

DEMOCRATIC AND POPULAR REPUBLIC OF ALGERIA

Ministry of higher Education and Scientific Research

Abbes Laghrour University -Khenchela-

Faculty of Letters and Foreign Languages

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The Influence of Demonstration Teaching Method on Students' Academic Achievement

Case study: Master 1 Microbiology students

Abbes Laghrour _Khenchela

**Thesis submitted in partial fulfillment of requirements for Master degree in
foreign languages and culture.**

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2020/2021

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ
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خَلَقَ الْمَوَدَّعَةَ

Dedication

*First and foremost I would like to thank and praise **Allah** for his uncountable blessings and gifts and for his guidance so that I have been finally ble to accomplish the thesis.*

It is with genuine gratitude and warm regard that we dedicate this work to my beloved parents who have been my source of inspiration and strength when I thought of giving up.

To my only brother and my three sisters who shared their words and support to escort me to the end of this long and tiring journey.

*To all my classmates and especially to my partner **Sihem** in this journey who never hesitated to boost me and enlighten my road whenever I felt tired and bored.*

To any person whether he/she helped me even with a word or a supplication.

To all my teachers who taught me from the first year till the last year during these beautiful years in which I learned a lot from what will benefit me in my life.

Souha

Dedication

*First of all I would give my undeniable thanks to the most gracious and merciful the Almighty **Allah** who has filled my life with countless blessings.*

This work is dedicated to my precious parents who have had the deepest efforts to succeed in my educational and scientific journey.

*I would like to dedicate this work to my lovely husband **Aziz** for his encouragement, support and love.*

*To my classmate and partner **Souha**, for her patience and determination to achieve our goal and submit a full work as flaws as possible as we can*

To all my teachers who stored by my side and pushed me to hold on and never give up.

Sihem

Acknowledgment

First and foremost, Praise to Almighty Allah for giving us the ability to exceed all the obstacles to complete this work.

A very profound debt of gratitude owed to our advisor and supervisor Mr. BOULAKROUN Issam for his continuous efforts to boost and help us conducting this work and complete it after a long time of studying and working, a long time which was really full of obstacles and sometimes with depression and tiredness but with our supervisor's guidance, instructions and motivation we managed to pass it with no failure or loss. His immense knowledge and enthusiasm helped us a lot in all times of preparing this dissertation and present it as clearly as possible. It was really a great privilege and honor to work under his guidance and supervision. So thanks a bunch to our competent supervisor Mr. BOULAKROUN.

We would also like to extend our gratitude to the examiner Mr. KHANFRI who have kindly accepted to read and evaluate this work.

We would like to thank with sincere emotions all our teachers for their academic assistance and support.

Special thanks go to master two students for creating joyful moments and making unforgettable memories

We are also indebted to our friend HAMZAOU Abesselem who brought considerable contribution to this work.

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Abstract

This study was carried out in Khenchela University, the department of biology to investigate teaching methods and their influence on academic achievement. The main objectives of the study were to study the influence of demonstration method in biology's students achievement, to know the role of both teacher and learner and to learn about the relationship between demonstration teaching method and educational achievement of biology's students.

To gather data about the situation, a triangulation as a data gathering tools was used as a strategy to gain precise and in depth information about the situation. A pre-test-post-test and an interview were administered to both teachers and students of master 1 microbiology, as well as classroom observation. The findings of data analysis revealed positive results concerning the influence of demonstration method on students' academic achievement. The results of the study show that the majority of teachers used this method. Furthermore, the majority of them get difficulty in applying it because of the lack of the necessary tools. Additionally, the findings yielded that the demonstration method on teaching affects the students' achievement positively. Therefore, teachers should identify and apply the stages at which demonstration method is done in teaching and they must submit a petition on the deficiencies of university laboratories that impede their work. as recommendation to help students to be successful in their life.

Key words: influence, academic achievement, demonstration method.

المخلص

أجريت هذه الدراسة في جامعة خنشلة، قسم علوم الطبيعة والحياة للتحقق في أساليب التدريس وتأثيرها على التحصيل الأكاديمي. وتمثلت الأهداف الرئيسية للدراسة في دراسة تأثير طريقة العروض العملية في إنجاز طلاب علم الأحياء، ومعرفة دور المعلم والمتعلم على حد سواء، ومعرفة العلاقة بين طريقة العروض العملية والتحصيل التعليمي لطلاب علم الأحياء.

ولجمع البيانات عن الحالة، استُخدمت عملية تثلثية كأدوات لجمع البيانات كإستراتيجية للحصول على معلومات دقيقة ومتعمقة عن الحالة. وأجريت مقابلة لكل من مدرسي وطلاب ماستر 1 علم الأحياء الدقيقة واختبار للطلاب فقط، فضلا عن مراقبة الفصول الدراسية. وكشفت نتائج تحليل البيانات عن نتائج إيجابية فيما يتعلق بتأثير طريقة العروض العملية على التحصيل الأكاديمي للطلاب. وتبين نتائج الدراسة أن غالبية المعلمين استخدموا هذه الطريقة، وعلاوة على ذلك، يواجه معظمهم صعوبة في تطبيقها بسبب الافتقار إلى الأدوات اللازمة. وبالإضافة إلى ذلك، أسفرت النتائج عن أن طريقة العروض العملية في التدريس تؤثر بشكل إيجابي على تحصيل الطلاب. ولذلك، يجب على المدرسين تحديد وتطبيق المراحل التي تتم فيها هذه الطريقة في التدريس، وعليهم تقديم التماس بشأن النقائص التي تعاني منها المختبرات الجامعية والتي تعيق عملهم لمساعدة الطلاب على النجاح في حياتهم.

الكلمات الرئيسية: التأثير، التحصيل الدراسي، طريقة العروض العملية

General Introduction

Introduction :

The university is one of the active institutions that is important in the upbringing, education, and teaching of individuals of the various knowledge and skills that guarantee them psychological, social and educational harmony through the so-called educational process. The latter has the input of a teacher, a learner, teaching method and educational programmes.

Teaching methods are considered to be the most important component of the curriculum for educational objectives, as they define the role of both the teacher and the learner in the educational process, as well as the methods to be followed, the means of educational communication to be used and the activities to be undertaken in order to achieve the objectives of teaching and achieve significant success results, and the demonstration method is one of the most important methods which is a method on which some teachers rely, namely, practical applications by teachers or students of the planned behavioral skills by using their subjects, machines or real devices. For example, if a teacher wants to teach his or her students how to operate a device, he or she will explain the operation, explain it in theory and then apply what he or she explains in practice by operating the device in front of them. It includes experiments and scientific lessons in practical laboratories, educational representation, class plays, simulations, models, simulations, sketches and educational games...

1_Statement of the problem :

Routine methods of teaching are often a boring routine for many students, and it has also been observed that the level of success and awareness of certain teaching materials is weak, possibly because teachers use routine theoretical-based teaching strategies that do not elicit students' motivation because they do not relate to the reality of their working life. Since

students had different ways of thinking and quick access to information, a strategy should have been used to help them absorb the subject and make it more appropriate.

The demonstration method is tailored to students' needs in realizing the information given.

As a result of the variety of methods of their presentation, they are either straightforward, easily applied and realistically anticipated and presented through laboratory experiments or educational games. And indirectly shown via graphics and video...

Some studies have pointed to the need for research on the demonstration strategy, which particularly recommends that this method be used to teach certain teaching materials to promote understanding and great success among students, and this study has therefore addressed the recognition of practical teaching on educational achievement and success rates biology's students

2_ Objectives

The main objectives of the study are :

- To study the influence of demonstration method in biology's students achievement.
- To know the role of both teacher and learner on demonstration teaching method.
- To learn about the relationship between demonstration teaching method and educational achievement of biology's students.

