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EVALUATION OF INTEGRATION OF NEW ICTS IN TEACHING-LEARNING OF SCHOOL SYSTEM

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Abstract- Information and communication technology in education (ICTE) is an important and indispensable component of the teaching-learning process. Its role is major in improving the quality of education. The introduction of ICTE in Moroccan school programs represents a key step in the reform of education. The government has adopted, since the year 2005, a very ambitious program named "GENIE". We conducted research in 2016 that targeted 145 middle and high school teachers in 25 schools in the provincial directorate of Meknes in Morocco. The objective was to assess the degree of use of ICT in the professional life of teachers. The questionnaires we distributed in this sense targeted three scientific disciplines: life and earth sciences, physics-chemistry, and mathematics. Although the GENIE program has been rescheduled over a period of 5 years (2009-2013), the integration of ICTE in the teaching-learning process of these three disciplines remains insignificant and very limited or even absent in several schools and the rate of teachers who have used these technologies does not exceed 24%. The rate of teachers who have never used the GENIE room reaches 97.2%.

Keywords: ICTE, GENIE Program, Life and Earth Sciences, Physics-Chemistry, Mathematics.

1. INTRODUCTION

New information and communication technologies, such as simulations, have become indispensable in many fields such as medicine, building design [1]. The use of ICTE in teaching is an essential means to improve the quality of teaching, especially in Morocco where most institutions suffer from a lack of didactic tools and laboratory materials [2]. ICTE can in this case substitute for the material.

Moreover, even in the presence of hardware, there are cases where it is impossible to do without this technology in science teaching. The various digital resources such as CAE (Computer Assisted Experiments) and simulation software form an inevitable tool in the teaching of science, especially to teach certain concepts that are too abstract, or to perform inaccessible experiments [3]. They make it possible to carry out experiments, which are not feasible in class. Indeed, the experimentation on the real is always not possible because of the incompatibility of the duration of the experiment with the school timetable; the impossibility of working on the real, because of the legal or ethical aspects (prohibition to experiment on vertebrates in certain countries or to provoke hyperglycemia in them); the danger of the chemical substances. Other problems of a technical and material nature are imposed such as very slow natural phenomena (the evolution of a hereditary character on a population scale), or invisible because of their dimensions (planetary or requiring electronic microscopy), or because of their natural situations in space (plate tectonics). The excessive cost of some materials and chemical reagents is also a reason for this.

In addition, ICTs promote the use of a competence-based teaching approach by implementing various active pedagogies such as differentiated pedagogy, in which each student evolves at his or her own pace, and autonomy pedagogy, which promotes a participatory teaching style in which the learner can actively invest in the construction of his or her own knowledge. This type of teaching practice allows for the achievement of autonomy in the learner, which is necessary for the development of his or her self-learning abilities and to guarantee continuous and sustainable learning.

In this context, the Moroccan Ministry of Education has set up the GENIE program (Generalization of Information and Communication Technologies in Education), which aims to generalize ICT in all Moroccan schools. This program was launched in 2005 and relaunched in 2009 as part of the emergency program over a period of 5 years (2009-2013). It focuses on infrastructure, adequate equipment, training of educators, the provision of digital resources and the development of the use of ICTE. Since then, 2838 schools have been equipped with multimedia rooms and multimedia suitcases and connected to the internet with filtering [4].

2. MATERIAL AND METHOD

We conducted this study in 2016 in twenty-five secondary schools, part of the provincial directorate of Meknes, thirteen of which were collegiate and twelve qualifying (high schools), each with a GENIE room. The study involved one hundred and forty-five teachers of the three specialties in the exact sciences (life and earth sciences, physics-chemistry, and mathematics), and twenty-five principals. We administered questionnaires relating to the use of ICT in the teaching practice of teachers, and to the exploitation of the GENIE room, with the aim of evaluating the integration of ICT in these practices and estimating the potential obstacles to this use. The data from the completed questionnaires were then entered and processed using SPSS (Statistical Package for the Social Sciences) software.

