INTERNATIONAL JOURNAL OF SCIENCE DIDACTICS AND EDUCATIONAL ENGINEERING (IJSDEE)
Journal Homepage: https://IJSDEE.com
Research Article

Volume 1	Issue 1	October-December (2023)	ISSN: 3009-5239	Page: 172– 185

THE IMPACT OF INTERACTIVE GRAPHIC ANIMATIONS ON THE MOTIVATION AND THE LEARNING OF THE GLYCEMIC REGULATION AMONG THE STUDENTS OF 1ST YEAR BACCALAUREATE IN MOROCCO

Rajae ZERHANE, Sara EL HAMMOUMI, Oumaima AZZI, El Mostafa AMIRI, Rachid JANATI-IDRISSI
ERIPDS[1], Ecole Normale Supérieure, Abdelmalek ESSAADI University, Tetouan, Morocco

ARTICLEINFO

Keywords: (3 à 6 Keywords)
Glycemic regulation; ICT; Graphic animation; teaching and learning process; motivation

ABSTRACT

The objective of this work is to evaluate the impact of graphic animations on the motivation of learners in learning life and earth sciences in secondary school, and especially for 1st year baccalaureate students in experimental sciences. The approach of our work is qualitative and interpretative. To do this, we carried out an experiment with three classes: two control groups and an experimental group, in order to determine whether animation can be used to support the teaching of certain concepts of hormonal communication, such as the regulation of glycemia. The results obtained show that the motivation of the learners taught by using graphic animations as tools has improved in a remarkable way compared to the sessions of traditional learning, thus the integration of animations has increased the desire to learn in students, as it allows them to witness simulated experiences to overcome the problem of lack or absence of experimental equipment.

I- INTRODUCTION

The third millennium saw a huge revolution in scientific and technological progress which led to radical changes in lifestyles, and it also generated a huge amount of knowledge and information in all fields. To face these challenges, developed countries have worked to integrate education in a perspective of progress: a solid education system, competent citizens, endowed with values, creative and capable of developing their societies and facing change.

Like other developing countries, Morocco has experienced changes at different scales. Given its history, its strategic geographical location and its external relations have certainly enabled it to be aware of technological changes, but also to follow them as far as possible. Indeed, Morocco's desire to enter the era of new information and communication technologies has been reflected since independence (1956: Creation of the

[1] *Equipe de Recherche en Ingénierie Pédagogique et Didactique des Sciences*
Corresponding author : rzerhane@uae.ac.ma

Ministry of Posts and Telecommunications), through 1996 when the Ministry added ICT as a subject for the first and second year of the baccalaureate, until the adoption of the Engineering program in 2006. However, while the Ministry of National Education has made the integration of ICT one of its priorities, many teachers are still wondering what good use a computer can be in the classroom, due to a lack of training, interest, motivation, but also because of a feeling of ignorance and exclusion during the design of such projects. Even among teachers who are convinced of the usefulness of IT tools, there are still many questions about how to integrate ICT into everyday practice.

Lever 10 of the Charter of Education and Training highlighted the presence of a strong institutional will to promote the integration of ICT in education in Morocco. Indeed, these tools represent "strategic imperatives" for improving the quality of education. This is why, given that the technologies that information and communication technologies are disrupting the world of teaching/learning, teachers must integrate ICT into their teaching methods in order to improve and optimize learning while adopting with the available material.

In this context, Morocco has been involved in programs to support the development of science education in secondary and higher education. Considerable efforts have been made, but several studies have shown some handicaps related to the learning of scientific disciplines, particularly in the Life and Earth Sciences. In 2016, the analytical report of the National Program for Prior Learning Assessment (PNEA) revealed that a significant proportion of learners have a negative perception of the teaching methods that, in their opinion, make it difficult to understand, and many learners want to benefit from overtime. In addition, learners' scientific conceptions are a major problem in science learning, particularly in the life and earth sciences. Also, for good reason, the nature of the curriculum, the discipline taken into account, the level of study, gender and the school environment that can influence attitudes towards sciences in school.