3_ Research questions

To reach our aim we set the following research questions :

1. Is there a relationship between teaching methods and achievement?
2. What's the impact of demonstration teaching method on the educational achievement of master 1 microbiology's students?

3. What is the role of both the teacher and the learner in applying the demonstration teaching method and achieving great success?

4_ Research Hypotheses

1. There is a relationship between teaching methods and achievement.
2. There is a significant differences in the achievement of master 1 microbiology's students before and after using demonstration teaching method
3. Both teacher and learner have an important role in applying demonstration teaching method.

5_ Significant of the study

This study is of great importance to university biology students, where it is hoped that it will improve their skills through viewing, demonstration, and laboratory experiments, which help to transfer conceptual knowledge into practical knowledge that helps to better understand theoretical lessons and use them in laboratories or on the ground.

It also helps guide professors to rely on some of the applied skills and necessary tools that need to be provided. In addition, it shows the role of both the teacher and the learner in this kind of teaching.

6_ methodology :

6_1 Choice of the method

The study used explanatory sequential mixed method design to examine the demonstration method effect on students of biology achievement. It consists of two different phases : the quantitative data was collected using pre-test-post-test design and the qualitative data was collected through face-to-face interviews.

A mixed method approach is a procedure for compiling and analyzing data by mixing both quantitative and qualitative research and methods in a single study to understand the research problem (Creswell, 2008)

6_2 Population

The population of the present study consists of 42 master 1 students of microbiology in Abbes Leghrour university_ khenchela. This is the level where students are grouped based on their specialization area.

A cluster sampling technique was adopted to select 42 students, and (5) students and (5) teachers participated in the interview.

6_3 data gathering tools

6_3_1 classroom observation

The first instrument used by the researchers in this study was classroom observation as qualitative tool for collecting data from natural occurring settings. As L. Cohen stated that "the distinctive features of observation as research process is that it offers an investigator the opportunity to gather live data from naturally occurring social situation.

6_3_2 Pre-Test - Post-Test Design

A type of true experimental design where test units are randomly allocated to an experimental group and a control group. Both groups are measured before and after the experimental group are exposed to a treatment.

6_3_3 semi structured interview

The semi structured interview is a meeting in which the interviewer does not strictly follow a formalized list of questions. Instead, they will ask more open-ended questions, allowing for a

discussion with the interviewee rather than a straightforward question and answer format.

The semi structured interview with 4 students as a quantitative tool will provide the study with more details and information about demonstration method and its influence on students' achievement.

6_3_4 Procedures

At the beginning, the researchers will conduct a classroom observation in a period of 8 weeks to get a general overview about the teaching process, then , they test students before and after teaching using demonstration method and then compare the results of achievement. Next, the researchers will use another tool to gather more details and data about the influence of demonstration teaching method on the achievement by conducting a semi structured interviews with them respecting Corona Virus prevention requirements.

6_3_5 structure of the work

The dissertation consists of two chapters, the first chapter is divided into two sections, it devoted to highlighting the theoretical framework of the study.

The second chapter is divided into three sections, the first one is dedicated to the research methodology. It unfolds the research design, the sample and the instruments used to reach the objectives the objectives of the study. The second section provides the analysis of the instruments addressed to the sample of the study. The last section presents the results of the finding , and a general conclusion.

Chapter one:

Reviewing Literature

Introduction

Student learning is the first concern of societies, because the activation of the role of students brings about the advancement of society for the better in all aspects (social, economic, political), To achieve that goal, it should be to consider what leads to a higher level of interaction in their societies, which is conducive to the positive for them and their community, The whole process of education, therefore, had to be developed as the most powerful factor helping them to create, think and change, with all the means, methods, activities and goals involved ; To this end, there was a call by educators to use different strategies to help improve students' thinking and achievement. And demonstration is one of these strategies.

Section one: Demonstration Teaching Method

1_1 Historical overview of demonstration teaching method

It was said that the demonstration method was contained in the Qur'aan, where different methods were used in raising individuals. One of those method is in Allah' saying "*Then Allah sent a crow searching in the ground to show him how to hide the disgrace of his brother. He said, "O woe to me! Have I failed to be like this crow and hide the body of my brother?" And he became of the regretful.*" (El ma'ida, 31), Here's Allah wanted to teach humanity how to bury, using the demonstration method.

In the Sunah of Prophet, this method is also used in the actions and words of the Prophet Muhammad May the blessing of Allah be upon him, like « *take your acts of worship from me* » to teach people how to perform Pilgrimages, and « *pray as you saw me praying* »

The history of the demonstration method has been briefly traced in the preceding sections and emerging patterns can be seen. Prior to 1910 the laboratory method was used almost

exclusively. But, by the early 1950's this method had been replaced by the demonstration method in many biology classes. (John Weily & Sons,1970)

This strategy comes from the idea of a pragmatic philosophy that believes that learning is through the practical experiences of everyday life, and it gives importance to practical experience, it considers that the information and skills acquired by students through experience yield positive results and that good thinking is based on trying. One of the qualities of the human being is to continue, regenerate and interact with the environment and its interaction with the social environment, which is the vital area for achieving the right education. It was later known as demonstration method.

1_2 Definition of demonstration method

Demonstration method is a method of explaining lessons through demonstrating and it is a method of teaching by presenting objects, events, activities and rules using relevant educational media, the purpose of this method is to show the process of something happening according to educational materials and how it is achieved and made easier for students¹. (Syah, Muhibbin,2003). Demonstration teaching method could be described as a display or an exhibition usually done by the teacher while the students watch with keen interest² (Mundi, 2006).

Also, demonstration teaching method could be described as a method whereby the teacher does whatever the learners are expected to do at the end of the lesson by showing them how to do it and explaining the step-by-step process to them. This method is an educational approach where teachers are the role players where they explain the lesson step by step to students and

¹ Syah, Muhibbin (2003). Psikologi Belajar. Jakarta : Raja Grafindo Persada

² Mundi, N. E. (2006). The state of students' academic achievement in secondary school agricultural science in Kogi State. *Teacher Education Journal*, 12 (1) 14-19

show them all the necessary stages of teaching, while students take into account the objectives of subsequent work¹. (Ameh, Daniel, & Akus, 2007).

the demonstration method involves the teacher showing pupils how to do something while they observe. Pupils' practice will follow the teachers' demonstrations². (Mutasa & Wills, 1995). According to Chamberlain and Kelly (1981), the demonstration method is used to show the procedures and techniques described and is also a direct means of explaining lessons to students³.

Demonstrations are illustrations of points in a lecture or lesson by using something other than conventional methods and/ or a visual-aid apparatus (Taylor, 1988). By presenting a concept in two different ways, students are able to see the concept at work in real life. I am not alone in my use of demonstrations. "Educators have often sought different ways to teach chemistry, and the use of demonstrations is but one of many teaching approaches adopted to enthuse students" (Erlis & Subramaniam, 2004). Another reason to consider the use of demonstrations in the classroom is for assessment. The teacher is able to ask probing questions on the topic being demonstrated and receive immediate feedback from the students. This allows a teacher to determine whether a new topic can be broached or if the one just taught needs to be revisited (Pierce & Pierce, 2007; Bowen & Phelps, 1997)⁴.

1_3 Types of demonstration

according to Chikuni (2003), there are two types of demonstrations, such as the step by step and the whole process demonstration⁵.

1_3_1 The whole process demonstration

¹ Ameh, I-Ei, Daniel, B. P., & Akus, Y. (2007). *Research and Methods in the Social Sciences*. Anka: Rowis press

² Mutasa, N. G and Wills, G.M (1995) **Modern Practice in Education and Science**. Gaborone, Printing and Publishing Company

³ Ochogba, C.O, Ogide, C.J & Ogide, C.G, Effect of Demonstration Method on Students' Academic Performance in Basic Technology in Secondary Schools in Ogba/Egbema/Ndoni Local Government Area, Rivers State, Nigeria, Department of Vocational and Technology Education Rivers State University, Port Harcourt, 2019.