Figures 1, 2 and 3 show the distribution of respondents by cycle, gender and specialty; and Figures 4 and 5 show the distribution of respondents by age and seniority.

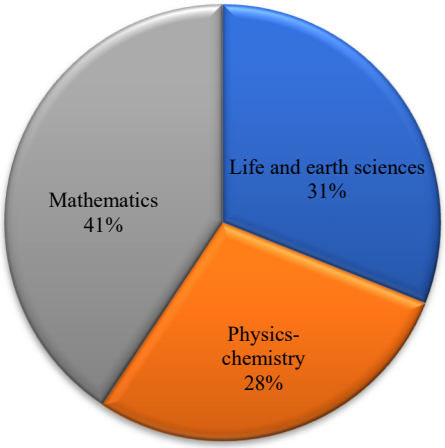

Figure 3. Distribution of respondents by specialty

More than 82% of the respondents have a seniority strictly superior to twenty years, and more than 86% of them have an age strictly superior to forty years. The other three parameters (cycle, gender, and specialty) are more or less homogeneous.

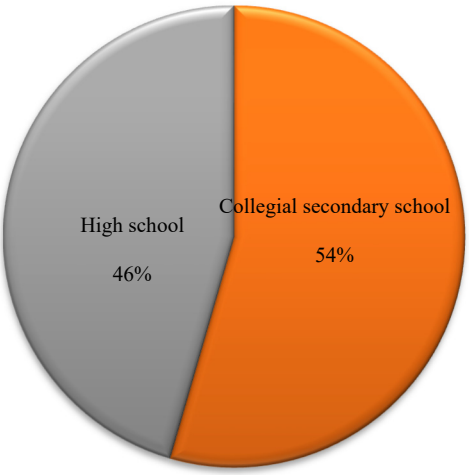

Figure 1. Distribution of respondents by cycle

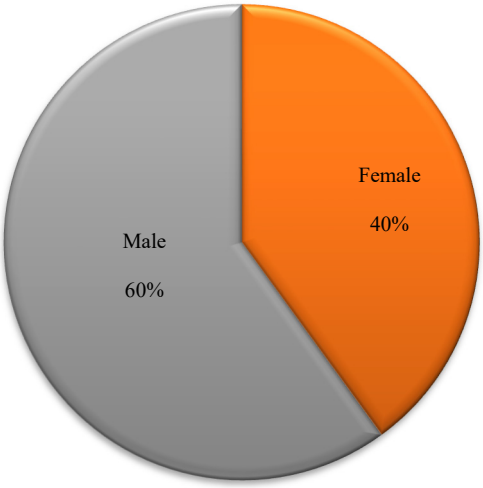

Figure 2. Distribution of respondents by gender

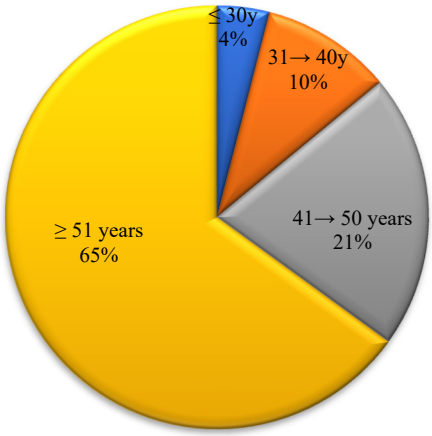

Figure 4. Distribution of respondents by age

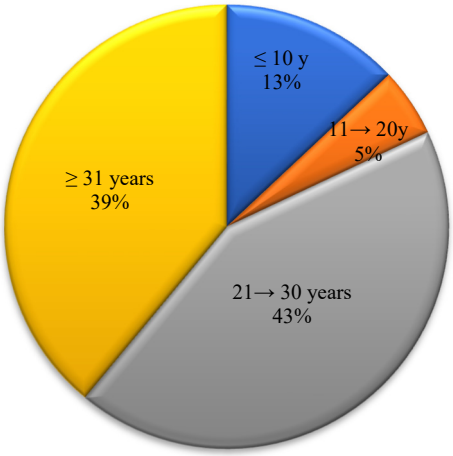

Figure 5. Distribution of respondents by seniority

3. RESULTS AND DISCUSSION

3.1. Principal Component Analysis

To assess the status of ICT implementation in Moroccan secondary schools, we used principal component analysis (PCA). The PCA allows us to measure the correlation factor (*R*) between the main component which is the use of ICT in the classroom on the one hand and other variables on the other hand, among others, the use of the GENIE room, the availability of digital resources including computer assisted learning (CAL), etc. Indeed, these variables are determinants in the use of ICT in the classroom. To complete the study, we used monovarietal and bivariate analyses.

3.2. Correlation of the Use of ICT with Operation of GENIE Rooms

