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# ICT use by the Life and Earth Sciences subject teachers of regional academies of education and training of Rabat-Salé-Kenitra in Morocco before and during the Covid-19 epidemic

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**ABSTRACT:** Generally, the technological development has made a great advance in the teaching/learning act even in life. The inclusion of information and communication technology (ICT) in education, as an initiation of a technical process and educational innovation, can lead to changes in teaching/learning practices.

In order to carry out this current study, we adapted the scientific method most recommended in the literature; deductive method, which makes it possible to follow the ICT use by the Life and Earth Sciences (LES) subject teacher at qualification secondary schools. Thus, the used questionnaire was produced and validated by experts, and it was published in Google drive and Facebook groups (LES- teachers), and it was completed by seventy-five (75) LES teachers during the school year 2019-2020. This process comprised more than twenty questions and divided into five sections. It is obtained that the majority of LES teachers have a computer and a personal internet connection, where55% of them integrate ICT in their classes for the lessons form, 23% in the tutorials form, and 35 % in the training exercises. In addition, it is noticed that 54 %of LES teachers use a projector (data show) as a classic method of the ICT use in the learning construction, a portion of 37% use interactive videos, and 9% use the interactive whiteboard.

On the other hand, the teachers questioned believed that the main obstacles to their educational practices relate to the ICT infrastructure, and that 61% of them during the teaching training did not follow courses relating to specifically on the educational use of the computer, with an insufficient number of computers connected to the Internet (10%), the absence of educational software (73%). For educational content adapted to school programs, the results obtained (13%), as well as the absence of educational meetings between teachers, inspectors and stakeholders around the digital resources use (67%), and lack of professional training for the realization of the educational scenarios. According to these results, the Moroccan education system must be based on a timely and thoughtful approach through the development of organizational and technological infrastructure, and to provide a training plan, support for teachers for the production and the integration of digital resources in learning situations in order to improve our education system quality.

**KEYWORDS:** ICT, Technology use, LES teachers, Learning, Learners.

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## 1 INTRODUCTION

Information and communications technologies (ICT) can raise the performance of a range of non-instructional teacher activities, such as student attendance, grading, textbook distribution and preparing administrative reports [1]. ICT also aids teachers be more active instructors, especially if they are well encouraged and reinforced [2], [3]. ICT enhances the productivity of basic instructional tasks, such as preparing lesson plans and class outlines, developing quizzes and examinations, and writing up comments on student papers and reports [4]. More advanced presentations contain fast identification of educational resources, including digital materials and collaborative projects.

In this sense, Morocco, like all developing countries, has understood the importance of the use and integration of ICT in its education system. For this, many schools have benefited from the equipment of Multimedia rooms, many training sessions were organized for the benefit of education stakeholders and several initiatives aimed at strengthening the use of ICT in education were taken. However, research in the field of ICT showed that its use is still very slow [5]. Thus, it seemed very important to us to question this situation and extremely opportune to lead, through this study, a reflection on the different uses of ICT really existing in the Moroccan education system as well as on the obstacles, which hinder these uses.

However, this text is limited to the presentation and analysis of data expressing the attitudes of qualification secondary teachers against the ICT integration in the education and teaching professions. In order to facilitate learning among learners, this explains the importance of the production and development of digital resources for learners to improve their skills [6].

As a result, the LES teachers, like all teachers, have one purpose: To train minds and transmit knowledge to understand the formative value of sciences subject teaching. Therefore, it seems interesting to follow the intellectual approaches of physicists, didacticians and computer scientists; and to consider at the same time the profile that learners can derive from the knowledge of certain procedures or application. This statement should encourage teachers to resort to ICT in order to keep this teaching its particular character. Given the importance of ICT and to encourage teachers and push them to use these digital resources, they must be presented within the framework of pedagogical scenarios, that respect the skills of teachers against technology and pace individual learner, learner participation, content structuring, perception and organization of messages, choice of teaching methods and learner motivation [7].

In fact, within the framework of independent work, learners realize the various concepts seen in class by using a digital resource, so they can assess themselves at a distance. This resource is designed to provide specific help with difficulties, in addition, learners improve and verify their knowledge through diagnostic, formative and then summative assessment [8].