⁴ Jessica.L.S, The use of classroom demonstrations to improve high school students' ability to understand concepts in chemistry, Louisiana State University and Agricultural and Mechanical College, 2019.

⁵ Chikuni, B (2003) **The Teachers' Handbook. A practical approach to Teaching**. Gwanda, Flame Publishers.

In the whole process demonstration, the teacher demonstrates the full process from the beginning to the end without interruption by learners' participation (Chikuni 2003). For instance, the teacher shows how to tack the dart, stitch it, and fasten the thread and pressing the dart to the correct side. The pupils will then follow the process by making their darts. Soroka, Hoagland and Mohale (1977) assert that the whole process demonstration enables the pupils to have a clear view of the process.

1_3_2 The step by step demonstration

according to Gwarinda (1993) the step by step demonstration is done stage by stage with teacher explaining each action as the operation proceeds. Chikuni (2003) notes that the demonstration is step by step, based on overlapping stages between learners. For example, when making a shirt, the teacher demonstrates how to attach the patch pocket and then the students work on their shirts individually. The teacher will then demonstrate how to work the seams and pupils follow suit until all the processes are completed. This method helps a lot of hearing-impaired students because they can't understand better as multiple and sequential ideas may confuse them. Bandura in Santrock (1997) affirms that pupils learn effectively through immediate imitation, especially children. Chikuni (2003) emphasizes that for convenience the techniques for imparting skills are presented in steps.

In addition to Chikuni's (2003) two types of demonstrations, McKeachie (1986) suggests the spot demonstrations, which is usually done after the teacher identifies a problem or a mistake being made by the pupils. This is done after the procedure has been shown before¹. For Petty (2000), if the teacher spots a problem, pupils will then be stopped and the teacher will redemonstrate the skill. This strategy helps to prevent worsening of the problem².

1_3_3 Direct and indirect demonstration

¹ McKeachie, W. (1986) *Teaching Tips: A Guide for the Beginning College Teacher*. Massachusetts, D. C. Heath and Company

² Chingombe.S.I, *Impacts of the Demonstration Method in the Teaching and Learning of Hearing Impaired Children*, *Educational Foundations Department: Great Zimbabwe University: Zimbabwe*

The demonstration is classified intuitive methods (Cerghit, 1980) and defined as a method of teaching - learning, in which the message is sent to the student includes a concrete object, a concrete action or their substitutes. Teaching demonstration in direct and indirect use.

Direct demonstration is accomplished by sensory things and phenomena in the field and placing students in the best position of observation. She performed in school premises (classroom, laboratories and workshops), and outside them. The school premises can only see objects of suitable size, ie those that allow easy handling in space (eg. Books, manuscripts, paintings, collections of minerals, exhibits). Direct encounter with the world of the senses most extensive and far is done outside school premises: carrying students on excursions in nature, in the near and far, in museums, in the face of cultural and historical monuments, performances and exhibitions, meetings with the grounds of the village present the creations of writers and artists.

Indirect demonstration is performed while the genuine objectivity is inaccessible or too complex and abstract for sensory knowledge. Then, instead of genuine reality, it shows evidence of it, and its implications, its traces and projections in various material forms. Intermediaries strong for knowing things and phenomena are thus photos, sketches, drawings, illustrations, charts, maps, models plastic-coated documents and audio. Teaching literature as indirect sources of information it uses, and all kinds of artistic and documentary works that appeared at literary creations and their authors. These are plays, screenings of literary and documentary films about writers and literary phenomena. Most educational means are adapted to show indirectly reality by reproducing images or sounds (sometimes together), for example. diafilmele, slides, overheads, instructional videos, electronic books and projection

equipment properly. Educational programs are based on radio and TV audiovisual scenic mediation that creates the illusion that genuine objectivity appears before our senses¹.

Direct demonstration' materials	Indirect demonstration' materials
<p>It is accomplished by sensory things and phenomena in the field and placing students in the best position of observation.</p> <ul style="list-style-type: none"> ✓ Classroom ✓ Laboratories ✓ nature ✓ Workshops ✓ Books, manuscripts, paintings, collections of minerals, exhibits ✓ cultural and historical monuments 	<p>It is performed while the genuine objectivity is inaccessible or too complex and abstract for sensory knowledge.</p> <ul style="list-style-type: none"> ✓ photos, sketches, drawings, ✓ illustrations, charts, maps, models plastic-coated documents and audio ✓ plays, screenings of literary and documentary films ✓ diafilmele, slides, overheads, instructional videos, electronic books and projection

Table 01 : direct and indirect dimonstration materials



Figure 01 : laboratory (direct dimonstration)

¹ Marinel.N & Brândua.J & Aleksandar.S, DEMONSTRATION AND OBSERVATION OF TEACHING METHODS USED IN TEACHING LESSONS OF ROMANIAN LANGUAGE AND LITERATURE, Teacher Training Faculty, University of Belgrade, 2016.



Figure 02 : workshop (direct demonstration)



Figure 03 : electronic books (indirect demonstration)

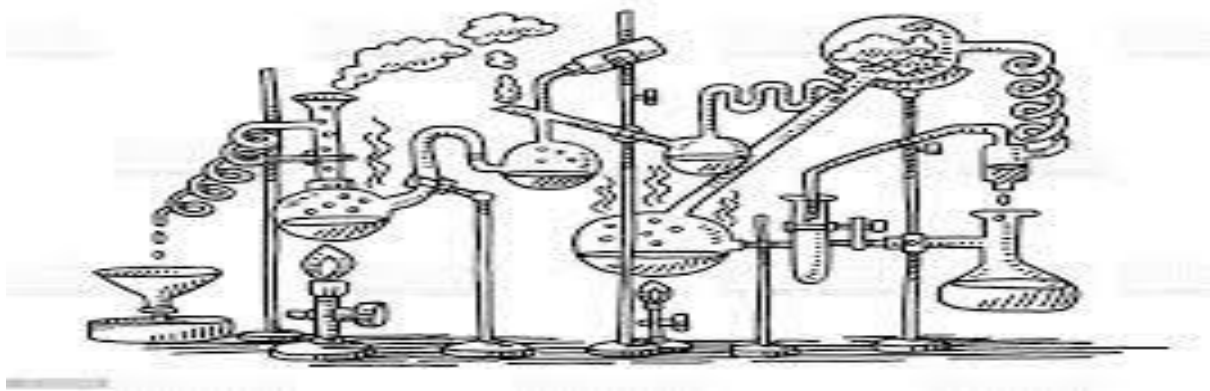


Figure 04 : experiment laboratory sketch (indirect demonstration)

1_4 General hints on how demonstration is done

According to Chikuni (2003), the demonstration method must be fully equipped and prepared to avoid error where it is difficult to correct.. Gatawa (1994) also points out that the teacher must explain the reasons why each step is important. To be effective, the teacher must plan it in advance. It is also preferable for a teacher to engage his students in applying this method by asking questions directly or after showing up using pictures, videos or educational games¹. (**Kim & Kellough, 1995**)

During demonstration, the use of educational aids where necessary. For example, a photographic media and videos can be used to show the appearance of a completed item. This may be important to establish an idea about the results obtained in the educational process². (**Gwarinda,1993**). Field trips can also be augmented with the demonstration method in imparting skills to the pupils. They involve pupils learning outside the classroom situation.