In addition, this discipline uses many abstract and complex concepts, often theoretical, especially in secondary education and progressing to higher education. As a result, learners do not understand how the activities they carry out in the classroom can have meaning in daily life, they no longer find the relevant and therefore disinterested.

This leads to a negative influence on attitudes towards science. This attitude towards science therefore deteriorates with age, starting in primary school, and the deterioration worsens after the transition to secondary school. Only the choice of learners' careers that would force them to do science, therefore guide them towards scientific studies.

In any case, learners' attitudes towards science vary according to the school environment and learning methods. For example, learners appreciate courses in which the teacher applies a wide variety of teaching strategies, provides significant personal support, and provides a clear structure for teaching. Indeed, learners like experimental activities more than written activities, and so their attitudes favorably influenced by the courses where they can discuss and participate strongly.

Meaningful learning in the life and earth sciences achieved when experimental activities become an integral part of the curriculum. However, and according to my meetings with life and earth science teachers

to discuss the needs and problems they face. I found that most teachers suffer from certain obstacles related to experimentation: they were only able to carry out a few experiments due to the lack or absence of laboratory equipment; the time factor in the planning and execution of experiments.

From this point of view, there is a need for a new alternative laboratory environment where teachers can conduct the various experiments required at any time and under safe conditions. One of the solutions that can help overcome these problems is the integration of technological tools such as 3D animations.

In addition, in a discussion with teachers who have more than seven years of experience, and who regularly use ICT with their learners, we noticed that they admit the positive influence of the use of ICT on the behavior of their learners, and in a remarkable way during the practical work sessions. Although; the school has a multimedia room (GENIE room2); the majority of teachers do not benefit from these services.

Indeed, we observed that the lack of use of this room can be explained either by the fact that these teachers do not know how to use it, or because there is a lack of software compatible with the programs taught or an organizational problem.

Based on the above, we came with the idea of mobilizing and using animations in life and earth sciences not only makes it possible to fill the lack of practical work (experiments) and to improve the quality of science teaching life and earth, but also to overcome the sources of demotivation documented above. It would be useful to use concrete facts, in other words, field data, to understand, if necessary, the change in the motivational situation of secondary school learners induced by these technologies. It is in this sense that our problem is based on the issues related to a reform aimed at effectively integrating computer simulators into life and earth science learning.

Purpose of the research

The purpose of our research is to study the contribution of the pedagogical integration of graphic animations on learner motivation and the learning of Life and Earth Sciences in Moroccan secondary qualifying education.

Speaking of pedagogical relevance, in the long term, the results of the study could allow secondary school teachers, on the one hand, to be informed about the effects of 3D animations on the behavior of learners in learning life and earth sciences and to other hand, to understand the processes leading to these effects. Better informed, teachers could be encouraged to train themselves to integrate 3D animations into their teaching in order to optimize learners' motivation and fill the gap in practical work (experiments). This allowed learners to find the life and earth sciences more interesting

II- Methodology:

We have chosen to work with learners in the first year of the baccalaureate, experimental sciences. Our sample was chosen at random, and it is composed of 119 learners who respectively group three classes (1bac 1, 1bac 2, 1bac 3). We evaluated the knowledge of three classes on the course of hormonal communication. The first two classes, considered as control classes (1bac 1, 1bac 2), followed the course by the

[2] GENIE: it is an ambitious program with these two stages: GENIE 1: 2006 -2009 and GENIE 2: 2009-2013 aims to integrate ICT into education life and earth sciences.

classical method without using new technologies. The third class 1bac 3, for its part, received the course through technological support (Interactive Graphic Animation). We will then compare the scores of the three classes. This comparison will allow us to determine whether animation influences the perception of the concepts of this course and whether animation is related to the change in motivation of learners in learning.

To achieve our goal, we distributed questionnaires: one for life and earth science teachers and the other for first-year baccalaureate students in experimental sciences. These questionnaires distributed to both teachers and students are anonymous and consist of three types of questions (closed, multiple- choice and open-ended). The purpose of choosing this type of questionnaire is to simplify responses and collect as much information as possible.