In order to exercise the teaching profession, most teachers try to adapt a teaching and learning method, so as to minimize physical and moral effort and increase the ability to acquire knowledge by the learner. For this reason, our work focuses on digital educational resources, despite the obstacles that hinder its use based on the process of learner self-training, which involves the following skills:

- Acquire methodological knowledge and know-how in order to plan the training.
- Define the need, manage the progress, and plan the working time according to the objectives and activities to be carried out.
- In addition, the self-training skill requires mastery of the use of a digital environment and the information into knowledge transformation (cognitive skill) in the learning environment.

## 2 METHODOLOGY

In order to achieve the objectives of this study, the researcher used the descriptive analytical method; the exploratory study aims to follow the use of ICT by LES teachers. The necessary data was obtained by using a prepared questionnaire analyzed by researchers. To analyze the problem posed and build a source of information complementary to the questionnaire, an interview was developed.

### 2.1 DATA COLLECTION

Data collection was carried out by means of anonymous questionnaires distributed to several LES teachers from qualification secondary schools in several Moroccan cities belonging to AREF Rabat Salè, Kènitra. Thus, the study sample was randomly selected from the study population by proceeding as follows: Implement the questionnaire form in Google Drive; publication of the questionnaire link in the “prof-SVT” Facebook pages and groups about Moroccan education; organization of meetings on a "zoom" platform with several LES teachers to answer interview questions.

### 2.2 QUESTIONNAIRE DESCRIPTION

To achieve the intended objective, we have adapted the methodology, which can include / mix / combine the collection of quantitative, qualitative data and tools. These have been developed to collect comments and information about the subject. As a methodological tool for our research, we have developed a questionnaire addressed to seventy-five (75) teachers' LES during 2019/2020 school year, in qualification secondary schools before and after Covid-19 pandemic. The objectives of this questionnaire were to highlight the use or not of ICT in learning of LES sciences, to determine the methodology suitable type for this use and to highlight the difficulties encountered by teachers. Table 1shows the distribution of the questions number according to the questionnaire axes.

***Table 1. Distribution of the questions number according to the questionnaire axes.***

| **Axis Number of questions Personal use of ICT** | 5 |
|---|---|
| **ICT use with pupils** | 5 |
| **Obstacles to the ICT use** | 9 |
| **Levers to enable the ICT use** | 5 |

## 3 RESULTS

### 3.1 PRESENTATION OF THE OVERALL SURVEY POPULATION

The information collected according to the questionnaire criteria showed that more than 75 LES teachers are spread over several towns in the Rabat-Salé-Kénitra region of Morocco, namely: Kénitra, Tiflet, Sidi Slimane, Rabat, Témara, salé, Sidi Kacem, and Khémisset. Table 2 indicated that a half of the sample is located between the age of 20 to 30 years, a 25% who are between 31 and 40 years, 17% for the 41 to 50 years and 8% only for teachers over 50. So, the studied sample was composed from 65 % masculine and 35 % feminine. In addition, it is noticed that 95 % of teachers have a personal computer, where 86.5 % of them have an internet connection. It is noted also that 70 % of LES teachers use the ICT despite the lack of professional training in this area.

***Table 2. Breakdown of the overall sample.***

| **Global population** | **Modality** | **Percentage (%)** |
|---|---|---|
| Age range | 20 - 30 years | 50 |
| | 31 - 40 years | 25 |
| | 41 - 50 years | 17 |
| | More than50 years | 8 |
| Sex | Feminine | 35 |
| | Masculine | 65 |
| Own a personal computer | Yes | 95 |
| | No | 5 |
| Have a personal internet connection | Yes | 86.5 |
| | No | 13.5 |
| Using ICT | Yes | 70 |
| | No | 30 |

### 3.2 PERSONAL USE OF ICT

As indicated above and mentioned in Table 3, the vast majority of teachers have a computer (95%) and a personal internet connection (86.6%). It is seen that that more than half of teachers are occasional users of ICT tools (59%), against 20.5% are beginners and 20.5% are frequent users. On the other hand, it is obtained that 97.4 % of teachers use the documents found on the Internet with a very high rate, and 61% of teachers have taken courses specifically on the pedagogical use of the computer during teacher training.