The principal component diagram illustrated in Figure 6, shows that the two variables "uses of ICTE in the classroom" and "exploitation of the GENIE room" correlate very weakly and negatively with each other, in fact, the value of the correlation factor "*R*" is too low, it is equal to -0.014. This calls into question the use of ICT in teaching-learning, or else these ICTs could be exploited in other rooms such as the specific rooms of life sciences and earth sciences and physics-chemistry.

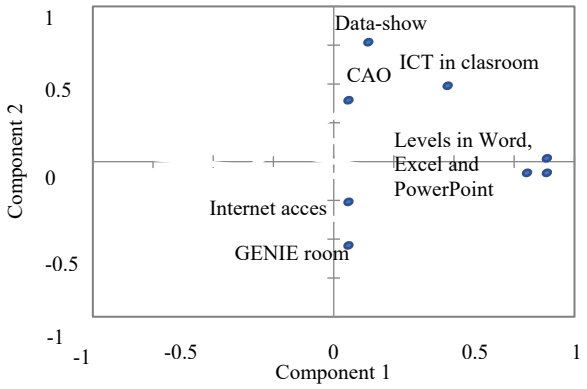

Figure 6. Principal component analysis

Although the percentages of teachers who reported using ICTs regularly, occasionally, or rarely in the teaching-learning process are equal to 12%, 23%, and 24% respectively as shown in the Figure 7, the majority of them (97.2%) do not or never exploit the GENIE room as mentioned in Figure 8 (97%). Abouzaid [5] also reported a value too low (22.5% for the integration of ICTEs regularly in the classroom) in a study that involved teachers of engineering sciences at the level of Greater Casablanca-Settat and Oriental in Morocco.

In the present study, the exploitation rate of the GENIE room is 2.8% as seen in Figure 8 (3%); it is extremely low compared to the value reported by the same author [5] in his study on ICTE in engineering sciences at the level of the Greater Casablanca-Settat and Orientale (35%). Nevertheless, these two values are much lower compared to the national average officially reported by the Ministry of National Education in its summary report of the emergency program (75%) [6].

