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# Impact of Systemic Teaching on Achievement and Literacy of Physics of the Fourth Scientific Grade Students

## Abstract

*The research aimed to verify the impact of systemic model on achievement of physics and physical literacy of the fourth scientific grade students, the researcher used the experimental design of the two equivalent groups, the research community was the fourth scientific students in the public day schools in the General Directorate of Diwaniyah Education for the academic year (2017 - 2018). The researcher is randomly, including Division B to represent the experimental group consisting of (30) students and Division C represents the control group made up of (29) students, the two groups were equal in variables: time age, intelligence, grades of the first course test, and the measure of physical literacy, the researcher prepared two tools, namely the achievement test (40 items) and the physical literacy test (30 items), and their validity and reliability were confirmed. The results showed the superiority of the students of the experimental group that studied the systemic model over the students of the control group that studied the traditional method in both the achievement test and the physical literacy, and in light of this the researcher recommended the use of the systemic teaching and suggested conducting other studies of stages and subjects.*

**Keywords:** Impact, Systemic Teaching, Achievement, Physics, Physical Literacy.

## Introduction

The educational literature in the recent period emphasizes the use of modern methods, models and strategies of teaching, because traditional methods, Although they are used for a long time and still used by many teachers, need to be changed to remove the routine and boredom that may afflict learners, by the researcher informing of many of the strategies and methods used in Teaching, especially those that dealt with the systemic model, he was found that all studies took this model with the acquisition of concepts as a study of (Olayan & et. al., 2009) that was conducted on university students, and a study of (Al Qadri 2009) that he used with primary school students in the subject of science, and study of (Al-Ramly, 2011) for religious concepts with intermediate school students, as there is no study that used the

systemic teaching with academic achievement and literacy of physics in the intermediate stage, so the researcher conducted this study to complement what previous studies went to, which demonstrated the effectiveness and impact of this model in acquiring concepts for a number of academic subjects, but with two other variables are achievement in physics and literacy of physics, which is defined as the minimum amount of physical information, and measure the impact of the systemic teaching on these two variables because of their importance in the field of teaching and public life.

## The Statement of Problem

Through the researcher's experience in the field of teaching (26) years, and from examining the records of scores in a number of schools and

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the opinions of a number of physics teachers, he was found that there was a noticeable decrease in the achievement of the fourth grade students and their physical culture, and when the teachers of the subject asked about the methods they use, many of them said, they use the traditional methods that depend on the save and retrieval of information, the researcher adopted the idea that these methods are the reason for this decline in students' achievement and physical literacy, and since the systemic teaching that refers to the Constructivism philosophy that focuses on the student's use of his past experiences found in his cognitive structure to be able to understand next knowledge, and this model is done to help students build their scientific concepts and knowledge systematically, which may help in increasing their achievement and physical literacy, upon, it is possible to summarize the research problem with the following question: What is the impact of teaching by systemic teaching on the achievement of physics and physical literacy of the fourth scientific grade students?.

### **The Research Importance**

The importance of research can be summarized in the following:

1. The systemic teaching emerges from Constructivism theory, which is an modern approach and theories in teaching.
2. This model depends on teaching on the meaning, which may lead to students' progress in achievement and physical literacy.
3. The research provides two tools, the achievement test and the physical literacy test that researchers and teachers may benefit from.
4. The research deals with important aspects of the student and the teacher, which are achievement and physical literacy.
5. Teachers and those interested in the educational process may benefit from the results of this research.

### **The Research Objectives**

The research aims to identify:

- The impact of using the systemic teaching of physics achieving for fourth-grade students.
- The impact of using the systemic teaching in the physical literacy of fourth-grade students.

### **The Research Hypotheses**

The following null hypotheses emerged from the research objectives:

- There is no statistical significant difference at the level (0.05) between the scores mean of students of the experimental group who study physics in the systemic teaching and the scores mean of students of the control group who study the same subject in the traditional method in the test of physics achievement.
- There is no statistical significant difference at the level (0.05) between the scores mean of students of the experimental group who study physics in the systemic teaching and the scores mean of students of the control group who study the same subject in the traditional method in the test of the physical literacy.