*Table 3. Breakdown of the overall sample according to personal ICT use.*

| | Modality | Percentage (%) |
|---|---|---|
| **Own a personal computer** | Yes | 95 |
| | No | 5 |
| **Have a personal internet connection** | Yes | 86.6 |
| | No | 13.4 |
| **take courses specifically on the educational use of the computer,** | Yes | 39 |
| | No | 61 |
| **Frequency of use of computer tools** | Beginner | 20.5 |
| | Casual user | 59 |
| | Frequent user | 20.5 |
| **Use documents found on the Internet** | Yes | 97.4 |
| | No | 2.6 |

Therefore, we focus on the mastery rate of applications in the discipline of school learning of teachers, it is found that a high rate approaches 90% of teachers, whose level allows them to master word processing software (Microsoft Word, etc.), presentation software (Microsoft PowerPoint, etc.), transformation of data by e-mails and / or social communication tools (Gmail, Hotmail, Yahoo, Facebook, Watts App, etc.) and Internet browsing (Mozilla Firefox, Google Chrome, Opera, etc.) have a good or medium level. In addition, it is obtained that 18.40% of teachers have a good level in the practice of Spreadsheet (Microsoft Excel, etc.), and opposite this tool 50% for an average level against 23.70% have a beginner level and 7.90 % without level. It is found also that about 50% of teachers have an average or good command of digital camera or digital video camera.

### 3.3 MASTERY DEGREE OF THE TEACHERS IN CERTAIN APPLICATIONS

Table 4 represents the mastery degree of the teachers in certain applications. It is noticed that nearly 90% of teachers master the word processing software (Microsoft Word, etc.), presentation software (Microsoft PowerPoint, etc.), and data transformations by electronic mail and/or social communication tools (Gmail, Hotmail, Yahoo, Facebook, Watts App, etc.). Indeed, 64 % of LES teachers master Internet browsing (Mozilla Firefox, Google Chrome, Opera, etc.). in addition, more than 18.40% of teachers have a good level of mastery of the Spreadsheet (Microsoft Excel, etc.), and that faced with this tool 50% for an average level against 23.70% beginner level and 7.90% never use it.

*Table 4. Mastery degree of teachers in certain applications.*

| | Well (%) | Way (%) | Beginner (%) | No one (%) |
|---|---|---|---|---|
| **Word processing (Microsoft Word, etc.)** | 43.60 | 46.20 | 10.00 | 0.00 |
| **Presentation software (Microsoft PowerPoint, etc.)** | 41.00 | 43.60 | 15.40 | 0.00 |
| **Spreadsheet (Microsoft Excel, etc.)** | 18.40 | 50.00 | 23.70 | 7.90 |
| **Email and social communication tools** | 44.70 | 47.40 | 7.90 | 0.00 |
| **Internet browsing** | 64.10 | 30.80 | 5.10 | 0.00 |
| **Digital camera** | 23.70 | 36.80 | 18.40 | 21.10 |
| **Digital video camera** | 17.90 | 41.00 | 12.80 | 28.20 |

### 3.4 ICT USE WITH STUDENTS

Such as indicated in the above, the integration of ICT as a teaching aid in the construction of learning can make it more active and effective. Figure 1 shows the percentage of certain methods of ICT used by LES teachers with students. It is seen that the majority of teachers use ICT with their students by 70% in class, 41.4% between five and ten times a year and 58.6% more than ten times a year. All teachers state that the classroom is the first place for ICT use, then the computer room (multimedia rooms) for 3.1% and the 3.1% using other places.

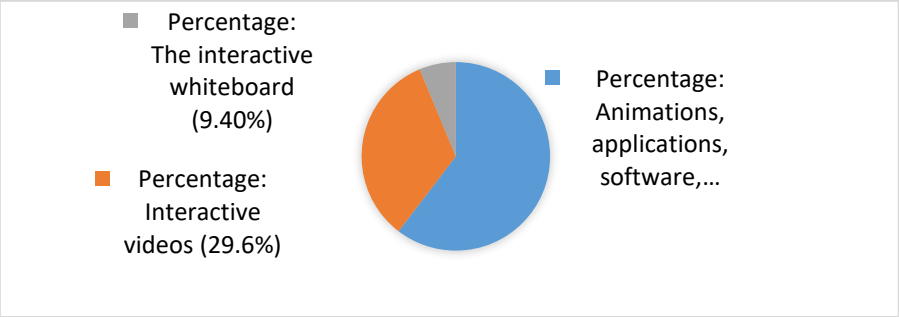


***Fig. 1. Percentage of certain methods of using ICT***

It is noticed from Figure 1, that the projector (data show) is the most widely used method of using ICTs by LES teachers for the learning construction, 29.6 % of teachers use interactive videos, and 9.4% of them use interactive whiteboards.