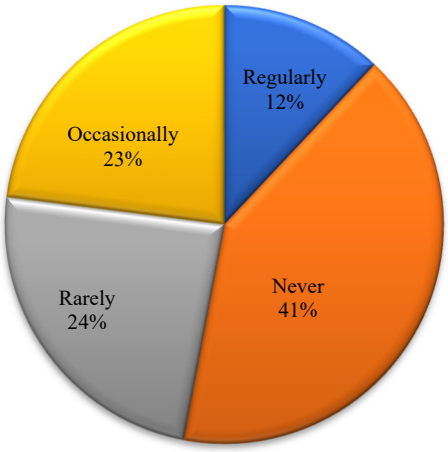

Figure 7. Rate of use of ICTE

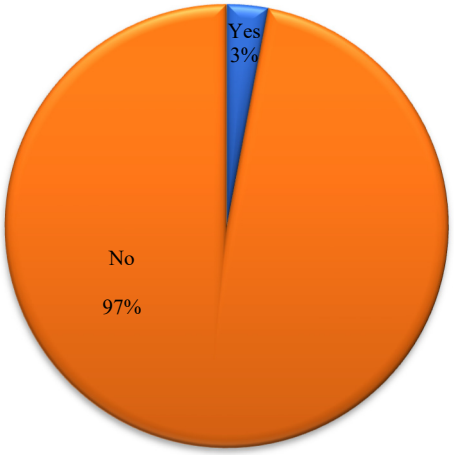

Figure 8. Rate of exploitation of the GENIE room

Figure 9 (bivariate analysis) shows that among the 2.8% of teachers using the GENIE room (4/145), only one (0.69%) uses ICT regularly and two (1.38%) rarely. On the other hand, most of the teachers who declared using ICT in their teaching practice regularly (11.72%), occasionally (23.45%) and rarely (22.07%) never used the GENIE room; among them, the life and earth sciences, and physics-chemistry teachers were content to use ICT in the specific rooms of these disciplines instead of the GENIE rooms.

The question then arises as to the involvement of learners in didactic situations including ICT outside the GENIE room, given that no other room is equipped with computer equipment suitable for the use of this technology (in the computer room only the "computer" discipline is taught). Moreover, 98.6% of the teachers questioned mentioned that these specific rooms and/or laboratories are not equipped with an internet connection as illustrated in Figure 10 (99%); the remaining 1.4% who stated that they work in specific rooms equipped with an internet connection only rarely or occasionally use ICT as seen in Figure 11.

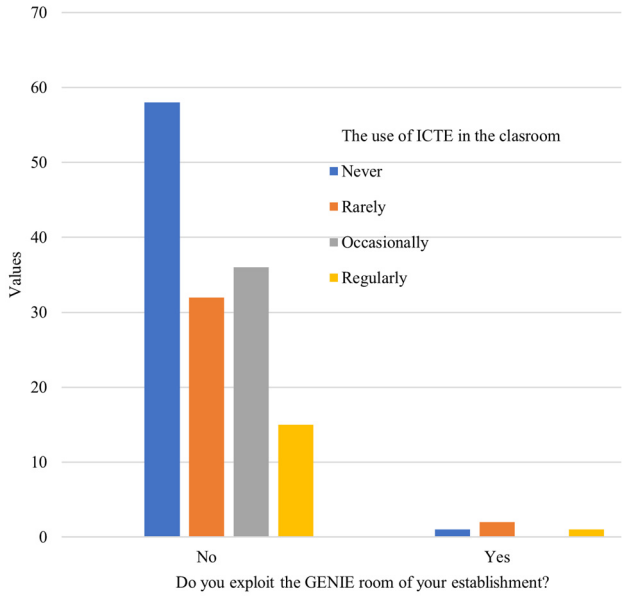

Figure 9. Ratio between these 2 parameters (use of ICTE and exploitation of the GENIE room)

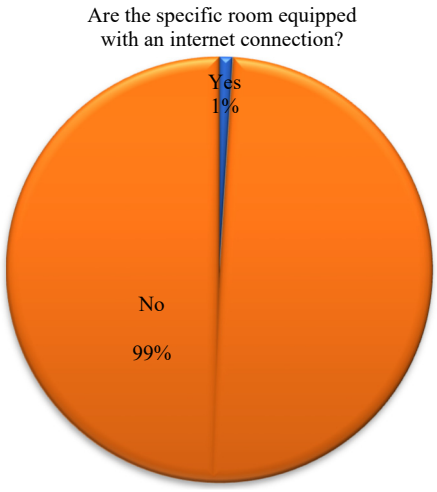

Figure 10. Availability of internet connection (a)