### **The Research Limits**

The current research is limits were the following:

- Fourth grade students in the governmental preparatory schools in Diwaniyah.
- The second semester of the academic year 2017-2018.
- Four chapters from the book of physics for the fourth scientific grade, fifth edition 2017, chapters (sixth - light, seventh - reflection and refraction of light, eight - mirrors, ninth - thin lenses).

### **The Terms**

#### **Systemic Teaching**

It defined as:

- (Fares, 2011) As learning concepts and topics as a system that links the past learning with current learning (Fares, 2011).
- (Amin, 2012) As connecting concepts and elements of the lesson together as an integrated system. (Amin, 2012).

#### **Physics Literacy**

It was defined by:

- (Al-Sheikh, 2009) As: The appropriate amount of general physical knowledge of the learner, an understanding of the mutual relationship between physics, society, and technology, and the

identification of their problems resulting from physical activities and contributing in their solution. (Sheikh, 2009).

- (Abu Jahjouh, 2010): As appropriate measure of physical skills and positive attitudes towards both physics and technology and their impact on society and the environment. (Abu Jahjouh, 2010).

### **Theoretical Background**

Education is one of the important factors in a persons life because of its managing the relationship with themselves and from the first moments of their life and the benefit of it is the direction of the individuals growth and relationship with their environment, others and by teaching him correct thinking and education has a great influence in many fields, as it is the basis for the development of all humanity and social sciences and fields, development and growth is accomplished by a specific system, and the system is defined as an integrated component of specific relationships that achieve certain goals, the system aims to build, reform, and develop what was set for it, and if education is in the form of a system that aims to build a conscious generation of what is going on around him in the world at the same time, keeping pace with the development and growth that it sees and interacting with the reality it lives and linking what it sees and learns with what it has and not to learn the topics and the concepts are separate from each another, leading to cognitive dispersion (Safi, 2012). Hence, we can consider the systemic teaching as a guide for planning and organizing personal and environmental experiences and developing them to achieve the desired goals for the service of the individual and society, and using it in developing science education works to achieve the goals of teaching of the subject which are well achieved by taking advantage of all the components of the educational system and linking it with personal and environmental aspects for achieving the best results, we can consider models, strategies, and teaching methods from the important elements of education affected by modern education in the cognitive or applied aspects that have a main role in education in general, and teaching in particular, it makes to develop the human capabilities of the countries, so that it can meet the huge challenges and keep pace with global systemic thinking In order to achieve the educational process aimed at building the human personality, the goal of systemic construction must be to build an integrated and precisely connected in all its components and stages that

must be considered a coherent and interactive system. (Yonis, 2012).

### ***The Systemic Model***

Using the systemic teaching based on Constructivist Theory and Meaningful Learning, and it is considered one of the teaching methods that complements the systems approach, which has proven effective in a number of academic subjects, dealing with concepts, facts, basic events and information, and knowing the relationships between them and the past information in an integrated manner with no attention to secondary matters because it is a facilitation tool to teach the content in an easy and meaningful way, leading to positive results and achieving goals, as it is used to link the components of the curriculum with each other and what has been studied in a previous stage, and contributes to the development of cooperation between the teacher and the student, It helps teachers to become more effective and efficient in teaching, by arranging information and creating systemic relationships of parts of the lesson, so that they are help the students to build their knowledge, so the systemic teaching increases the learners ability to organize their knowledge structure to receive any next learning, to organize its new information to be closer to the complementarity and interdependence with its cognitive structure, this may increasing the absorption and achievement of learners, meaning that it contributes to the interconnected knowledge building of both the teacher and the student (Adnan, 2009).

### ***Objectives of the Systemic Model***

The systemic model aims to achieve several goals, the most important of which are:

1. Raising the efficiency of teaching and developing it in a comprehensive system.
2. Presenting study materials in an attractive way for students.
3. Organizing the curriculum content in a sequential and integrated manner.
4. Develop the ability to link elements and things together and learning becomes meaningful.
5. Helping the learners to future think in a comprehensive and integrated form for any topic without losing its particles.
6. Developing higher-order thinking, such as analysis, synthesis, and creative problem solving.
7. Linking the problem to the environment and searching for its

- possible solutions from their environment.
8. Developing a culture of inclusion and integration. (Al-Zaidi, 2008).