Discussion method can also be augmented the demonstration method during the teaching and learning by grouping pupils to solve a given task. The method of discussion leads to cooperation among learners and promotes communication and exchange of ideas³. (**Siyakwazi & Siyakwazi, 1989**). Fraser, Loubser and Roy (1990) in Siyakwazi and Siyakwazi (1999) observed that there is less spoon feeding in this method. Pupils will be free to make some contributions during their learning processes. In addition, they say that pupils' views will be respected. This will be done through the use of sign language for effective group discussions to be realized.

1_5 Initial considerations for using a demonstration method

¹ Kim, E.C and Kellough, R.D (1995) **Resource Guide for Secondary School**. USA MacMillan Publishing College.

² Gwarinda, T.C. (1993) **The Practice of Education** .Bulawayo, R.C.P Belmont Press.

³ Siyakwazi, B. J. and Syakwazi, P. D. (1999) **Strategies in Teaching and Learning**. Harare.Mazongororo Paper Converters

These strategies have primary considerations that the teacher should take when using them to know the purpose¹. (Abbas and Absi, 2009). These considerations include:

- To do this, the teacher must plan correctly.
- Provision of means and tools.
- Explain the reasons and objectives behind this task.
- Explain the important points for students to look for.
- Explaining new terms and ideas.
- Use of optical means if possible.
- Making sure students can see and hear clearly.
- Linking lessons to student tribal gains.
- Follow the teaching stages in this way step by step.
- Asking questions when using the demonstration method to verify understanding and also encouraging students to ask questions.

1_6 Purposes of the demonstration method

The demonstration strategy has the following purposes:

- **Impulse thrill:** The demonstration includes a particular problem without discussing it, which causes students to be motivated to ask questions for clarification, so that the presentation is an input to the topic.
- **Clarification of facts:** That is, using images, illustrations, video or representation to explain what is difficult for students to understand.

¹ Faten.M.Kh, The Effectiveness of Using Demonstration Strategy on Basic sixth grade Students Achievement in Islamic Education Course in Na,our District, Management and Curriculum Section, Faculty of Educational Sciences, University of the Middle East , 2018

- **Answer questions:** The teacher uses practical presentations as an answer to the questions that students ask in advance so that the subject can be clarified more easily to the teacher and to the students.
- **Mentoring learners to acquire accurate skills:** The teacher offers a position so that he can guide the students on how to work individually or collectively.
- **Introduction to educational equipment and means:** The teacher uses teaching aids in front of the students and shows them.
- Involve the senses in the educational process of wider cognition by re-application by students.
- **Providing opportunities** for students to participate effectively and move away from the listening circle while diversifying opportunities with diverse levels of accountability to match individual differences between students and common values for all.

(Abu Chikh,2008)

It leads to the student's ability to:

- **Planning and design:** It has the ability to ask questions, make hypotheses and design application steps.
- **Performance:** the ability of students to carry out the task individually or collectively, and the ability to record observations.
- **Analysis and interpretation:** Students' ability to explain, interpret, purpose and make generalizations.
- **Application:** The ability of students to assume new attitudes commensurate with the purpose of the demonstration method.

(zeytoun, 2007)

1_7 Steps to implement the demonstration strategy

In performing demonstration method, the teacher should take steps so that he or she is able to do his or her work, and create a correct picture among the students in terms of information and application, including: The initial demonstration method, during the demonstration method and the end of the demonstration method, is as follows:

1_7_1 The initial demonstration method

include:

- **Planning:** Like any new lesson in which teaching goals are analyzed, so that the appropriate method is used according to the course of the goals and the demonstration method to be used, attention must be paid to the time set so that it is proportional to the time available.
- **Preping Display Location:** By having the tools the teacher needs to present the method and process the necessary materials during the demonstration method, and by finding the appropriate venue for it that allows all students to watch.
- **Experimentation before demonstration method:** So the teacher can avoid mistakes that might happen before.
- **Preparing learners:** by providing students before the demonstration method starts with the necessary information so that they can be prepared and understand the subject so that they can link the subject to it presented to them.

(Baderkhan,2006)

1_7_2 During the demonstration method

The teacher must observe the following steps :

- Inform learners of the desired goals of the demonstration method in its different forms.

- Adjust the time during which the demonstration method is expected to be implemented in order to lead to the expected results.
- The teacher's supervision of the performance of the demonstration method with his/her clarification of some of the things that need to be clarified.
- The teacher manages the educational process during the demonstration method by controlling and managing the discussion among students until all of them have the correct knowledge.
- Mandating students to write notes during the demonstration method, which helps them better understand them.

(Hila, 1999)

1_7_3 The End of the Demonstration method

Students must be reviewed through methods Calendar associated with lesson goals to make sure they understand the subject, and make sure the displays are shut down. **(Abuchrih, 2008)**

In order to ensure the success of this method, the teacher has to take the factors that will help him or her to succeed in it¹.

1_8 Success factors of the demonstration method

- **Purpose clarity:** Or the point of the demonstration, so that the student can focus around that goal and keep him/her away from being distracted from complex words and using simple speech.
- **Teacher's excitement:** The way the teacher's presentation changes according to the subject matter, such as a change in tone, and being heard and clear.

¹ Faten.M.Kh, The Effectiveness of Using Demonstration Strategy on Basic sixth grade Students Achievement in Islamic Education Course in Na,our District, Management and Curriculum Section, Faculty of Educational Sciences, University of the Middle East , 2018

- **Not to mention the results beforehand:** So that students will continue to interact and awaken to reach the desired conclusion through the course.
- **Accuracy of the conclusion:** The teacher then accesses the students to the accuracy of the conclusion through careful observation of the demonstration method and until it is linked to the overall purpose of the lesson.
- **Teacher role model:** The teacher must apply the model in the demonstration method so that the students can apply it properly and have a proper perception of the goal of the course.
- **Step up during the demonstration with the involvement of students:** In order for a teacher to reach the desired results, the demonstration method must be graded from general to specific or from simple to complex, and so that the student can be able to understand the idea.

(Abusraie.A,2008)

1_9 The demonstration method strategies and the role of both teacher and student

- **Teacher view:** The teacher implements the demonstration method in proportion to the subject of the lesson, which helps to better understand the subject.
- **Teacher and student presentations:** Students share performance with the teacher, and this way makes students more attentive.
- **Student group presentation:** The show is shared by a group of students, and they are often chosen by themselves who do the show with them. This way gives the students confidence in themselves.
- **Solo student show:** A student of the class is doing practical performances.

- **Guest demonstration:** The teacher has the right to call a guest from abroad to perform the demonstration and is able to perform the presentation with skill.

(Huwaidi.B,2005)

1_10 Advantages and Desadvantages of Demonstration method¹

Advantages of demonstration method	Desadvantages of demonstration method
<ul style="list-style-type: none"> ❖ Enhances observation skill of the student. ❖ Stimulates the sense organs of the students. ❖ Helps to bring the clinical situation in the classroom. ❖ Helps to integrate theory and practice. ❖ Enhances confidence level of the students. ❖ Teacher invites cooperation of pupils. ❖ Develop interest and motivation for active participation. ❖ Helps achieve psychomotor objectives 	<ul style="list-style-type: none"> ❖ Time consuming ❖ Only a limited number of students can be arranged at a time. ❖ All the procedures cannot be demonstrate clearly. ❖ Teacher who do not have mastery of skill cannot demonstrate the procedure. ❖ Can only be used in skills subject. ❖ Due to poor economic condition of the government schools, there is scarcity of audio-visual aids and equipment

Table 02 : Advantages and Desadvantages of Demonstration method

¹ ASSIGNMENT Write down a comparative study on Lecture method and Demonstration method in Teaching. Should submit on 20/2/16.

Section two: Academic achievement

Achievement is one of the most structured educational concepts, because many school and social factors and processes are involved in its production. It also plays an important role in the daily life of the individual, the family and society, which is not matched by any other educational concept.

academic achievement in the field of education is crucial for students, as it is influenced by various internal factors, both specific to the student and external to the medium in which he is studying.