The questionnaire for teachers focuses on the use of interactive graphic animations in the teaching learning of blood sugar concepts as part of the Hormonal Communication course. It includes 17 items divided into two sections, the first one aims to recognize teachers' personal information and the second part focuses on the use of ICT in the classroom (the use of graphic animation in our case), its obstacles and its favorable conditions. This questionnaire was distributed in paper format on the teachers of some of Martil-Tetouan's colleagues and also put online via Google Forms and social networks. This allowed us to obtain 61 answers spread over five regions of the kingdom.

Among the students, we administered questionnaires for three different classes (one experimental and two control classes). There were three categories of questions: multiple-choice questions, captioned diagrams and exercises related to hormonal communication (Blood sugar). The objective was to identify the difficulties encountered by the students.

In addition, to show the influence of graphic animations on learners' motivation, we used a data collection method based on observation sheets that will allow us to determine some criteria for learners' reactions.

III- Analysis and Discussion

1- Analysis of the results of the questionnaire dedicated to teachers

After analyzing the data, we observed that 56% of the respondents are women and 44% are men, out of a sample composed of 61 teachers in the secondary school earth and science discipline.

As for the distribution of teachers according to the regional academy, the teachers responding are mainly from the region of Tetouan - Tangier - El Houceima with a percentage of 43%, followed by Souss Massa Derâa and Guelmim Essemara with 18% of teachers. Then the region Bni Melal-Khénifra which ranks third with 13% of respondents and finally Fez Meknes presents a minimum of 8% of the teachers surveyed.

Regarding the professional experience of the surveyed population, we noticed that 43% of respondents have less than 5 years' seniority, 26% have between 5 and 10 years' seniority, 18% have 10 to 15 years' seniority and only 13% have more than 15 years' seniority. It can be seen that half of this population is composed mainly of young teachers.

According to professional training, the results represent 38% of teachers reporting that they have been trained at ENS, 34% at

CRMEF, 18% at CPR and only 10% are associate teachers.

Also, almost half of the teachers who responded to our questionnaire have never received training in the use of ICTs. A percentage of 33% of teachers acquired computer skills during vocational training and 15% through self-study.

Most of the teachers surveyed are not beneficiaries of training in ICT, which is due to the fact that a module on ICT has not been introduced into the training system until 2012. However, the number of teachers trained in this module remains limited despite the efforts made by the GENIE program.

- **Do you have a multimedia room (engineering room) in your establishment? Have you ever used the multimedia room?**

We found that the most schools have only one multimedia room, which means that teachers do not use it and do not have equipment provided by the school because they have only one classroom equipped with computers and a data show. But except for computer subject teachers who use it, so they are forced by life and earth science teachers to use their own computers.

- **The use of multimedia resources in the classroom in the course of hormonal communication, the concept of blood sugar**

We observed that 48% of the teachers surveyed sometimes use multimedia resources in the course of hormonal communication Glycemic. 26% often integrate ICT and almost the same number of teachers rarely uses these tools. While a small percentage of teachers report that, they never use these resources in the classroom, 8%.

From these statistics, we noticed that a significant proportion regularly uses ICT in the teaching of the notion of Blood Sugar since our sample is mainly composed of young teachers who have already received training in ICT.

- **Types of resources used in the classroom**

With regard to the typology of multimedia resources used in the course concerned, we can say from the responses given by teachers that videos, images and animations are mainly used more than 70% of teachers, followed by 51% who use drawings/schemas. On the other hand, audio seems very poorly used with a percentage of 5% of respondents.

- **Types of multimedia resource use in the classroom**

For this question we noticed that almost all the teachers responding to our survey (93%) use multimedia resources in the classroom to teach the hormonal communication - blood sugar course. 34% of them use them during classroom review sessions, 26% during the exercises and only 16% in the collective work.

These results can then confirm the importance of the use of ICT in teaching hormonal communication concepts despite the limited percentage of teachers using them.

- **Students' reaction to interactive graphic animations**

The percentage obtained confirms the results of the previous question, and also shows that the use of interactive graphic animations has a positive effect on learners' reactions. The results of this analysis indicate that almost all the teachers responding to our survey find that animations seem to be considered as a source

of motivation for learners (62% motivated and 33% highly motivated). On the other hand, only 5% of teachers say that their students are not motivated, but none says they are bored with these teaching tools.