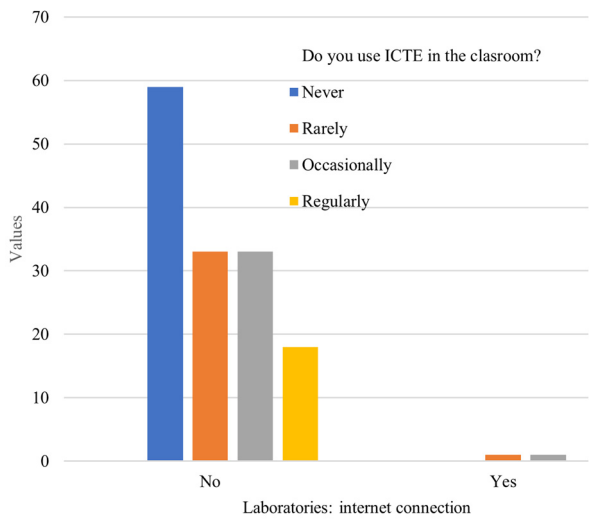

Figure 11. Use of ICT according to the availability of internet connection (b)

3.3. Correlation of ICT Use with Availability of Digital Resources

The two variables "use of ICT in the classroom" and "digital resources" are weakly correlated with each other; the correlation factor "*R*" is equal to 0.228. This could mean that the teachers declaring to have used ICT in their teaching practice do not have in their possession the digital resources necessary, or even inevitable, for the use of ICT.

Furthermore, according to the data in Figure 12, we can see that 80.7% of the respondents noted that the specific rooms and/or laboratories are not equipped with digital resources such as simulation software or CAD/CAM. For the 19.3% of the respondents who stated that they had these resources, the bivariate analysis in the Figure 13 showed that they generally only used ICT occasionally or rarely, if at all.

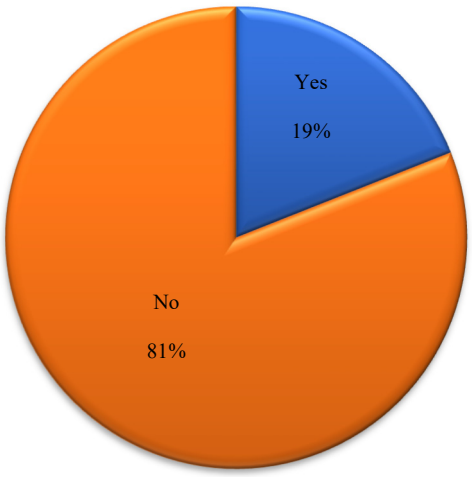

Figure 12. Equipping laboratories (life science and physics-chemistry) with digital resources (a)

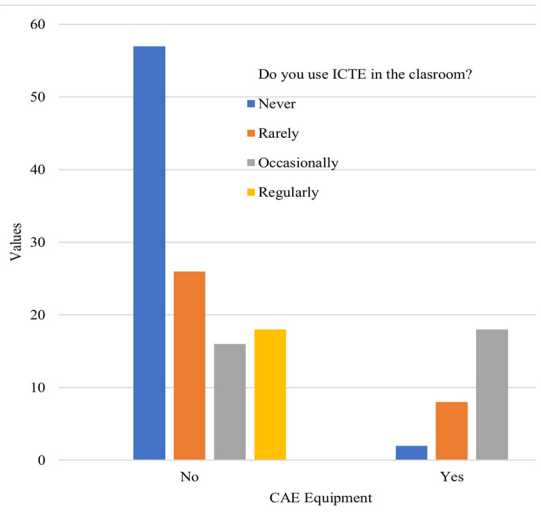

Figure 13. Using ICTE depending on the availability of appropriate software (b)

This paradox translating the lack of use of the GENIE room by the majority of teachers declaring to exploit the ICTE suggests that the meaning of the use of ICTE in the sense of these could be limited to the introduction of a computer tool; but also, and especially to the use of some

digital teaching aids (photos, videos) which are generally substituted for the adequate material of the laboratory. The laboratories of these disciplines are characterized by an under-equipment in appropriate equipment and by a lack of maintenance of that already existing due to the insufficient number of preparers [2-6]. Figures 14 and 15 show that the use of digital teaching aids is relatively favored by the availability of video projectors.