2_1 Definition of Academic Achievement

academic achievement in terms that have not settled on a clearly defined concept. Most definitions are overlapping and different, there are those who limit it only to school work, and there are those who see it as all that one gets from knowledge, whether inside or outside the classroom. Academic achievement is the knowledge obtained by a pupil or student through a school program designed to adapt it to the medium and work of study. **(Robert.L,1973).**

it is the successful and outstanding performance and achievement in special places, fields and studies, usually resulting from skill and hard work accompanied by attention. **(Hawes & Hawes, 1982).**

academic achievement is the amount of knowledge or skill an individual has acquired as a result of training and past experience.**(Abderrahman.I , 1984).** It is a specific level of performance or competence in school work assessed by teachers or through tests or both **(Charplin, 1968).**

Most researchers use procedural definitions that are consistent with their research variables. It is difficult to find a single definition to be agreed by all researchers, They have therefore worked hard to develop a definition that agrees, which is as follows :

Academic achievement is the knowledge gained and performance measured by tests according to the information provided to the student by the teacher at the end of each semester or stage of study and sought through the detection of points.

Achievement is the standard that determines the understanding of students and their access to the information and experience they acquire. This information is provided to students through the methods used by the teacher and activities that take into account cognitive, motor and emotional aspects so that it is linked to the thinking and orientation of students and helps them to prepare for acceptance, in order to learn about students' access to this information and the validity of their thinking, tests are developed that reflect teachers' expectations about their students and based on which appropriate methods have been used for them¹. (Damrash,2008)

2_2 Academic achievement' factors

Most scientists are convinced that the performance, achievement or attainment of a person in any field has always been dependent on a variety of different factors and influences, so that these factors are divided into two parts².

Internal factors specific to the individual: Students are the actual holders of knowledge and learning and they are at the centre of real education.

It's a person's different abilities and their hallmarks of intelligence, motivation, etc.

External environmental factors: There are factors that are specific to the miniature family, the community, and other factors that are specific to the school.

It means home and street and friends...etc

¹ Faten.M.Kh, The Effectiveness of Using Demonstration Strategy on Basic sixth grade Students Achievement in Islamic Education Course in Na,our District, Management and Curriculum Section, Faculty of Educational Sciences, University of the Middle East , 2018. Translated

² Ganish.S, Educational communication and its relationship to levels of achievement, dissertation of Master's Degree in Psychology, Work and Organization, 2011/2012.translated

Internal factors specific to the individual	External environmental factors
❖ Intelligence	❖ Family and parents
❖ Perception	❖ The Community and the Street
❖ Memory	❖ School
❖ Save	❖ Teachers
❖ Retrieval and Recognition	❖ Teaching Method
❖ Stimulus	❖ Pupils or students
❖ Physical Effects	❖ Curriculum

Table 03 : Academic achievement' factors

2_3 the influence of the demonstration method on academic achievement

Students are influenced by the teacher's measures in clarifying concepts and presenting information, in their perception and speed of understanding. These actions reflect the strategy used by the teacher. Whenever he uses different methods of presentation, he can integrate the students with the lesson, helping him to stimulate their motivation towards each new subject or idea. He/she breaks the deadlock and changes the process of his/her presentation of the information given according to the needs of the subject and appropriate in how it is presented. This helps students to keep information and leads to an improvement in their level of learning and this is reflected in achievement when students are tested in the information given.

The demonstration method was commensurate with improved student achievement; Given the variety of methods of presentation, they do not depend on a particular procedure, but take several ways of presentation depending on the nature of the subject, the need and the level of knowledge of the students who can do what has been taken, this helps him or her to relax the information in his or her mind and to develop new hypotheses on the subject in the course, With the participation and interaction of students, they increase their ability to clarify the

information, and also have ways of bringing the information to the reality of the students through either video or photographs.

All of this helps improve students' level of achievement.

Conclusion

The demonstration strategy depends on the teacher. He/she is the principal factor who manages and guides students. Like other teaching strategies, they have key bases on which to rely: The teacher's method, which encourages students to be motivated, raises their motivation and helps to manage the quota in the right and orderly way, pre-preparation, teaching tools, methods of presentation and a pre-teaching plan, moving in knowledge from known to unknown, from simple to complex, taking into account individual differences, distributing work to the majority of students and motivating students to interact and express their views. This influence students' academic achievement.

Chapter two : Research Methodology and Data Aalysis

Introduction

This chapter presents the practical side of the work. It is divided into three sections. The first section, the researchers provide an explanation of the appropriate methodology used in the study. In more details. They discuss the research design, data gathering tools, the sample and how data can be analyzed. The second one deals with the analysis of the instruments addressed to the participants. In the last section, both the interpretation and the discussion are covered.

Section one :

1_ Research Methodology :

According to James R. Martin research methodology is "the strategy or architectural design by which the researcher maps out an approach to problem-finding or problem-solving".

According to Leedy (1993), research methodology forms an integral part of any research that is undertaken. Therefore, the methodology illustrates how research is planned, organized and implemented in compliance with scientific criteria. (Mouton & Marais, 1996), it also refers to the theoretical justification of research in a selected system, including principles, axioms, beliefs and models. (Hameed, 2020)

In terms of research methodology, two research designs can be used, namely quantitative and qualitative. Wyse, (2011) gave a brief distinction between the quantitative and the qualitative designs. The former is used to quantify the problem by way of generating numerical data that can be transformed into useable statistics. It makes use of measurable data to formulate facts and uncover patterns in research. Where as, the latter, qualitative design, is

a kind of an exploratory research which used to gain an understanding of underlying reason, opinions, and motivations.

1_1 Research design

According to Jahoda, Deutch & Cook "a research design is the arrangement of the conditions for the collection and analysis of data in a manner that aims to combine relevance to the researcher purpose with economy and procedures."¹

Zikmund defined research design as "a master plan specifying the methods and procedures for collecting and analyzing the needed information"², it should be based more or less on some methodology the research design should be made once the topic and problem of research have been selected and formulated, objectives have been properly outlined, concepts have been properly defined and the hypothesis have been properly framed.
(Akhtar, 2016)

In this current study a combination of both quantitative and qualitative methodological approaches adopted for the purpose of attaining realistic results from the research. this claim is clearly supported by Massey (2003) "quantitative data are collected under controlled conditions in order to rule out the possibilities that variables other than one under study may account for the relationships identified, while qualitative data is collected within the context of its natural occurrence" . Moreover, combining different sections of qualitative and quantitative research have been called mixed methods research.

1_2 Sampling

¹ Ahuja Ram, (2010), Research Methodology, New Delhi: Rawat Publication

² Coldwel D. and Herbst F.J., (2004), Business Research, Cape Town: Juta and Company Ltd

Sampling is the process of selecting few participants from the whole population to be the sample of the study.

1_2_1 Student's profile

This study has been dealt with students of Master 1 microbiology in Abbas Leghrour Khenchela, located in El_Hamma. Sample of 42 students were selected as participants in this study. Their age is more than 22 years old. The Arabic was the native language of the whole population but they are studying in French language.

The sample has chosen by researchers because of the nature of their study, which was based on laboratory experiments as a demonstration method on teaching.

1_2_2 Teacher's profile

Researchers conducted a semi-structured interview with four Master 1 microbiology' professors in compliance with corona virus prevention requirements, and they asked only few predetermine questions while the rest of questions are not planned in advance.

1_3 data gathering tools

For the purpose of realizing this work, the researchers opted for using four main tools namely; classroom observation, pre-test-post-test and semi-structured interview.