### ***The Need to Apply the Systemic Model***

There are many reasons and justifications for using the systemic teaching, including:

1. The huge cognitive development affecting all individuals and cultures.
2. The interrelated relationship among science, technology and society.
3. The speed, accuracy and effectiveness of transferring information to learners via the Internet, which has spread in all developing countries.
4. The emergence of new problems that need solutions that may contribute to solving them.
5. Following traditional methods of teaching leads to the boredom of the learners and their sense in the importance of what they are learning.
6. Focusing on memorization and retrieval in educational situations without linking the knowledge existing to the learner and what is intended to be taught.
7. Accustoming learners to memorize in order to succeed in exams only, and this leads to a lack of understanding of the information.
8. The learner preparation is not balanced among the cognitive, skill and emotional aspects. (Faraj, 2009).

### ***The Difference between Systemic Teaching and Traditional Teaching***

There are a number of differences between systemic teaching and traditional teaching, including:

1. Objectives: In systemic teaching, the objectives vary according to their entrance behavior, and they are not the same for all students, but the objectives in traditional teaching for all students.
2. Past knowledge: In systematic teaching, emphasis is placed on information and previous experiences of students to link them with new information and experiences that they are studying, as for traditional teaching, there is no interest in past experiences.
3. Selecting, organizing and analyzing the content: In systemic teaching it is carried out by specialized experts, while traditional teaching is done by central authorities in the Ministry of Education.
4. Teaching method: The teaching methods in the systemic teaching vary according

to the subjects, content and student role are positive, as for the traditional method, the main role is to the teacher, the student role is negative.

5. Teaching tools: In systemic teaching, educational methods play a fundamental role in achieving specific aims and rules, as for traditional teaching, they are limited in use and limited to specific types.
6. Evaluation: In systemic teaching, the evaluation is entered into the concept of the comprehensive, which includes the structural evaluation and the final evaluation, that is, it is characterized by continuity and diversity. (Afaneh and Al-Khazindar, 2009).

### ***Systemic Teaching Steps***

Teaching in the systemic teaching consists of six steps:

1. **preconceptions:** It is for the learners to know their previous information on the subject of the lesson and relate it to the subject of the lesson and arrange the previous information in the form of a system of concepts.
2. **Engagement:** Encouraging learners to participate in the search for new concepts and linking them to the new topic.
3. **Exploring:** the learner discovering ideas and relationships that he did not know through new questions, activities and problems to find solutions to them.
4. **Concept introduction:** Interpreting and clarifying the relationship between concepts and possible solutions and discussing them with the teachers or their colleagues.
5. **Elaboration:** It is the application of what it has learned in new situations, and linking new experiences or situations with the existing knowledge of the learner's structure.
6. **Evaluation:** Is the measurement of the extent to which the goals have been achieved or what the student has learned and must be from the beginning of the educational process to the end. (Faraj, 2009).

### ***Methodology***

#### ***The Research Procedures***

This chapter deals with a review of research procedures, the experimental design, the research community and its sample, setting procedures, preparing research requirements

and tools, procedures for applying the experiment, applying the research tools, and presenting the statistical methods used.

### **Research Methodology and Experimental Design**

The researcher used the experimental approach and experimental design with the two experimental and control groups with the post-achievement test and physical literacy.

### **The Research Community and Sample**

The current research community consisted of students of the fourth scientific grade in preparatory schools in the General Directorate of Education in Diwaniyah, Al-Zeitoun preparatory school was randomly chosen, consisting of three classes of the fourth scientific, the researcher randomly chosen from them class B to represent the experimental group consisting of (30) students and class C represent the control group consisting of (29) students.