3.4. Factors that Hinder the Use of ICT

Figures 14 and 15 show that 45.5% of the respondents declare having data-shows and that only 66.66% of them use ICT occasionally or regularly. Moreover, the correlation value "*R*", in the Figure 6, between the use of ICTE and the availability of data-shows is equal to 0.411; this is a relatively important value, which confirms the previous hypothesis on the significance of the use of ICTE in the sense of teachers, as simple digital teaching aids (photos, videos).

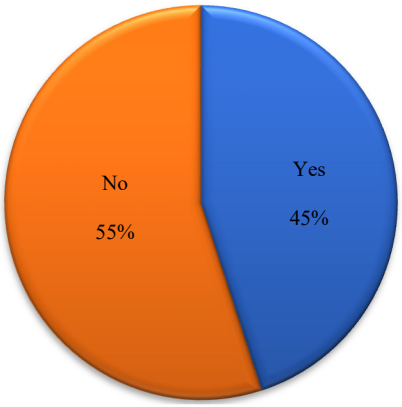

Figure 14. Equipment of specific rooms in Data-show (a)

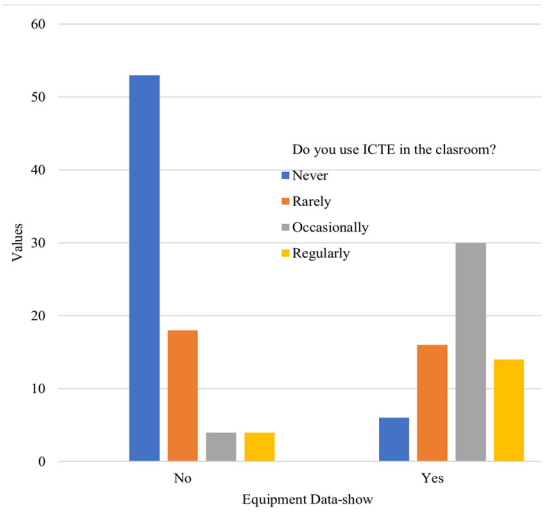

Figure 15. Use of ICTE according to the availability of Data-show in specific rooms (b)

The concordance of the whole of the preceding results does not leave any doubt on the truth of the insufficiency, if not of the absence of the exploitation of the rooms GENIE and the new technologies of information and communication in the Moroccan educational system.

Several reasons were mentioned by the teachers, some of which are listed in Figures 16, 17, and 18: insufficient computer training for teachers (39.3%), too many students (44.8%), lack of time (42.1%), low or no Internet speed in the GENIE rooms and difficulties in accessing the GENIE room.

3.5. Teacher Training, Overcrowding and Lack of Time

3.5.1. Teacher Training

Regarding continuing education, Morocco has allocated very significant financial resources, almost 244 million US dollars covering the investment and operating budgets for the period 2009-2012; this budgetary envelope aims to implement quality continuing education in ICT for all human resources in the national education sector in the schools; This budgetary envelope aims to set up quality in-service training in ICT for all human resources in the national education sector in the school system, i.e. 230,000 executives (teachers, administrators, educational inspectors) [7]. The objectives are: introduction to the use of computers and improvement of the use of ICT in teaching-learning, pedagogical administration, and pedagogical control.