However, Figure 2 represents the percentage of teachers integrating ICT for learning construction. It is seen that 55 % of LES teachers integrate ICT in their classes for lessons construction, 23 % of teachers for the tutorials form, 17% of teachers for the research activities form, and 35% of them for the training exercises form.

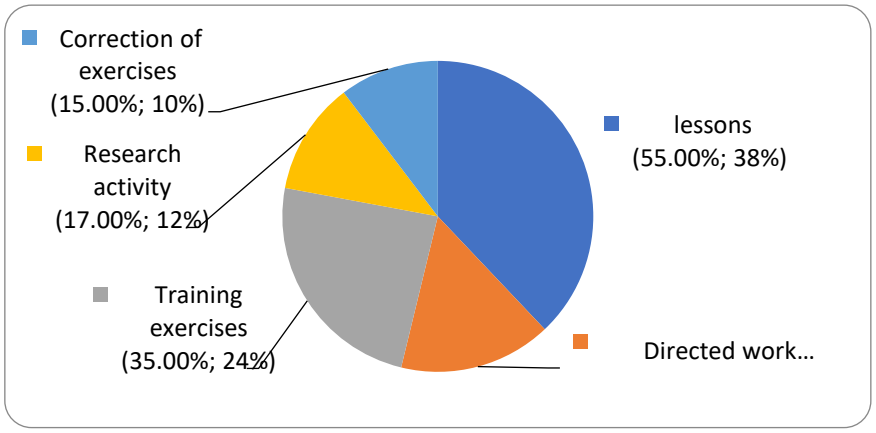


***Fig. 2. Percentage of teachers integrating certain types of ICT***

On the other hand, for more detailed the impact for using ICT for Moroccan education system, Table 5 shows the percentage of LES teachers used some software in their classroom. A global look at the percentages of the use of some software in the classroom in different academic learning disciplines, it is seen that the majority of the population integrates word processing (Microsoft Word, etc.), presentation software (Microsoft PowerPoint, etc.), Animations, simulations, Spreadsheet (Microsoft Excel, etc.), and audiovisual documents in their sequence on a regular or occasional basis. It is noticed also the presence of formation and production of Virtual laboratory software containing audiovisual documents... In addition, it is obtained that a large part of the population does not use the production of audiovisual material by analog devices like: camcorder, digital camera, or tape recorder, which is surprising in the case of educational.

*Table 5. Percentages of LES teachers use some software in class*

| | Regularly (%) | Occasionally (%) | Rarely (%) | Never (%) |
|---|---|---|---|---|
| **Word processing (Microsoft word, etc.)** | 12.50 | 71.90 | 12.50 | 3.10 |
| **Presentation software (Microsoft PowerPoint, etc.)** | 59.40 | 31.30 | 6.20 | 3.10 |
| **Spreadsheet (Microsoft excel, etc.)** | 6.30 | 37.90 | 28.10 | 28.10 |
| **Animations, simulations...** | 37.50 | 59.40 | 3.10 | 0 |
| **Virtual laboratory software** | 27.60 | 37.90 | 10.50 | 24.10 |
| **Video playback and processing software** | 28.10 | 37.50 | 15.60 | 18.80 |
| **Use of audiovisual documents** | 9.40 | 68.80 | 9.40 | 12.50 |
| **Production of audiovisual documents** | 3.10 | 25 | 34.40 | 37.50 |

### 3.5 USE OF EDUCATIONAL PLATFORMS BY TEACHERS AND LEARNERS DURING THE COVID-19 PANDEMIC

During COVID19 pandemic, the statistical results of the data, presented in Figure 4, showed that most LES teachers use youtube with a percentage of 58%, 55% of teachers use social networks, and almost half of them use the connection in the news source (research on Google and the page to benefit from and study the courses and the exercises). In addition, it is noticed that only 25% of teachers use email, and 77 % of them use whatsApp application to facilitate communication and documentation sharing tasks with learners.