- **Effect of graphic animations on the teaching/learning process**

Similarly, the result that we obtained shows that 82% of respondents confirm that the use of interactive graphic animations has a positive effect on the teaching/learning process of the notion of Blood Sugar. 15% say that these technological tools have a normal effect and a small percentage find that they act negatively, with 3%.

- **Barriers to integrating ICT into the classroom**

We noticed almost all of the teachers surveyed (57 teachers) do not integrate ICT into their teaching practice because of the overcrowding of students in the classroom, the majority report not using these computer technologies due to the lack/absence of resources (50 respondents), and the lack of ICT training (42 respondents). Other teachers perceive that it is rather the lack of time volume.

- **Classroom experiences**

For the experiments, we asked teachers two questions:

Do you conduct experiments in class?

What about the percentage of experiments programmed in the textbook?

Although experimentation is an integral and essential part of the earth and life science, it can be seen that the implementation of classroom experiments is very limited because not all teachers carry out the experiments programmed in the textbook. According to them, this may be explained by the situation of the laboratories, the majority of teachers say that the major problem is the lack or absence of experimental equipment or it is outdated.

- **Interactive graphic animations against classroom experiences**

For this item, we asked teachers if the use of graphic animations could replace classroom experiences. Analysis of the results of this question shows that almost half of the teachers responding to our questionnaire see that interactive graphic animations can relatively replace practical work in the classroom, which means that it depends on the learning context and situation. 38% are fully convinced of their effectiveness by stating that they can replace classroom experiences, while 13% of teachers are uncertain about the contributions of these technological tools that respond with negation.

- **Conditions favoring the integration of ICT (interactive graphic animations) in the classroom**

The effective integration of graphic animations as a means for pedagogical purposes can only take place if a set of conditions are offered and deployed in such a way that teachers can use them in their educational act. The results show the favorable conditions for the successful integration of these technological tools into life and earth science according to the conceptions of the teachers interviewed.

The results that we obtained provide a good understanding of the main conditions that encourage the successful integration of motion graphics into educational practices. According to the opinions of those questioned, in order of importance, these are:

- The provision of material equipment remains the most requested condition

(82% of teachers) since these tools play a key role in their use in class; otherwise, teachers find themselves unable to use them with their students.

- The reduction in the number of pupils per Class, 51% of the responding teachers declare that for an effective use of ICT, it is necessary to provide this condition, knowing that the high number of pupils is a factor hindering the implementationof several forms of pedagogy.

- The availability of resources still plays an important role thanks to the successful and objective integration of ICT for 44% of teachers

- Having a sufficient volume of time is also a fundamental condition for the effective integration of technological resources for 48% of teachers, withoutwhich they will be unable to complete the school program, since the use of these technologies requires more time in class.

- The training of teachers in the use of ICT is such an important step in the efficient implementation of these educational technologies, because 49% of the teachers questioned insist on its availability.

- The provision of an unburdened school curriculum remains an important condition for a percentage of 26% of teachers responding to our questionnaire.

2-Analysis of the learners' questionnaire

Question 1: Role of the pancreas and the liver in regulating blood sugar levels

More than half of the students were able to make the link between the pancreas and liver and their role in the process of regulating blood sugar.

Question 2: Caption / Legend the diagrams

Of the four diagrams presented to the students, only the first one labeled well by more than half of the students consulted. The learners who participated in our survey considered the other three schemes difficult.

Question 3: Synthesis and practice exercises:

After receiving and correcting the copies, we were surprised by the rate of correct answers which did not exceed 10% for the 1st exercise and 14% for the 2nd.

During this research, we gave great importance to the methodology of teaching blood sugar control. We noticed the dogmatic character of the course; the teacher monopolizes theword and the knowledge, dictates information to the students which they write down in their notebooks. They are not generally involved in the construction of their own knowledge because of the lack of precise pedagogical activities to be exploited through analysis, comprehension, and interpretation and modeling, which does not favor the concentration and motivation of thelearners who are often interested in scientific subjects in general. This results in difficult and erroneous conceptualization, which can lead to academic difficulties, misrepresentations that can persist in the

curriculum as well as in the future of the learners. This failure is largely related to the lack of experimental pedagogical materials in the textbook.