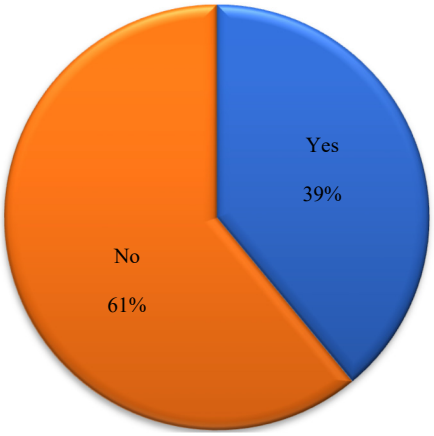

Figure 16. Factors hindering the use of ICTE: Insufficient teacher training

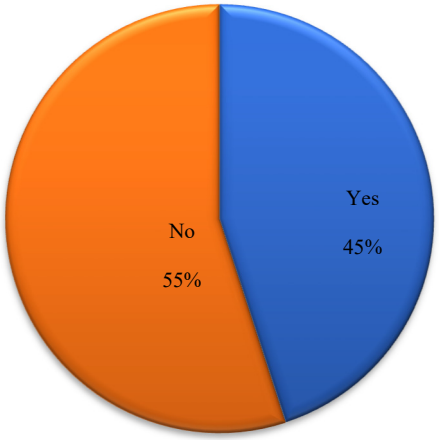

Figure 17. Factors hindering the use of ICTE: Overcrowding

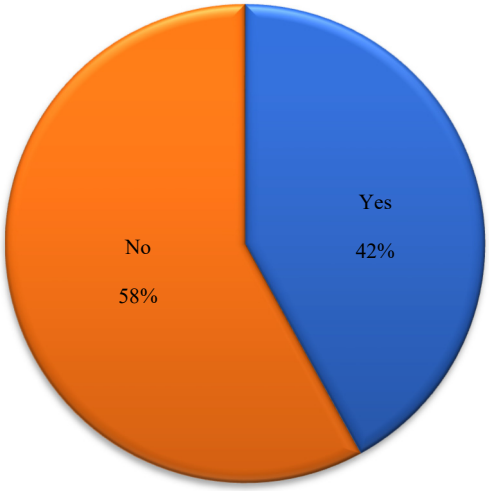

Figure 18. Factors hindering the use of ICTE: Lack of time

Figure 16 shows that only 39.3% of the teachers reported having undergone in-service training, if not self-training in the computer field; as for the impact of this training, we asked the respondents to choose a level that corresponds to them among these five: none, beginner, average, good and expert.

Figures 19, 20 and 21 show that the rate of teachers who declared themselves to be nil or beginners is the order of: 41.93% in Word, 66.13% in PowerPoint, and 53.23% in Excel, respectively. Despite the considerable efforts made in this area and the significant financial resources mobilized, it seems that the objectives are far from being achieved. These results are consistent with those reported by El Madhi in his study on the obstacles that hinder the integration of ICT in the teaching of life and earth sciences at the college in the provincial direction of Khemisset (Morocco) [8].

Today, Morocco has integrated a training module on ICTE into the initial training system within the regional centers for education and training professions. This is part of the qualification cycle for teachers (since 2012) and the training of pedagogical administration executives (since 2014) [9].