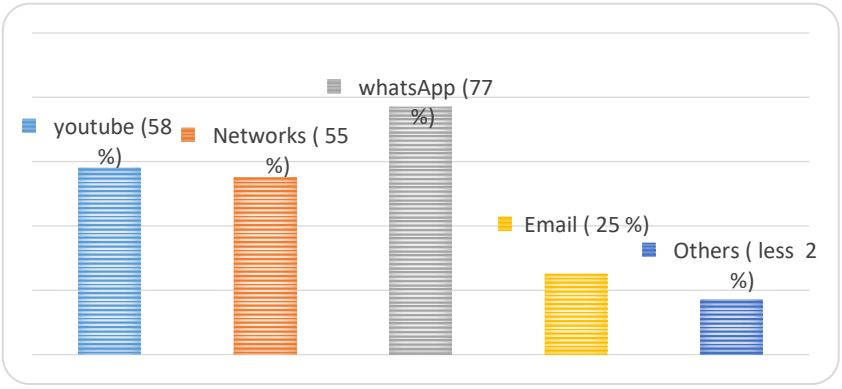


*Fig. 3. The use of educational platforms by teachers and learners*

### 3.6 THE BRAKES ON THE ICT USE BEFORE AND DURING COVID-19 PANDEMIC

It is known that the several obstacles to the ICT use are: equipment, location, digital resources, training, etc. Figures 5 and 6 represent some obstacles for the use of ICT by LES by teachers. It is noticed firstly that among the obstacles of the digital resource that obstruct teachers are the ICT use because it requires too much time for preparation. In fact, Figures revealed that 42.5%of teachers agree, 22.5% tend to agree, 12.5% of them tend to disagree, and 22.5%of teachers disagree. On the other hand, it is remarked that 29% of teachers who rely on the platform using the link " www.taalimtice.ma" to download all digital resources, while 71% of them use other sources of digital resources that required more skills and time.

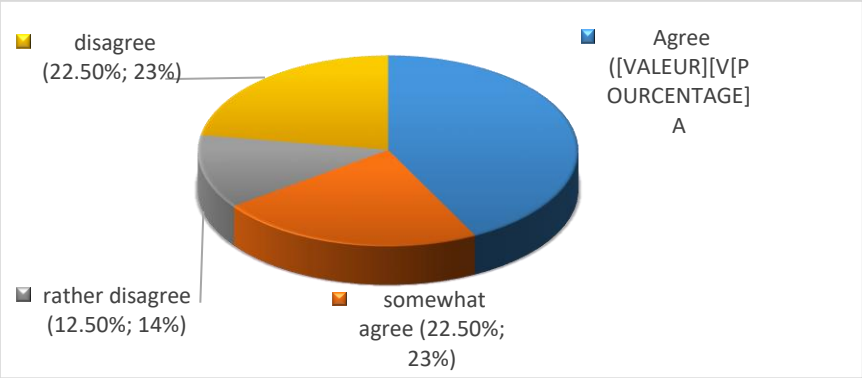


*Fig. 4. Degree of agreement that the ICT use requires too much preparation time*

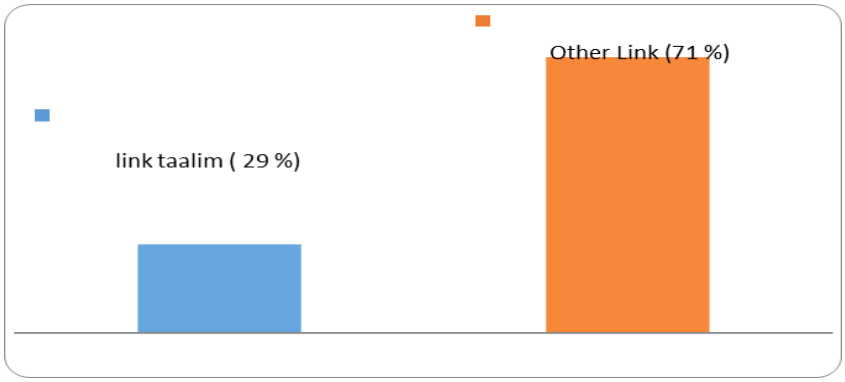


*Fig. 5. Source for download of digital resources*

On the second study, Figure 7 shows the degree of agreement of teachers according to the material and local obstacles to the ICT use. It is noted among the material and local obstacles which slow down the teachers are the lack of ICT equipment in the establishment, its non-reliability, and there is also the risk of breakdown in the presence of students. It is also noticed that almost half of the class to use ICT, and the huge problem which hinders its use is the lack of sufficiently free computer rooms.