1_3_1 Classroom observation

The first method used by the researcher in his/her study was the classroom observation as qualitative tool for collecting data from natural occurring settings. Classroom observation is one of the key methods used to study and assess teaching, i.e. to measure and evaluate the quality and effectiveness of teaching. The data gathered from classroom observations are usually supplemented by evidence drawn from other sources, such

as student evaluations or performance, review of teaching materials, administrative reviews, the instructor's own self-assessment, etc. However, classroom observation is the assessment method that provides the most direct data about the instructor's act of teaching¹. (Macdonald, 2016).

1_3_1_1 Description of the observation

After receiving approval from the Department of Biology in attendance with Master 1 microbiology students, provided it is one day a week, for the protective laws that have been imposed to avoid the spread of the corona virus. Since the study was 15 days by 15 days, the number of classes attended was 8, 4 theoretical classes and 4 TP classes in laboratory of the university where teachers provided the investigators with a general view about the environment of the study.

1_3_2 Pre-Test - Post-Test Design

pre-test and post-test design is used in evaluations of participants attitudes or perceptions relative to an event or to assess comfort in applying the information presented in a training session or with introduction of new concept (acceptance and efficacy study). One would assume that an increase in knowledge or positive attitude that is evident in better scoring on a post-test compared to a pre-test implies better knowledge or perception relative to an intervention applied after the pre-test².

1_3_2_1 Description of the Pre-Test-Post-Test Design

The initial student test was conducted by biology professors after theoretical classes, however, because of the conditions experienced by the Department of Biology, the classes in which

¹ Ronald Berk, "Survey of 12 Strategies to Measure Teaching Effectiveness," in International Journal"

² Prehospital and Disaster Medicine , Volume 34 , Issue 6 , December 2019

professors would have re-tested after the TP were removed, except for one. The professor re-tested the students in the laboratory in appropriate conditions and in compliance with the prevention laws of Corona virus, and she used the same four questions to see the difference in students' achievement before and after using demonstration method.

1_3_3 Semi structured interview

A semi-structured interview is a meeting in which the interviewer does not strictly follow a formalized list of questions. Instead, they will ask more open-ended questions, allowing for a discussion with the interviewee rather than a straight forward question and answer format. In this type the interviewer asks only few predetermine questions while the rest of questions are not planned in advance.

1_3_3_1 Description of the semi structured interview

A semi structured interview was carried out with 5 students (M1 Microbiology) and 5 teachers from Abbas Laghrour_ Khenchela, during the last week of the investigation. This type of interview preceded by an observation lasted approximately a week which allowed the researchers to develop a keen understanding of a topic to prepare a meaningful and relevant questions needed in the interview. We used semi-structured interview where we could use the participant's responses to come up with new questions about the topic, come in case their responses arouse new aspects to be discussed, through which we can gain reliable, comparable and precise data.

The interview consisted of 10 questions prepared to be asked to the participants (five asked to the students and five asked to the teachers).

The interview started by a brief conversation in which the interviewers intended to extract general information about the interviewees such as name, age, average for the students and

name, subject's teaching, number of years of teaching. At the same time, the aim was to reduce their stress and anxiety as well making them more comfortable. Later on, the interviewers asked all of them the same six prearranged questions to know the impact of demonstration teaching method on the students' academic achievement and to know if the teachers find it helpful in teaching.

With students, the first question was devoted to know teaching methods used at the University. The second question was to find out what information they knew about demonstration teaching method. The third question was whether all the necessary means of teaching were available. Then, the interviewer moved to the fourth question asking the participants if they find it difficult to understand when using this method, if the answer is yes, what are these difficulties. As for the fifth question, the participants were inquired whether this method worked and affected their educational achievement positively.

With teachers, the first question was devoted to know the specialties they teach and how they find work at Abbas Laghrour University _Khenchela_. The second question was to find out what information they knew about demonstration teaching method, and whether all the necessary means of teaching were available. The third question was if they find demonstration teaching method useful in the process of teaching. Then, the interviewer moved to the fourth question asking them if their students find lessons and tasks more easier when they apply this method. As for the fifth question, the participants were inquired whether they noticed a positive impact of this method on students' academic achievement.

Section Two: Data Analysis

1-1 Analysis of the Observation

The observation was carried out to investigate the methods of teaching at the department of Biology in Abbes Laghrour_Khenchela_, and teachers' reliance on demonstration teaching method in laboratories in TP classes, and how students interact with this it. the observation were in a period of 8 sessions that was sufficient to collect the required information.

The results showed that teachers used two different methods of teaching, theoretical teaching in classrooms and practical teaching in university laboratories or so-called demonstration method, where they re-explain the course by applying it to students according to its stages and using the necessary tools. Moreover, they worked hard to make the lesson clear to students well and asked them to participate in the experiments by following the necessary stages as well as correcting their mistakes in order to obtain the required and correct results.

As was noted, the great interaction of students during TP classes, and the speed of understanding and assimilation of the lesson compared to theoretical classes.

The observation also revealed that students are divided into several groups while teaching at the laboratory to enable all students to participate in the experiments.

1_2 Analysis of Pre-test-post-test

1_2_1 Pre-test score analysis

Score \ Students	N°	(%)
[00 ; 05[36	86%
[05 ; 10[05	12%
10	01	02%

Table04 : Pre-test students' score

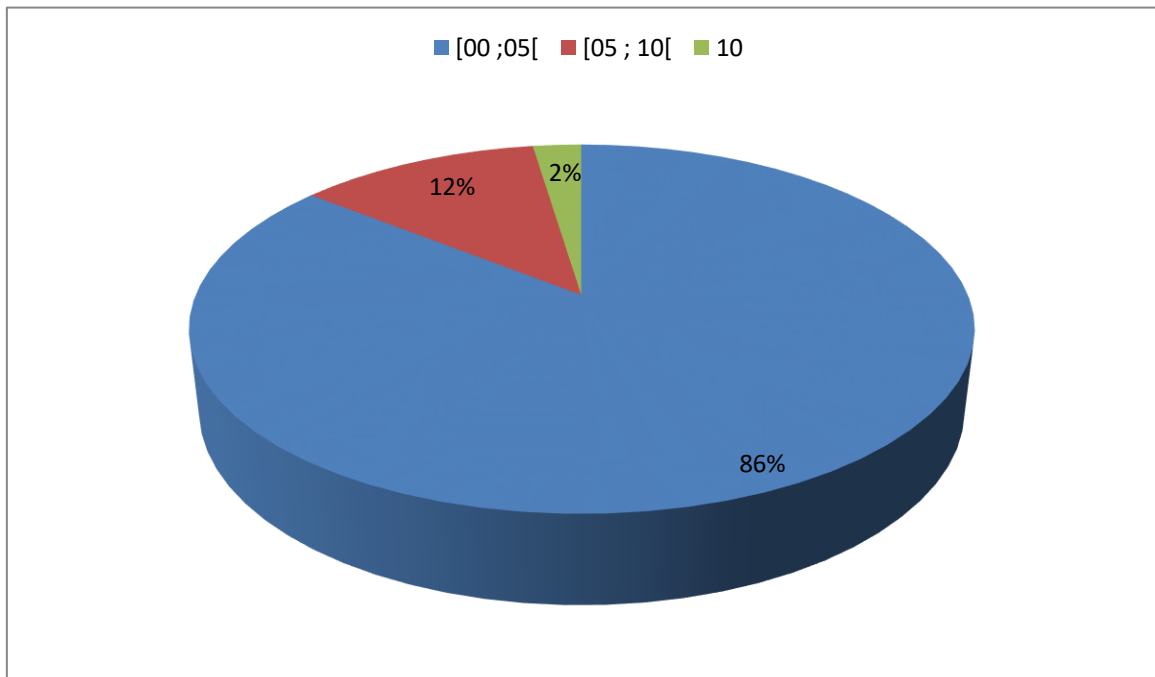


Figure 05 : Pre-test students' score

The table shows that the majority of the students got less than 5 points in the test doing before teaching using demonstration method (36) taking 86% from the whole ratio, while 5 of them got more than 5 points with a percentage of 12%, and just one student got the full mark (10 points) with a percentage of 2%.