### **Validity of Experimental Design**

The equivalence procedures of the two research groups were carried out in four variables: (age in months - intelligence - scores for the first course exam in physics - physical literacy test), as well as non-experimental factors were controlled: (experiment duration - maturity - test position - research tools - waste - interaction test with experiment - teacher).

### **The Requirements of The Research**

- **Determining the educational subject:** It is four chapters from the book of physics for the fourth scientific grade: (sixth - light, seventh - reflection and refraction of light, eighth - mirrors, ninth - thin lenses).
- **Formulating behavioral objectives:** The researcher formulated (193) behavioral objectives according to Bloom cognitive classification of levels (remembering, understanding, applying, analyzing) and presented to a number of arbitrators to ensure their validity.
- **Preparing the teaching plans:** The researcher prepared (24) teaching plans for the experimental group according to the steps of the systemic teaching and (24) plans for the control group according to the traditional method, the plans were presented to the arbitrators in the methods of teaching science to ensure their validity.

### **The Tools of the Research**

The researcher prepared the two research tools, the achievement test and the physical culture test as following:

#### **1- The Test of Physics Achievement**

- Determining the main objective of the test, which is to measure the achievement of physics of the fourth scientific students in the (experimental and control group).
- Preparing test items: The researcher prepared (40) objective items of multiple choices type (four alternatives), one of these alternatives is correct.
- Instructions of the test and answering form: The researcher developed the typical answers and instructions of answering the test, giving (one mark) for the correct answer and (zero) for the wrong or abandoned answer.
- Validity of the test: The researcher verified the validity of the test by applying it to a random sample of (100) students, and after getting the scores, it arranged in descending order, then a upper and a lower groups at a rate of (27%) were taken, the discrimination was calculated for each of the test items, the values ranged between (0.31 - 0.88), and the difficulty whose values ranged between (0.4 - 0.65). Thus, all the test items are acceptable and appropriate in terms of their difficulty, the effectiveness of the wrong alternatives for all items was calculated and their values were negative.
- Calculating the test reliability using Cronbach's alpha coefficient, the value was (0.804).

#### **2- Test of Physical Literacy**

The physical literacy test was built after the researcher got several literature and studies (experimental and descriptive) that dealt with the scientific and physical literacy, the researcher conducted the following:

- Determined three dimensions (cognitive, skill, and affective), 10 items for each dimension were formulated with four alternatives, one of them is correct, so that the total of items (30), the test was presented to a number of arbitrators to ensure its validity.
- The researcher devised instructions for answering and checking, one mark was given for the correct answer for each item

and (zero) for the wrong answer, and the left item.

- The validity of the test was calculated by applying it to a random sample of (100) students and the scores were arranged in descending order and took from them two upper and lower groups at a rate of (27%), discrimination of the test items was calculated and its values were between (0.38 - 0.67), and the difficulty coefficient for the items between (0.42 - 0.69), the effectiveness of the alternatives were all negative.
- Cronbach's alpha coefficient was used to calculate the reliability of the test, and its value was (0.86).

### **The Procedures of Applying the Experiment**

After conducting the equivalence process, the researcher began teaching the two research groups, the experimental and control groups were taught according to the teaching plans of each of them, according to the school table for 8 weeks.

### **Applying the Research Tool**

After the experiment ended, the achievement test of physics was applied on the two research groups in the same place and time, the students were informed one week before the test date.

After a day, the physical literacy test was applied on the two research groups in cooperation with the subject teacher and the researcher supervising, the students' scores were obtained of the two groups (experimental and control) of the two tests.

### **Statistical Methods**

SPSS used to calculate the following:

- The percentage, for arbitrators' opinions.
- Mean.
- standard deviation.
- t-test two independent samples, for equivalence and research results.
- Coefficient of discrimination for the two test items.
- Difficulty coefficient for the two tests.
- The effectiveness of the wrong alternatives to the items of the two tests.
- Cronbach's alpha coefficient for the reliability of the two tests.

## **Presentation and Discussion of the Results**

Results will be displayed according to the two research hypotheses as follows:

### **(A) The First Null Hypothesis**

To verify the results of the first null hypothesis "There is no statistically significant difference at the level (0.05) between the scores mean of students of the experimental group who study physics in the systemic teaching and the scores mean of students of the control group who study the same subject in the traditional method in the test of physics achievement".

