

# *Effects Of Manipulations On Student Learning In Physics And Chemistry*

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**Abstract** – It is known that manipulations are important in teaching scientific subjects such as physics and chemistry, for example, which makes them essential in teaching. But using the latter is not always possible due to the tools and equipment it requires, which are often expensive, forcing the teacher to abandon them in his work. It is very common to confuse what the scientific method imposes as an experiment with what is simulated in classrooms as manipulatives. For this purpose, the research aims to correct this confusion between the two concepts. First, awareness was made of the importance of manipulatives in teaching physics and chemistry, through an experimental statistical study that took place in one of the Moroccan public institutions, which will contribute to enhancing the importance of manipulatives experimentally.

**Keywords** – Experiments - Manipulatives - Computer simulation - Moroccan educational system - Certificate levels - Education - Educational directives - Achievement - Competency approach.

## **Introduction:**

Physics and chemistry constitute one of the scientific subjects, as they combine what is abstract and theoretical, such as mathematics for example, and what is experimental and applied. However, the broad scope of this subject and its complexity constitute a major obstacle in teaching it to adults, let alone teenagers. Therefore, importance must be given to the methods and principles of teaching this subject. And identifying everything that could hinder the achievement process, taking the age factor of the target group as an important aspect that should not be neglected. In light of the ongoing attempts at the scientific community level that aim for a greater study and a deeper understanding of how learning occurs, and thus reveal everything that would enhance students' achievement in this subject. Studies and research formed an essential source for this study, which contributed significantly to raising the effectiveness of academic achievement in the subjects of physics and chemistry, based on a set of experiments and data drawn from the ground, which this research considers this as part .

### **1) Difference between experience and manipulation:**

Experiments are characterized by a set of characteristics and are made up of a set of elements. They are a stage of the experimental method, subject to conditions, and the results are not expected or known. Rather, the theory is built and then its validity is verified, with the possibility that its results may result in a contradiction with the theory. The experiment is characterized by what we call the error rate, consequently, each one remains subject to other experiments that may be more accurate than its own, and thus its reliance is revoked. Something that we do not see in handling, which represents an experience with known contents and results, in which the recipient tries to change a set of values and controls in order to obtain a result that is completely identical to what was accomplished previously. Therefore, the difference between them is that the experiment is

used to research and collect information about an unknown phenomenon and we do not have its results, which results in a new discovery for the first time, while manipulation is not used in research. However, its purpose remains educational only to highlight a phenomenon, not to determine its causes and unknown variables. On this basis, we can say that all the experimental activities carried out by the teacher in the classroom are manipulations and not experiments, because their purpose is clear and their results are known. Rather, the teacher is often forced to change a set of conditions and values to obtain the same result that was achieved find it in a book or reference.

There are many reasons affecting the efficiency and effectiveness of handling and the extent of learners' academic achievement, and they are summarized as follows:

- Professional qualification of the teacher: The effectiveness of achievement in teaching depends on the extent of the teacher's professional qualification and the teaching method that he uses [1], as the teacher must be familiar with everything related to teaching techniques, the pedagogies used, in addition to the didactics of physics and chemistry and the psychology of learners [2].
- The teacher's experience: The teacher's experience affects the achievement and achievements of the learners, and the teacher's repeated training and practice develops the ability to control his practical development [3], even if some specialists do not believe in this and do not believe that repeated practice guarantees the growth of the teacher's competence [4], [5].
- The burden of teaching: This obstacle is summed up in everything that is a burden that makes the teaching process difficult and prevents its success, such as the length of the curriculum, its complexity, the increase in the teacher's working hours and the multiplicity of sections assigned to him, in addition to the different options available from a general option based on the Arabic language, a French option based on The French language and the English option for the rehabilitation course are all reasons that lead many to retire from the teaching profession[6].
- Preparation level 30 Pre-planning of lessons and discussions before the class is a vital element in the teaching and learning process [7] It keeps teachers organized and on track, while teaching in this way allows them to teach more and help the student achieve goals more easily[8].
- Availability of high-quality experimental equipment. The availability of the necessary equipment is a basic condition for carrying out the handling, although most of this equipment is of poor quality and prone to malfunctions, which makes it difficult to carry out the handling and demonstrate the physical or chemical phenomena to the learners. Also, most of the materials used expire with time, which requires their renewal.