1_2_2 Post-test score analysis

Score \ Students	N°	(%)
[00 ; 05[04	10%
[05 ; 10[14	33%
10	24	57%

Table 05 : Post-test students' score

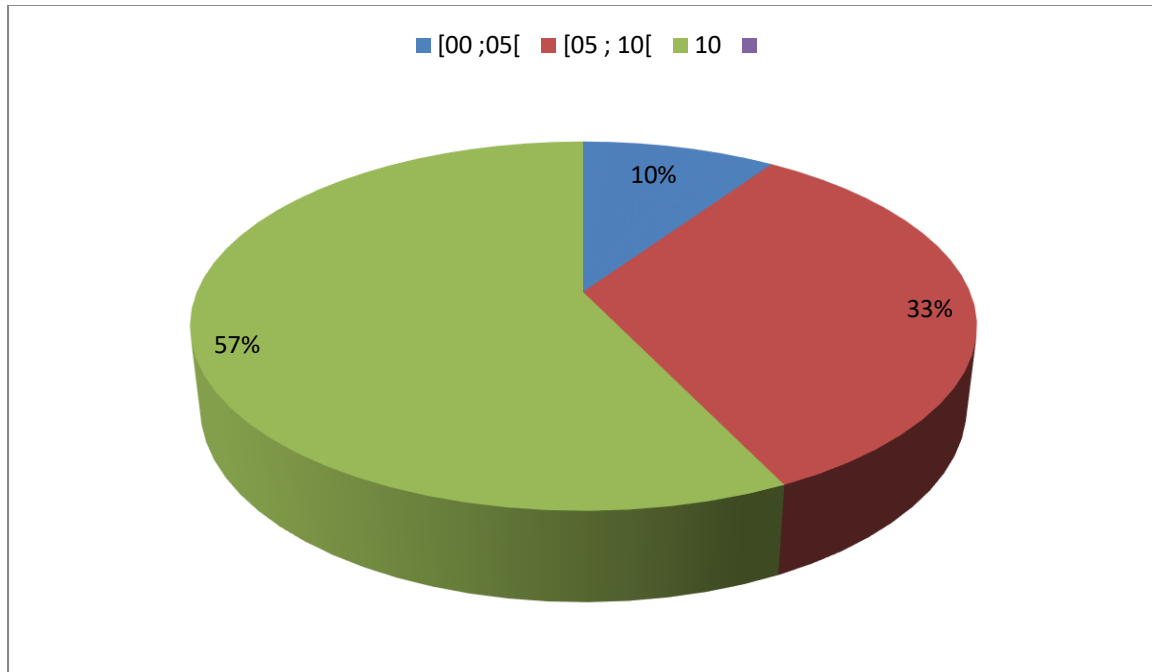


Figure 06: Post-test students' score

The table shows that the majority of the students got the full mark (10 points) in the test doing after using the demonstration teaching method (24 students) taking 57% from the whole ratio, while 14 of them got more than 5 points with a percentage of 33%, and just 4 students got less than 5 take 10% of the whole ratio.

1_2_3 A comparison between pre-test and pos-test scores

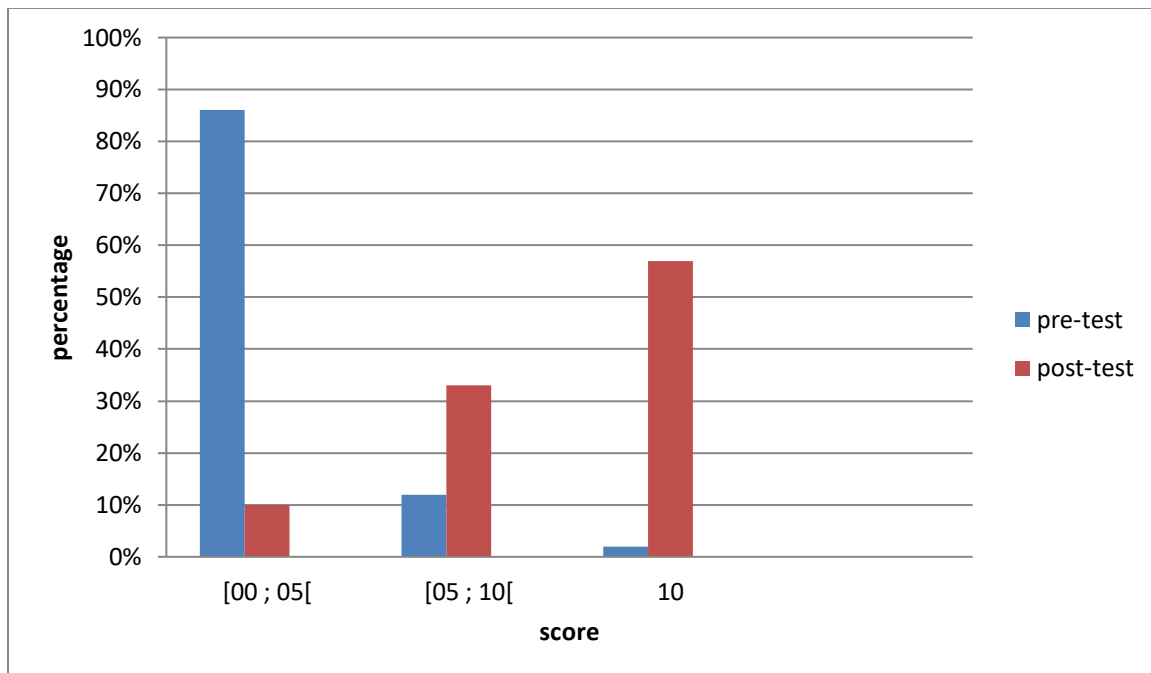


Figure 07: A comparison between the percentages of pre-test and post–test score

The corresponding figure shows the difference in the score ratio of one Master 1 students microbiology before and after the use of demonstration teaching method.

There is a marked improvement in student scores in the domain [00; 05 [, before this method was used it was represented by 86% and decreased to 10% after it was used. Then, it rose in the domain [05; 10 [, from 12% to 33%. Also, many students get the full mark (10 points) after it was almost non-existent before this usin method, rising from 02% to 57%.

1_3 Analysis of the interview

The interview was conducted with 5 students (master1 microbiology) from the total of 41 students studying in Abbes Laghrour University, khenchela. And 5 of their teachers.

The interviewers started their conversation with the interviewees by presenting themselves to break the ice, then they ased them personal questions such as name, age qnd average for students and name, age, subject of teaching and number of years o teaching. To get more

information, the interviewers expanded their conversation to touch their tagged points through the following questions.

1_3_1 With students

The first question was devoted to know teaching methods used in the university and all of them said that they studied in the classrooms and in the laboratory of the university to apply what they have seen in classrooms.

The second question was to find out what information they knew about demonstration teaching method, all of them asked the interviewers to translate and explain this question to them because they heard it for the first time. After explaining this method to them we noticed that two students had extensive knowledge about it, its definition, the stages it went through and the means it used. Three of the remaining students knew only a simple definition of it and some of the means used.

The third question was whether all necessary tools of teaching are available in the laboratory of the university, three students said that half necessary tools were not available, and sometimes, because of the lack of the necessary tools, teachers asked them just to try to imagine the results of the experiments. But the other two students replied that everything was available.

In the fourth question, the interviewers asked them if they found difficulties to understand when using this method, all students said that they find some difficulties when the necessary means were not available, but when all the tools were available they found the lesson very easy to understand, and they interacted with their teachers.

