the SA in teaching and learning science in the region, to the best of the researchers knowledge, it may added to the literature in this issue.

Variables of Study

- a- Gender variable (male, female)
- b- Methods of teaching variable; humanities (SA and conventional) .

The scope and the Limitations of the Study

This present study was administered only on the students of fifth grade a who were studied science at Tafila province, the second semester for the scholastic year 2007-2008. It is also limited to the Environment Unit of the science curriculum for grade V, the basic cycle, the last of the second semester of the science curriculum.

Operational Definitions

Some of the concepts were used in this study are as follows operationally defined:

Systemic approach

Study of the concepts and issues through an integrated system where all the clear relations between the concept and other concepts so the students can relate the new knowledge with the previous knowledge. In this study all the concepts at the environment unit in the fifth grade textbook have been rearranged in a systematic way where the relationships between the concept and other concepts are clear in a way to help the to understand these concepts and relate them to the concepts known previously to hem/her.

Conventional way of teaching. A usually teaching methods where the teacher present and explain the concepts and the information using the chalk and talk methods.

Science achievement; what fifth grade students' achieve in science, unit of environment, which have been measured at this study by the students' score at the pre and post test prepared for this study.

Fifth grade students; the students whom age between (11-12) years old according t Jordanian educational system whom were participated at this study.

Methodology and Procedures

Population and Sample of Study

The population of study includes all fifth grade students enrolled at the end of second semester of the scholastic year 2007 – 2008 at tafila directorate of education. The sample of study consisted of 76 male and female students . They were distributed into two groups; experimental (taught by SA) and control as shown in table 1.

Table 1 : The distribution of the sample of study according to method of teaching and gender

<i>Teaching methods</i>	<i>gender</i>		<i>Total No.</i>
Experimental (SA)	Males	21	38
	Females	17	
Control (conventional)	Males	21	33
	Females	17	
Total			76

Instruments of Study

Two instruments were used for the purpose of study. The first one was a teaching materials from unit of environment , in the Arabic language, based and re-organized according to SA. It was submitted to a panel of 8 experienced science educator from Mutah University and 5 experienced science teachers to revise it and report their remarks about its suitability and reliability. Based on their remarks several changes have been made. The second instruments was a science achievement test prepared by the researcher for the purpose of this study in the Arabic language. The validity and stability (Reliability) of the test were obtained. The test was consisted of 30 multiple choice items in its final draft.

Results and Discussion

To find the equality between the groups of the study, Befor starting the study, the participants have been set to the per-test. Table 2 summarized the results. From the table, it can seen that the differences between the means and the standard deviations have been limited and very small, which may indicate that the groups are nearly equal in the achievement of science. .

Table 2: The pre-test Means, standard deviations of students' achievement in science according to teaching methods and gender

<i>Teaching metods</i>	<i>gender</i>	<i>number</i>	<i>means</i>	<i>St. d.</i>
SA	male	21	17.5	1.2
	female	17	18.9	1.3
conventional	male	21	16.2	1.2
	female	17	19.7	1.3

To find whether these differences are significantly observed at the level of $(0.05 \geq \alpha)$, the Two way ANOVA was used to analyzed the data and to find if there are any differences attributed to the students gender or the interaction between the gender and the methods of teaching. Table 3 summarized the results. We can see from the table below that there were no significant differences at the level of $(0.05 \geq \alpha)$ between means of the students mean scores which was less than F value. This indicate that all the groups are nearly equal.

Table 3: Two way ANOVA analysis of the differences in the students' achievement of the pre-test attributed to the students gender or the interaction between the gender and the methods of teaching.

Variation resource	Squares Sum.	Freedom degree	Squares means	F	significany
Methods of teaching	1.460	1	1.460	0.049	0.825
Gender	105.142	1	105.142	1.544	0.064
Methods of teaching * Gender	22.828	1	22.828		0.383
The	2136.056	72	29.667	0769	
Total	2265.486	75			

Now, to answer the study questions which were;

- Are there any significant difference at $(0.05 \geq \alpha)$ in the students' achievement of science attributed to the method of teaching used (conventional or SA).
- Are there any significant difference at $(0.05 \geq \alpha)$ in the student's achievement of science attributed to the students gender (male , female).
- Are there any significant difference at $(0.05 \geq \alpha)$ in the student's achievement of science attributed to the interaction between the teaching used and the students' gender?

The means and the standard deviation of the students' performance on the post test were calculated. Table 4 summarized the results. From the table, it can seen that there were differences between the means and the standard deviations of the two groups in favor the experimental group. This means that the achievement of the students whom were taught by SA is better that those who taught by conventional method.