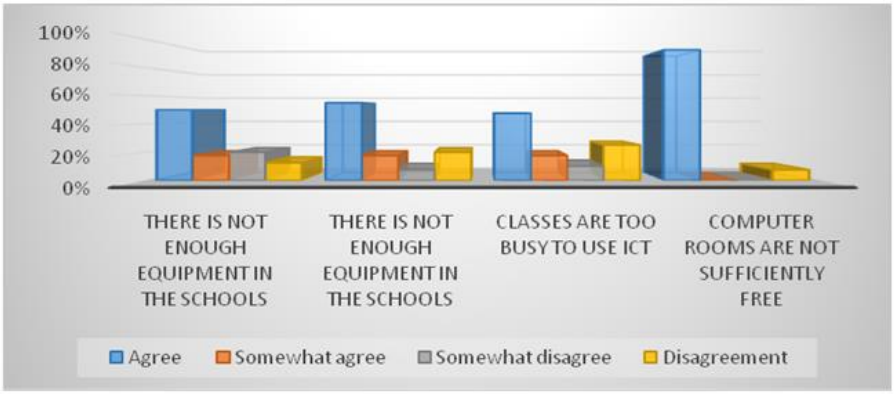


*Fig. 6. Degree of agreement of teachers according to the material and local obstacles to the ICT use*

However, Figure 8 represents the degree of agreement of teachers according to the training obstacles for the ICT use. So, the third remark on the formative obstacles for the ICT use: despite the fact that 59% of teachers took specific courses on the pedagogical use of the computer during their teacher training. It is seen that the majority agree (over 81.5%) that there are not enough multimedia rooms for the ICT use, which leads them to tinker during the realization of the lessons. In addition, it is noticed that most of the teachers declare that without a computer scientist attached in the establishment the use is not possible.

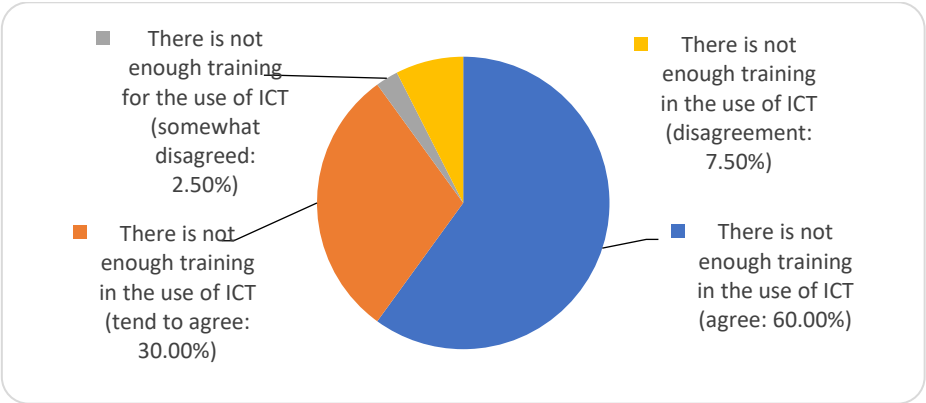


*Fig. 7. Degree of agreement of teachers according to the training obstacles for the ICT use*

Fourthly, there is also another obstacle on the ICT use, which is related to the attitudes of teachers. In fact, Table 6 represents the opinion of teachers on the role of the ICT use. It is found that the majority of teachers (67.5 %) disagrees that the using of ICT is a waste of time. It is remarked also that two thirds of teachers disagree that the usefulness of ICT for teaching is not proven. In addition, almost the same attitudes state that the use of ICT does not make students work.

*Table 6. Opinion of teachers on the role of the ICT use*

| | Agree (%) | Somewhat agree (%) | Somewhat disagree (%) | Disagree (%) |
|---|---|---|---|---|
| **Using ICT is a waste of time.** | 22.50 | 2.50 | 7.50 | 67.50 |
| **The usefulness of ICT for education is not proven.** | 17.50 | 17.50 | 17.50 | 47.50 |
| **The use of ICT does not make students work.** | 30 | 12.50 | 17.50 | 40 |

### 3.7 LEVERS TO ALLOW THE ICT USE AS LEARNING TOOLS

Table 7 expresses the degree of agreement and disagreement with the levers to allow the use of ICT. It is seen that the majority of LES teachers confirm the need to have a video projector in their classroom, which becomes a condition essential for the use of ICT. In addition, it is remarked that the most of teachers confirm that teamwork is favored for the use of ICT (and vice versa) and allows (teamwork) a better motivation of the students, and to vary the activity.