According to the answers of the pupils to the questionnaire which was intendedfor them, we can affirm that the pupils encounter serious difficulties at all levels:

- At the structural level (diagram): students have difficulty memorizing diagrams in order to be able to reproduce them.
- At the relational level: the student has difficulty linking the role of the pancreas and the liver in the process of blood sugar regulation
- At the level of synthesis: when it comes to transcribing in writing the observationsand explanations of such and such a situation in the course, the students do not have the skills necessary to write a structured response. They suffer from language problems and a lack of terminology and vocabulary.
- At the practical level: the absence of experiments, whether in class or in the laboratory, means that students lack practical knowledge.

Two types of reasons can be distinguished behind these weaknesses. Endogenous reasons directly related to students, such as their pre-acquired knowledge, personalities, family and cultural environment, school phobia, learning disabilities, lack of self-confidence, lack of inner motivation, etc. and other exogenous reasons, such as poor orientation of students during the transition to the secondary cycle, life course disorders (family problems, illness,bereavement...).

Whether endogenous or exogenous, these weaknesses discourage the learner and affect his or her ability to concentrate organizational skills and demotivate him or her.

These weaknesses, encountered among students, prevent teachers from performing their tasks correctly and satisfactorily. The inadequacy of students' pre-acquired skills is a real handicap that makes the majority of students unable to follow the teacher's explanations. As a result, their level of concentration and motivation is disrupted. When we talk about the deterioration of the level of pre-acquits, we are not only referring to the life and earth sciences, but also to almost all subjects.

Since life and earth science teaching involves several subjects such as physics, chemistry, mathematics and language, the teacher is in the best position to observe this failure among students in all subjects.

Apart from problems related to learners, there are problems relating to the didactic resources made available to teachers. For example, there is a lack of experimental equipment. So, even if the teacher can overcome the problem of pre-acquisition and students' reluctance to learn, he or she still faces a deficit in experimental devices. This deficit is an element of disorder that reduces the student's motivation and prevents him or her from manipulating and acquiring the rules of the experimental process. On the other hand, it does not allow it to develop the ability to record measurements and observe scientific facts during the experiment. The student is also unable to analyze and interpret the results of these experiments.

From these observations, teachers find that the practical side is essential in learning life sciences and earth sciences in general and in teaching blood glucose regulation. It is through experimentation that the student establishes a relationship with his environment. Living the experience will give students the opportunity to acquire knowledge that abstract and oral explanation is not enough to transmit. Staying in the abstract pushes the learner to lose concentration in a very fast way and therefore loses interest in taking the course, which becomes more of a chore than an entertainment. This makes it more difficult for the teacher to teach and capture the students' attention. As a result, he must double his efforts to maintain concentration as long as possible to be able to convey the idea of the course. In addition to the absence of experimentation, there is also the absence of pedagogical materials, with the exception of those contained in the textbook. The teacher has no documentation to fill the lack of practical experience.

The educational field has undergone a series of radical changes in recent years. These changes affect the very foundations of the education system, since it is about the modernization of pedagogy (pedagogy by competence). The overload of the school program far exceeds the amount of time set aside for it. As a result, many teachers are unable to complete the planned program. This overload is of concern not only to teachers who must complete the program, but also to students who must find time to prepare their lessons before the learning session, and even to review them immediately after to be able to follow the teacher's explanations in a correct way.

3- Results of direct observation sessions

The observations we made focus on learners' behaviors when using interactive graphic animations. Indeed, we will compare the observed behaviors of learners in the three groups (Control and Experimental).

As we know, it is very difficult to assess learners' motivation. But in the learning sessions, we tried to evaluate the indicators and determinants of motivation. Each observed behavior is assessed on a scale from zero to 10, based on Denise Barbeau's[3] motivational model. (BARBEAU, D., A. MONTINI and C. ROY (1992))

We also note that we have based ourselves on a personal and approximate assessment. This table 1 presents the evaluation of the main effects observed on learners following the use of interactive graphic animations in class for the experimental group and compares them with the two control groups that were taught in a traditional way. The level of onset of behaviors (from 0 to 10) is determined after discussion with the participating teacher.