The mean and the standard deviation of the scores of the two groups were extracted, as the mean of the scores of the control group students was (25.0), and a standard deviation (2.84103), and the mean of the scores of students in the experimental group reached (28.6), and a standard deviation (3.86496), after applying the t-test for two independent samples, the calculated value was (4.06504), which is greater than the tabled value (2), at significance level (0.05), (p-value < 0.05) in a degree of freedom (57), as in table (1), which indicates that there is a statistical difference between the means of the two groups, and in favor of the experimental group, therefore we reject this null hypothesis.

**Table 1.**

*t-test results for the two groups in the achievement test*

Group	N	Mean	Standard Deviation	t-test	Degree of freedom	p-value	significance level (0.05)
Experimental	30	28.6	3.86496	4.06504	57	0.00149	
Control	29	25.0	2.84103				

### **(B) The Results of the Second Null Hypothesis**

To verify the results of the second null hypothesis "There is no statistically significant difference at the level (0.05) between the scores mean of students of the experimental group who study physics in the systemic teaching and the scores mean of students of the control group who study the same subject in the traditional method in the test of the physical literacy", means, standard deviations were extracted of the scores of the two groups, the mean of the

scores of the students in the control group (18.1379), and the standard deviation (2.66892), mean (21.5333) and standard deviation (2.23966) of experimental group, Calculated t-test (5.300371) is greater than the tabled value (2) at the level of significance (0.05), (p-value<0.05), degree of freedom (57), this indicates that there is a statistically significant difference between the two groups means and in favor of the experimental group, as in table (2), so null hypothesis will be rejected.

**Table 2.**

*t-test results for the two groups investigating the physics literacy test*

Group	N	Mean	Standard Deviation	t-test	Degree of freedom	p-value	significance level (0.05)
Experimental	30	21.5333	2.23966	5.300371	57	1.95E-06	
Control	29	18.1379	2.66892				

**Discussion of the Results**

The researcher explained the results according to the two variables as follows.

**Achievement**

The results indicated that the experimental group that studied by the systemic teaching better than the control group that was studied by the traditional method in achieving of physics, and this can be explained as follows:

1. The systemic teaching refers to the Constructivism theory, thus it makes students able to link their past knowledge and experiences with present experiences, leading them to meaningful learning and thus raising their level of achievement.
2. Presenting the topics in the form of physical situations, or problems that stimulate the minds of students to generate multiple ideas through the use of past experiences, which in turn leads to raising their level of achievement.
3. Dividing students into groups increases competition among them and their answers are more accurate, which leads to raising the level of achievement.

4. Using the systemic teaching increases awareness of the relationships between concepts in the article through mutual opinions during discussions.

**Physics Literacy**

1. The system model is one of the models of Constructivism theory, which allows for diversity in the sources of information, and this increases students' physical literacy.
2. Providing academic content in the form of problems or scientific questions for learners that makes them in a state of cognitive unbalancing that will lead to find many ideas to solve the problem, and this leads to an increase in physical literacy.

**Conclusions**

In light of the results, the researcher concluded the following:

1. Teaching by the systemic teaching contributed to raising the level of physics achievement for the fourth grade students.
2. Teaching by the systemic teaching has an impact in raising the physical literacy of the fourth-grade students.

**Recommendations**

In light of the results, the researcher recommends the following:

1. The necessity of using systemic teaching by physics teachers, because of its impact in raising the achievement and scientific literacy of students.
2. The necessity of adopting of teaching all subjects by the systemic teaching because it is one of the modern models of teaching.
3. Focus and interest in physical literacy because it enriches students' experiences and information.

**Proposals**

To complement the current research, the researcher suggests the following:

1. Conducting a study on the effectiveness of the systemic teaching in other variables such as logical thinking, or critical thinking, and others.
2. Conducting a study to know the impact of the systemic teaching on other academic stages and subjects.

3. Studying other teaching models and strategies with achievement and physical literacy.

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