*Table 7. Levers to allow the use of ICT*

| | Agree (%) | Somewhat agree (%) | Somewhat disagree (%) | Disagree (%) |
|---|---|---|---|---|
| **Having a video projector in your classroom is an essential condition for using ICT** | 85 | 10 | 0 | 5 |
| **Teamwork promotes the use of ICT (and vice versa)** | 70 | 17.50 | 2.50 | 10 |
| **The ICT allow a better motivation of the students, to vary the activities** | 77.50 | 17.50 | 2 | 3 |
| **Without local technical assistance for the use of ICT, the use is not possible** | 52.50 | 20 | 5 | 22.50 |

## 4 DISCUSSION

The integration of ICT consists, first of all, in removing the obstacles to change in teaching practices, in particular by involving individuals in a dynamic of change by adopting the project-based approach to accelerate the informatics technology use of equipment and digital resources made available to students and teachers. In this regard, schools need more freedom and

autonomy to manage resources and constraints wisely. It would henceforth be necessary to think of planning at the local level, of moral and material recognition, of the achievements evaluation (by sanctioning successes and failures) by the councils and bodies concerned.

To do this, the commitments of the Regional Academies of Education and Training (RAET) and the adhesion of the delegations to the GENIE Program as well as its appropriation by the schools remain undoubtedly the real guarantee for the success of the pedagogical integration of ICT [9].

Teachers are not yet ready to use computers in their classroom. All they think about is that they have to finish the program, using the computer every now, and then may take them away from their lessons.

However, they suggested that when using computers in LES class, the teacher should assist the learner without pretending to do so. They were all unanimous in affirming that before any use of this tool, training of the teaching staff is essential. There should be no gap between the achievements that a learner can have and that of his teacher. This is where the fear of teachers lies.

The integration of ICT poses a difficult question for schools. Most teachers do not consider this question to be easy, let alone solved. All agree that the development of the ICT uses requires adjustments in the establishments organization, which are not without effect on teaching practices [10].

In addition, most of the teachers surveyed have more than ten years of teaching experience. This implies that at the beginning they did not have computer equipment. They had an overhead projector at their disposal which they rarely used. Under pressure from their administrative and even educational supervision, they had to hurry in order to be on time and complete the program on time. In the collective representations, it does not find any idea on the Pedagogical Guide for the integration of ICT. No initiative has been taken to introduce multimedia in the classroom, or even documents annexed to the guide [11].

ICT in collective representations have a relatively blurred outline. The teachers surveyed state that it is not their fault for asking for on-the-job training to visit a site to familiarize themselves with this tool.

The perception of the usefulness of the computer tool in the classroom is not clear. No reflection seems to have been initiated in this direction. This situation of technological or even didactic ignorance is at the origin of a certain apprehension of teachers against the tool. The usefulness or use of this technique is still perceived by teachers as a distraction that can entertain learners, or at least in practical work.

What emerges from interviews with LES teachers is that the contributions of ICTs to autonomy are numerous, but their great added value is shown timidly in the classroom. It is observed that the number of computers and projectors for each establishment remains insufficient, and very few LES teachers use them. They not being convinced of the educational usefulness of these technological tools and only using them for teaching. So, other researches indicated that the initial teacher training does not focus on the use and pedagogical integration of ICT [12].

Perreault has identified ten new skills for teaching, including: Using new “ICT” technologies [8]. In addition, Marcel Lebrun, for his part, asserted that: "The importance of information, technical support and pedagogical support to teachers is a priority so that technologies really catalyze pedagogical renewal [13]. Without this, new technologies will make it possible to reproduce old pedagogies at best. In other words, it is fair to say that if teachers are not trained in these technologies, in many cases, they simply risk perpetuating traditional teaching methods using a new medium.

The meager sharing of teaching material designed by teachers who do not all have a personal computer, the little time to learn ICT and no time recognized for the creation of digitized teaching material. To this can be added the traditional practices, which do not lend themselves well to a pedagogy that integrates ICT [14].

Indeed, the majority of teachers associate ICT with an increased task and a host of technical problems and see it as a threat to the power of the teacher in his class, they seduce the learner and could lead to teacher, in some contexts, to think that he no longer has control over the learners [15].

## 5 CONCLUSION

The integration of ICT into active pedagogies within the framework of learning activities, gives the learning process an additional dimension would make the teachers and the learners capable to build their knowledge in accordance with real mental and intellectual capacities, by seeking information himself to enrich their knowledge and develop their capacities.