The following table presents the results obtained:

Table: Table presents the evaluation of the main effects observed on learners following the use of interactive graphic animations in class for the experimental and control group

[3] Cognitivist model of motivation (Barbeau et al. 1997): it is a model of academic motivation that brings together, ina dynamic set, the various determinants and indicators of motivation.

		Group Control1			Group Control2			Experimental Group		
		S1	S2	S3	S1	S2	S3	S1	S2	S3
Theoretical presentations by the teacher	Learners ask questions if necessary or to better understand	6	5	5	6	6	5	6	7	9
	Learners are concentrated	4	5	6	4	4	5	6	9	9
	Learners are attentive and attentive and attentive	6	5	5	5	6	5	7	8	8
	Good participation of learners	5	4	6	5	5	4	6	7	7
Exercises or practical work	Learners are applied	5	7	6	6	5	5	9	8	8
	Learners help each other or ask the teacher for help	7	5	7	7	6	6	9	9	8
	Complete the work on time	3	4	4	4	3	4	5	5	5
	Significant investment of effort	4	5	5	4	3	5	9	8	8

The analysis conducted showed a significant difference in participation between learners in the three groups in all three learning sessions.

As expected, the graphic animation has a positive effect on the motivation of learners. They show more interest in the activity and are much more involved in the task when they are in a practical situation.

It can be seen that working with graphic animations increases the degree of collaboration between learners. In addition, we note that the learners in the experimental group are applied to the work required more than the control groups.

In addition, it is noted that all three groups have time management problems, andthat a small group of learners complete the requested work on time. In any case, it can be seen that the graphic animation used seems to increase the motivation of each profile of learners, with difficulties, advanced or not.

4- Comparison of the results of the summative evaluation of students in blood glucose regulation:

As mentioned in the methodology, we conducted a knowledge assessment of three classes on the course of blood glucose regulation. The first two classes, considered

as control classes, followed the course by the classical method without the use of new technologies. The third class received the course through technological aids (interactive graphic animation). We will then compare the scores of the three classes.

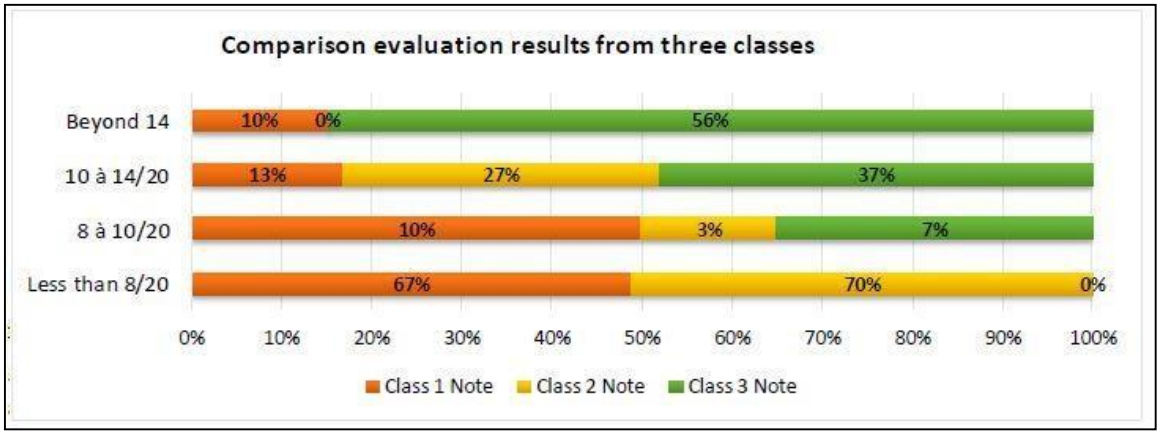

Figure 1: Representation show the results of the three groups

This comparison will allow us to determine if graphic animation influences the perception of the concepts of this course.