## 2) Search procedures:

### Research problem and questions

The research aims to answer the following question: What is the effect of manipulations and experiments on learners' academic achievement in physics and chemistry? An investigation into the problem leads us to answer the following questions: What is the relationship between the use of manipulatives and experiments and the teaching of physics and chemistry? How can we see and highlight the relationship between the use of manipulatives and learners' academic achievement? Can continuous monitoring assignments provide an answer to the effectiveness of training on learners? What about computer simulations? Does it have a role in learners' achievement as a part of training? Based on a realistic experience and based on data taken from a Moroccan public school setting, this research, both theoretical and applied, will answer these questions.

### Research sample:

The research sample consists of 166 students in the third year of Moroccan middle school, 82 of whom are in the French international track and 84 of whom are in the general track.

### Research method :

The experimental method was used in the research to measure the effect of the independent variable, represented by handling, on the dependent variable, represented by the achievement of physics and chemistry, expressed in the students' answers.

### Search tools:

In this research, a test tool was used, which was based on the points obtained for each student, through two assessments in the subject component in the form of two guarded assignments in the first session. . In the first guarded assignment, students were evaluated on the lessons "Examples of some materials used in our daily lives" and "Materials and Electricity." As for the second guarded assignment, students were evaluated in two languages in the lessons "Reactions of Some Substances with Air" and "Acid Solutions and Basic Solutions".

The tests approved in the research target a set of competencies included in the curriculum. The importance ratios of each component are respected. After collecting the latter, correcting them, and extracting data from them, the proportions related to each sample group were calculated. The first lesson (examples of some materials used in our daily lives) was limited to documentary activities only, while computer simulations were used in the "Atoms and Electricity" lesson. Four exams were used to collect data for this experiment, two of which were in Arabic and the other two in French. The lesson "Reactions of Some Substances with Air" consists of two parts: oxidation of iron and aluminum and combustions. Experimental handling was carried out in the combustions part, while documentation and the traditional method were relied upon in the activities of the iron and aluminum oxidation part. While in the lesson "Acid and Basic Solutions" a computer simulation was used, the data for this experiment was also collected through 4 protected exams, with two models for each option. The samples were divided into three sections according to the points obtained in each component:

- The first section: a low-achieving sample, with a score between 0% and less than .50%
- The second section: a sample of average to good achievement, with a score between 50% and less than 80%
- The third section: a well-scored sample, with a score of more than 80%.

### 3) Search results:

• For the first exam regarding the general option, it was noted that a decrease in the percentage of learners obtaining a grade below the average. The percentage decreased from 77.5% to 68.6% with handling. The percentage of average students also increased by 1.3%, while the percentage of good students increased significantly by 7.6%. With regard to the French option, this sample witnessed a significant decrease in the percentage of students below average by about 20.7%. There was a very significant increase in the percentage of good students by about 21.9%. In general, it can be said that the percentage of struggling students decreased by 14% thanks to handling in the form of computer simulation, while the percentage of good students increased by 15.1%.

• For the second in the general option, a sharp decline was recorded in the percentage of learners who obtained a grade below the average, as the percentage decreased by 60.3% with the implementation of handling. . The percentage of average students also increased by 37%, while the percentage of good students increased significantly by 23.7%. As for the French option, this sample witnessed a very significant decrease in the percentage of students below average by about 50%, and a slight increase in the percentage of average students by about 11%, while the percentage of well-achieving students increased by about 39%. Overall, the percentage of struggling students decreased by 55.5% thanks to Communion in both forms, while the percentage of good students increased by 31.4%.

### **Conclusion :**

The results obtained show the role of manipulation and its impact on achievement, as the use of computer simulation contributed to a moderate increase in the achievement rate, which can be seen based on the high percentages of good students. It also appears to us that the use of scientific experience and its application in the department contributed clearly and fundamentally to the high rate of achievement among learners, even if a difference in achievement was observed between the general and international options.

Based on the research results, we can conclude the following:

- Learners' achievement rate changes only by changing the choice, let alone changing the course or people.
- Achievement is related to a large number of complex and interconnected variables. Everything that is used to measure this does not accurately describe the level of achievement.
- The use of computer simulation has an effective role in raising the achievement rate among learners, which is confirmed by the experiments completed in this project.
- Manipulation using experimental equipment is considered the best way to increase academic achievement, as it has produced more important results than manipulation using computer simulation. Therefore, we can say that experimental training is an important method that the teacher should not dispense with, despite its difficulty and the problems that prevent it from being carried out. Otherwise, the use of simulation through programs would be another successful method, despite its cost and its various requirements and tools.

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