The above analysis has enabled to observe the efforts made to improve the education quality. Nevertheless, discrepancies between the intentions of stakeholders in the educational field and the digital resources implementation in the practices of teachers remain observed. Based on this study, it believed that an emergency strategy based on the following approaches is necessary:

- Improving communication on innovation, within schools and in collaboration with the engineering program management.
- Revising the procedures for reproducing and distributing digital educational documents.
- Raising awareness among Moroccan teachers of the ICT importance in order to encourage them to adhere to educational innovation and better communication of the political orientations and projects put in place.
- Diversification of means of support for initiatives that actively and positively participate in changing the learning ways. These measures are likely to reduce the extent of the resistance intrinsic factors to change and the mutation that must be experienced in the teaching profession.
- Accelerating the process of setting up functional multimedia rooms in schools and establishing or at least updating and revitalizing teacher training plans on computer tools and their pedagogical uses to meet the great demand expressed by surveys in this area skills acquisition.

## REFERENCES


[1] Kirkwood, M., Van Der Kuyl, T., Parton, N. & Grant, R. The New Opportunities Fund (NOF) ICT training for teachers programme: designing a powerful online learning environment. Paper presented at the European Conference on Educational Research, Edinburgh, September 20–23, 2000.

[2] Becta (2004).A review of the research literature on barriers to the uptake of ICT by teachers Retrieved, from http://www.becta.org.uk, October 13, 2013.

[3] Empirica (2006).The Digital Divide Index—A Measure of Social Inequalities in the Adoption of ICT Retrieved, from http://www.empirica.com, December 20, 2012.

[4] Uluyol, Ç. and Sahin, S. Elementary school teachers' ICT use in the classroom and their motivators for using ICT British Journal of Educational Technology. doi: 10.1111/bjet.12220, 2014.

[5] Eddif A., Larhzil, H., Touir R., Majdoubi H., Kenafi J., Ouazzani H., Boutsougame A. Integration of Information and Communication Technologies in Education for Life, Earth Sciences, Physical and Chemical Sciences Teachers of the Secondary and College Level in Morocco: Reality and Aspirations. Computer Engineering and Intelligent Systems, Vol.7, No.5, 1-8, 2016.

[6] Karsenti T. Tchameni N. Educational integration of ICT: Action strategies and avenues for reflection. Ottawa: International Development Research Center (IDRC). The journal: The world of education, «What do you mean learner independence». vol.5, p.3, 2013.

[7] Frédéric HAEUW. Analysis of the training needs of higher education personnel for the use of ICT in the teaching-learning process. Paris: ALGORA, 55 p, 2002.

[8] Perreault N. Between the abacus and the computer, a passion: to teach. Meeting with... Mona Plamondon, professor of mathematics at CollègeÉdouard-Montpetit«, Clic, 36, p. 5-6, 2000.

[9] Mangenot F. Computer-assisted collaborative learning applied to languages. In R.Bouchard, F. Mangenot, Interaction, interactivity and multimedia, Notions en questions N ° 5, ENS Editions, pp. 11-18, 2000.

[10] El Mahdi, Y., Chiacou, B., Belkhayti, D., El Karrim, K., El Haluoani, H. The constraints linked to the integration of ti c in the teaching of the sci e nces of life and land in m aroc: European Scientific Journal. Edition vol. 10, No. 34.p 63-71, 2014.

[11] Basque J. Introduction to educational engineering (4th Ed.). Text written for the online course TED 6312 Instructional Engineering and Educational Technologies, (4), 55-63, 2017.

[12] Frackowiak, P. (2008). Obstacles to the development of ICTs in schools.
Available: ttp://www.cafepedagogique.net/lesdossiers/pages/2009/frack_obstaclesaudeveloppementtic.aspx. Last accessed 12.02.2013.

[13] Marcel Lebrun. Impacts des TIC sur la qualité des apprentissages des étudiants et le développement professionnel des enseignants: vers une approche systémique. STICEF (Sciences et Technologies de l'Information et de la Communication pour l'Éducation et la Formation), ATIEF, 18, 20 p. <hal-00696443>, 2011.

[14] Labioui H., Rhiat M., Driouich A., Ouhssine, M., Maqboul A., ElAssyry A. Practice of digital resources to develop the quality of education in Morocco: the case of the life sciences and earth, The International Institute for Science, Technology and Education. 3 (2), 65-73, 2015.

[15] Larose F., Grenon V. and Palm, S. Survey on the state of practices of appropriation and implementation of computer resources by teachers in Quebec, Center for Research on Educational Intervention, University of Sherbrooke, May 2004, p. 10, 2004.