The representation above in figure 1 gives us a clear view of the difference in level between the students who received a permissive course and their peers who were entitled to a course presented by graphic animation. At first glance, marks below 8 largely dominate the results of the evaluation in the first and second class with 67% and 70%. In the third class, no pupil received a mark lower than 8. On the contrary, half (56%) of the pupils of the third class obtained a mark higher than 14. 27% of the pupils of the second and 37% of the third class had between 10 and 14.

Discussion

From the results obtained and the method used, we can say that graphic animation has a great influence on the level of knowledge and motivation of students, and this can be explained for several reasons.

As we mentioned during the analysis of the responses to the student questionnaires, students suffer from deficiencies at all levels, the structural level (diagram), the relational level, the practical level and the synthesis level.

However, among third grade students, these weaknesses seem to disappear. Students who have taken their courses on modern media have knowledge and skills to share with their colleagues in both control classes. This explained by the degree of concentration and motivation shown by these students. Thanks to their playful nature, multimedia media capture the attention of students for much longer periods than traditional course materials.

Thus, the motivated learners will become more engaged in their learning process. Interest, which is a variable of motivation, also has an important role in learning. Indeed, when a learner has developed an interest in a particular subject, he or she has a higher level of attention and engagement for that subject than one

who has no particular interest in that subject (B. Lassadi (2014).; I. Puspawati, (2020); Renninger, (2000); Durik and Harackiewicz, (2007); A. Valentin. (2012)).

Multimedia media also fill the gap in experimentation by popularizing concepts and making them more accessible to learners' minds. Graphic animations bring complex notions out of the world from the abstract to the virtual world. They can sometimes be more useful andeasier to understand than the actual experience.

As a game, computer-based courses are more accessible to students. Learners do not feel the weight of the course itself. They are more relaxed and more open to receiving knowledge. Knowledge that is better memorized and easily reproduced during evaluations.

The open-mindedness and concentration rate of learners make it easier for teachers to find themselves in front of a motivated and knowledge-hungry class. Teachers only have to passon their knowledge to the students.

The use of ICT in general not just graphic animation, can provide a rich and diverse learning experience. It can make abstract concepts more concrete and increase student engagement by providing opportunities for active learning. For example, computer simulations can enable students to explore complex biological phenomena that may be too challenging or dangerous to study in the laboratory.

Moreover, the use of ICT can facilitate personalized learning and self-directed learning. Students can access online resources such as videos, interactive exercises, and simulations that allow them to learn at their own pace and in their own style. This level of control over their learning can lead to increased motivation, interest, and enjoyment.

And for Sure, Animation can be a powerful tool to motivate students to learn because it can make complex concepts more accessible and engaging. Here are some ways in whichanimation can help to increase motivation in students:

- **Visual appeal**: Animation can be colorful, dynamic, and visually appealing, which can grab students' attention and make the learning experience more enjoyable. The use of animation can break up the monotony of reading textbooks and listening to lectures.
- **Simplifying complex concepts**: Some biological concepts can be difficult to understand and explain through words or static images. Animation can help to simplify complex ideas by visually illustrating them in a way that students can easily comprehend. For example, animation can be used to show the intricate workings of the human body or demonstrate the processes of photosynthesis.
- **Providing a sense of realism**: Animations can be used to create realistic simulations that allow students to visualize complex processes or phenomena that might be too dangerous or difficult to study in real life. For example, animations can help students visualize the effects of pollution on ecosystems or the spread of diseases.
- **Increasing engagement:** Animations can help students stay engaged and focusedby providing a more interactive and dynamic learning experience. Animations can

be designed to include quizzes, interactive exercises, and other forms of active learning that help students reinforce what they have learned.

- **Personalizing learning**: With the use of animation, students can learn at theirown pace and in their own style. Animations can be paused, rewound, and re- watched, allowing students to review the material until they fully understand it. This can help build confidence and a sense of accomplishment, which in turn can motivate students to continue learning.

Finally, graphic animations play a crucial role in improving the teaching/learning process of life and earth sciences in general and of notions related to hormonal communication in particular. Indeed, these pedagogical technologies offer a significant number of benefits, mainly in motivating students and encouraging them to be more attentive in class, reinforcing the memorization of knowledge through the visualization of the different biological processes, bringing learners closer to the reality of the phenomena studied and consequently improving school results.