Table 4: The pre-test Means, standard deviations of students' achievement in science according to teaching methods and gender

Teaching metods	gender	number	means	St. d.
SA	male	21	22.8	1.4
	female	17	28.2	1.5
conventional	male	21	17.8	1.4
	female	17	22.5	1.5

To find whether these differences are significantly observed at the level of $(0.05 \geq \alpha)$, the Two way ANOVA was used to analyzed the data and to find if there are any differences attributed to the methods of teaching. Table 5 below summarized the results. We can see from the table below that there were significant differences at the level of $(0.05 \geq \alpha)$ between means scores of the students due to the method of teaching. Students whom were taught by SA achievement in science was better than those were taught by conventional way. The differences were significant at the level of $(0.05 \geq \alpha)$. The calculated F value was 12.457.

Table 5: Two way ANOVA analysis of the differences in the students' achievement of the post-test attributed to the students gender or the interaction between the gender and the methods of teaching.

Variation resource	Squares Sum.	Freedom degree	Squares means	F	significany
Methods of teaching	505.389	1	505.389	12.457*	.001
Gender	504.298	1	504.298	12.430*	0.001
Methods of teaching * Gender	5.073	1	5.073	0.125	0.383
The	2921.182	72	40.572		
Total	3935.942	75			

This may be attributed to the fact that the SA presents the subject matter in simple, systemic and attractive way instead of linear way. The relations between science concepts is clear.

The students believe that all the parts of the subject are clear and connected to each other. The findings of the present study were in accord with the findings of Al-qarah (2006) study, and Al-gahdiri (2006) study. Regarding the differences between males and females students in science achievements, table 5 showed that there are significant differences at $(0.05 \geq \alpha)$ in the student's achievement of science attributed to the students gender (male, female), in favor of females students. The calculated F value was 12.430. This may be attributed to the fact that female student on Jordan concentrate on their study more than male students. The findings of the present study were not in accord with the findings Al-gahdiri (2006) study and Al-bashaireh (2007) which indicated that there were no statistical significant differences at the level $(\alpha = 0.05)$ were found attributed to student's gender. It is also clear from table 5 that there are no significant difference at $(0.05 \geq \alpha)$ in the student's achievement of science attributed to the interaction between the teaching used and the students' gender. The calculated F value was 0.125 which less than the significance level. This may be due to the similarity between the teaching and learning environment for both genders. this finding was in accordance with Al-bashaireh (2007) study.

Recommendations

In the light of the study findings several recommendations have been suggested. Among them, several studies have to be conducted to investigated the SA effect in teaching other subjects and dealing with other variables, Comparing teaching by SA with other linear teaching and learning methods. Science teachers need to be trained on using SA in science teaching and learning. Science curricula need to be arranged and presented in systemic way.

References

- Al-Bashaireh, Z. A. (2007) The effect of suggested program on environmental education based on systemic approach on faculty of educational sciences students' achievement at Mu'tah University. The Faculty Of Education Journal, Ain Shams University, 2(31); 431-451.
- AlGadiri, S. (2006) The Effect Of Teaching By Systemic Approach In The Acquisition Of Scientific Concepts. Paper presented at the sixth Arab conference for th systemic approach. Cairo, 13-15 April.
- Alqarareh, A. O. (2006) The Effect Of Teaching By Systemic Approach In The Acquisition Of Six Grade Students of scientific concepts. Irbid University Journal, 10(2): 141-160
- de Rosnay J. (1997) Analytic vs. Systemic Approaches. Viewed at <http://pespmc1.vub.ac.be/ANALSYST.html> at 22/62009.
- Fahmy A. F. M., El-Hashash M., (1999). "Systemic Approach in Teaching and Learning Heterocyclic Chemistry". Science Education Center, Cairo, Egypt
- Fahmy A. F. M., Hashem, A. I., and Kandil, N. G. (2000) Systemic Approach in Teaching and Learning Aromatic Chemistry. Science, Education Center, Cairo, Egypt.
- Fahmy, A. F. M. and Lagowski, J. (1998). Systemic approach in teaching and learning carboxylic acids and their derivatives, Available at: <http://www.salty2k.com/satlc.htm>;
- Fahmy, A.F.M., Lagowski, J.J.; (2000). "Systemic Approach in Teaching and Learning Aliphatic Chemistry"; Modern Arab Establishment for printing, publishing; Cairo, Egypt .
- Michael S. & Claudia E. (2005) conducted a study on Preparing Teachers for Interdisciplinary Teaching and Learning – A Systemic Approach to Complex Problem-Solving. Paper presented at the fifth Arabs conference on the systemic approach in teaching and learning. April Einshamis University. Cairo, Egypt.
- Schallies, M. (2004). The role of research in a systemic approach to School development - Experiences from interdisciplinary School projects. In Bernd Ralle & Ingo Eilks (Hrsg.), *Didaktik der Naturwissenschaften Quality in Practice-oriented Research in Science Education*. (S. 137-146). Aachen: Shaker Verlag.
- Zaitoon, Hasan. (2001) . Systematic View , Alam Alkutub, Cairo , Egypt.