In the last question, students were inquired whether this method worked and affected their educational achievement, four students said that, yes, this method affected their educational

achievement positively, and they said that when the lesson was explained in this way, they understood it better and it became very simple for them. And only one student spoke with great confidence and replied that he could understand the lesson without using this method, and it did not affect his achievement.

1_3_2 With teachers

The first question was devoted to know the specialties they teach and how they find work at Abbes Laghrour University _Khenchela_, they all responded that they teach more than one speciality depending on the subject being taught. As for working at Khenchela University, three of them replied that they have difficulty in working because they come from a remote place, but they have no difficulty in teaching and dealing with students. The two other teachers responded that they found work good, and they did not have any problems.

The second question was to find out what information they knew about demonstration teaching method , and whether all the necessary means of teaching were available. All of them said they'd looked for this way of teaching when the interviewers attended with them, they even benefited a lot during research and tried to apply the stages of this method during teaching, and they also thanked them.

The third question was if they find demonstration method useful in the process of teaching, they all said that they saw it as very useful in the teaching process because it made it easier to explain the lesson and bring the idea closer to the students' mind.

In the fourth question, the interviewers asked them if their students find lessons and tasks more easier when they apply this method, two of them said their students find the lesson very easy and can do all the tasks. But the three remaining teachers said that their students find the tasks easy and simple only if the means of teaching are available.

As for the fifth question, the participants were inquired whether they noticed a positive impact of this method on students' academic achievement, all of them responded that they always notice continuous progress in their students' achievement after doing TP class and they interact with them perfectly.

Section three : discussion and interpretation of the results

Some time ago, many researchers touched on the subject of demonstration method in teaching process, its importance and its impact on academic achievement, to get more details, we shed light on three key questions that assume that initial hypotheses can be proved or refuted after data analysis.

Classroom observation reveals that most teachers use this method while teaching but lack the means and steps to follow, and it also demonstrates the great interaction of students with their teachers, This was also demonstrated in the interview with both teachers and students, and both emphasized the importance of this method and its impact on academic achievement. This proves the first hypothesis which is « There is a relationship between teaching methods and achievement ».

The results pre-test and post-test shown in the tables and the picture show a significant difference in student achievement, which is a significant improvement after the use of demonstration teaching method, so that 57% of all master 1 microbiology students get the full mark (10 points). And that's what proves the second hypothesis which is « There is a significant differences in the achievement of master 1 microbiology's students before and after using demonstration teaching method ».

The third and last hypothesis said that both teachers and students have an important role in applying the demonstration teaching method was validated at one point from the results of the

interview with both of them, showing a great role for teachers in applying this method because they are the ones who do it to explain the lesson to students and by following the basic steps and the necessary means, but the students don't have a big role, because they just watch and sometimes interact. So, the hypothesis is not true 100%, because only teachers have an important role in applying the demonstration method in the teaching process and they are responsible for it.

Conclusion

To recap, this chapter dealt mainly with discussion and interpretation of the findings revealed by analyzing data, trying to check answers for our researches questions and to what extent they met or unmet with our hypotheses.

The finding provide information on the importance of demonstration method in the teaching process and its positive influence on the academic achievement of students, especially if the means are available, even though the laboratories of Abbes Laghrour University _Khenchela_ lack a lot of means, this sometimes hampers the work of teachers.

Suggestions and recommendations

Demonstration is a method used in the teaching process using many means and following certain steps.

In many research and studies it has been found that the lack of means has a negative impact on the viability of this method and that the lack of knowledge of the steps to be followed by teachers also has a negative impact on its results. And these are some of the suggestions from university administrators and teachers.

Recommendations for managers

- ✓ University managers should be aware of the shortcomings in the various facilities at the University, especially in its laboratories.
- ✓ managers must provide all necessary tools that professors need in their work and help students.
- ✓ managers must make sure that professors do their jobs.
- ✓ Encouraging teachers to use electronic and laboratory tools in classes.
- ✓ Intensification of educational seminars for professors.

Recommendations for Teachers

- ✓ Teachers should create suitable space to help students interact with them.
- ✓ Teachers must submit a petition on the deficiencies of university laboratories that impede their work.
- ✓ Using different methods of teaching to get a good achievement.
- ✓ Attempt to identify and apply the stages at which demonstration method is done in teaching.
- ✓ Avoiding the use of complex methods and difficult instructions.

- ✓ Teachers should work with an appropriate curriculum that meets students' needs and facilitates work.
- ✓ Teachers should join educational seminars on teaching methods to obtain more knowledge.

Limitations of the study

- ✓ We found it difficult to do research at the Faculty of Biology because of the late approval by the Dean of the department in attendance with Master 1 microbiology students.
- ✓ This research is limited to space and tools because the Corona virus obliged us to minimize our sample from 20 interviewees to 10 (5 students and 5 professors).
- ✓ The lack of all the necessary tools in the university's laboratory, which prevents accurate results that help do the test properly.
- ✓ We have been late in collecting the necessary data as a result of the new university time that is sensitive to the conditions imposed by the Corona virus.
- ✓ Abrupt cancellation of TP classes, which is why we had to cancel some tests and minimize the sample from 120 to 42 students.

General

Conclusion

General Conclusion

This study dealt with the effectiveness of teaching by demonstration method on students' academic achievement. Its main concern was to investigate the link between this method and the achievement of Master- 1 microbiology students at Abbes laghrour University –Khenchela-. Taking into account the previous concern, three questions were formulated in an attempt to obtain reliable answers:

1. Is there a relationship between teaching methods and achievement?
2. What's the impact of demonstration teaching method on the educational achievement of master1 microbiology's students?
3. What is the role of both the teacher and the learner in applying the demonstration teaching method and achieving great success?

Using data gathering tools, interview, pre-test-post-test , classroom observation, following hypotheses were investigated:

1. There is a relationship between teaching methods and achievement.
2. There is a significant differences in the achievement of master 1 microbiology's students before and after using demonstration teaching method
3. Both teacher and learner have an important role in applying demonstration teaching method.

The current study is total of two chapters, the first chapter is divided into two sections, it

devoted to highlighting the theoretical framework of the study. The second one provides the description of the instruments, findings, data analysis, and the conclusion of what has been discussed previously.

As result of this research, it had been provided that demonstration teaching method has an influence on master 1 students' achievement. Furthermore, the lack of means required by this method negatively affects the success of its stages and the academic achievement of students. In addition, the demonstration method is a good teaching method in which teachers use different methods and follow certain stages. Therefore, they and university administrators had to provide all necessary means to ensure the functioning of the work.

To conclude, this study investigated the influence of teaching by demonstration method on master 1 microbiology students' academic achievement in Khenchela University. The findings of the study could be of some value for both teachers and students. On the whole, the results from this study are supposed to open up areas for further research on demonstration method and maybe including new things and rules in it. These finding will change the students' level and the level of awareness among professors of the importance of the demonstration method on teaching and its influence on students' academic achievement.

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Appendices

Appendices

Interview

With students

- A. What are teaching methods used in the university?
- B. What do you know about demonstration teaching method?
- C. Does all necessary tools of teaching are available in the laboratory of the university?
- D. Do you find difficulties to understand when using this method?
- E. Does demonstration method affect your educational achievement?

With teachers

- A. What specialties do you teach?
- B. What do you know about demonstration teaching method?
- C. Do you find demonstration method useful in the process of teaching?
- D. Did your students find lessons and tasks easier when they apply this method?
- E. Do you notice a positive impact of this method on students' academic achievement?

Test' questions

1. Sur quel milieu se fait ce test?
2. Est-ce qu'on a besoin d'une souche de référence ?
3. Est-ce qu'on a besoin d'un témoin ?
4. Est-ce que le diamètre de la zone d'inhibition est important ?