Conclusion

In an attempt to make the learner more motivating in the classroom and to propose a tool that will serve as a solution to the problems of experiments in the teaching of life and earth sciences in Morocco. We have experimented with a pedagogical approach that consists of integrating interactive graphic animation and evaluating its influence on the learning of this discipline.

To show the important role of the integration of graphic animations, several studies have devoted and designers believe that they help to better convey a message or teach (S. El Hammoumi (2020); Rieber, 1990; Rieber, Boyce and Assad, 1990). Also, Baek and Layne(1988) found that animation increased learning performance compared to static graphics and text-only instruction. Palmiter et al., (1991), Palmiter and Elkerton, 1993, examined the effectiveness of animations to demonstrate simple interface procedures.

Following this experience, we can affirm that the judicious integration of animations into the learning process has a positive effect on the motivation of learners' learners, and that the result was more important for those who were less interested when the class sessions were conducted using the classical method. The use of graphic animations also seems very beneficial on the cognitive engagement of learners.

Although our research focused on a single first-year bachelor's degree in hormonal communication from experimental sciences to Morocco, we believe that the integration of animations can bring the same advantages in the teaching of other sequences of the life and earth science program. As well as the results can be generalized to other disciplines, and to all levels of education, whether primary or college, and even to the university level.

It is highly likely that the role of graphic animations in the life and earth science education sector will increase significantly in the coming years. This is an opportunity for theMoroccan education system to focus more and more on in-service teacher training and to make efforts to support the teaching staff in the integration of communication and information technologies by encouraging and motivating them to innovate these teaching methods. To

enable a school that is more adapted to the expectations of a society that changes from one day to the next.

References:

Alberto Valentína, Pedro M.Mateosa, María M.González-Tablasa, Lourdes Pérez, Estrella Lópeza, Inmaculada Garcíaa, (2012) Motivation and learning strategies in the use of ICTs among university students

Baek, Y. K., Layne, B. H. (1988). Color, graphics, and animation in a computer-assisted learning tutorial lesson. Journal of Computer Based Instruction, 15, 131-135.

Barbeau, D., A. Montini And C. Roy (1992). La motivation scolaire, plans d'intervention, Rapport de recherche, Montréal, Collège de Bois-de-Boulogne.

Boutheina Lassadi (2014). Using ICT to increase learners' and teachers' motivation, edulearn 14 Proceedings, pp. 2329-2335.

Indah Puspawati, Rohmi Juharoh (2020). Proceedings of the 4th International Conference on Sustainable Innovation 2020–Social, Humanity, and Education

(ICoSIHESS 2020) https://doi.org/10.2991/assehr.k.210120.130.

Palmiter, r.d., Sandgren, e.p., Avarbock, m.r., Allen, d.d. And Brinster, r.l. (1991). Heterologous introns can enhance expression of transgenes in mice. Proc. Natl. Acad. Sci. Usa. 88: 478-482.

Palmiter, S., Elkerton, J. (1993). Animated demonstrations for learning procedural computer-based tasks. Human-Computer Interaction, 8(3), 193-216.

Renninger, K. A. (2000). Individual interest and its implications for understanding intrinsic motivation. In Sansone, C., and Harackiewicz, J. M. (eds.), Intrinsic Motivation: Controversies and New Directions, Academic Press, New York, pp. 373–404.

Rieber,L.P. (1990). Using computer animated graphics with science instruction with children. Journal of Educational Psychology, 82, 135-140.

Rieber, L. P., Boyce, M. and Assad, C. (1990). The effect of computer animation on adult learning and retrieval tasks. Journal of Computer-Based Instruction, 17, 46-52.

El Hammoumi Sara, Zerhane Rajae, Rachid Janati Idrissi (2020).Pedagogical innovation on interactive graphic animations: Case study of synaptic transmission - 1st year baccalaureate degree, life and earth sciences, Morocco. https://doi.org/10.1016/j.ssaho.2020.100103