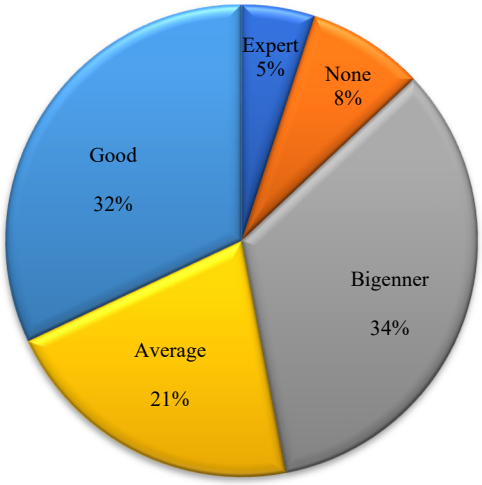

Figure 19. Teachers' computer skill levels in Word

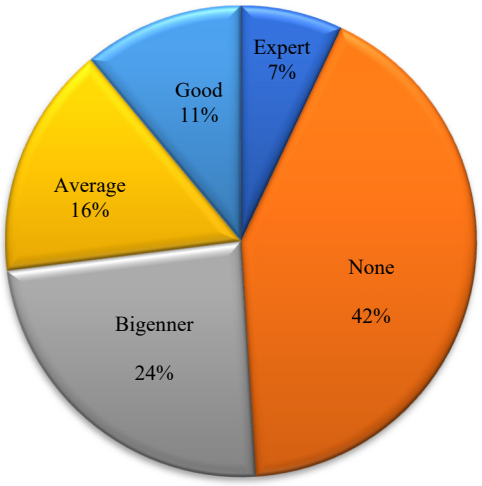

Figure 20. Teachers' computer skill levels PowerPoint

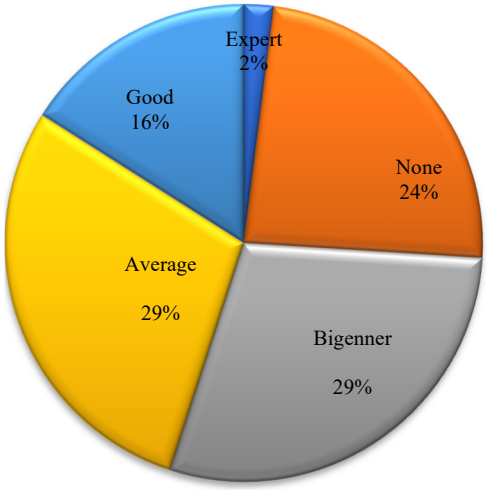

Figure 21. Teachers' computer skill levels in Excel

3.5.2. Number Of Students (Overcrowding)

44.8% of the teachers mentioned the problem of overcrowding as illustrated in Figure 17; it should be noted that the GENIE rooms and their equipment are almost identical in all the schools: a single room with the same number of computers... This poses the problem of managing this room both at the level of the entire school and at the level of each class. As a result of the emergency plan, Morocco has deployed nearly 28,000 computers in 2055 multimedia rooms, which is 1 computer for every 52 students [10]. However, this average does not reflect reality, as the actual equipment rate in the schools studied is in the order of 40 to 135 students per computer (40:1 to 135:1) [11], whereas Moroccan standards for promoting excellence call for an equipment rate of one computer per 10 students [12], a value that is far from being achieved. El Madhi reported in his study a student-to-computer ratio of 38:1 to 212:1 [8].

4. CONCLUSIONS

Although the supervisory ministry has put a lot of effort into the integration of ICT in education, the results are still unsatisfactory and too far from the objectives that

were targeted by the competent Ministry. This being the case, the budgetary envelope that was devoted to the GENIE program was very high, which means that the problem posed was rather a management problem.

The GENIE rooms do not meet international standards of quality: overcrowding: 1 computer per 40 to 135 students, resulting in a huge inequality of opportunity. This problem is accentuated by an extremely low internet speed. The training of teachers was poorly done despite the investment of very important funds.

Therefore, it is necessary to consider the introduction of programs and curricula that integrate inevitably ICTE and to introduce standards of this technology in the reference frameworks related to the evaluation of learners.

NOMENCLATURES

1. Acronyms

NICT	New Information and Communication Technologies
PCA	Principal Component Analysis
GENIE	GENeralization of Information and communication technologies in Education
CAE	Computer Assisted Experiments
CAL	Computer Assisted Learning

2. Symbols / Parameters

R: Correlation factor

REFERENCES

[1] F. Haqparast, B. Ahmadkhani Maleki, "Simulation in the Building Design Process", International Journal on Technical and Physical Problems of Engineering (IJTPE), Issue 20, Vol. 6, No. 3, pp. 109-115, September 2014.

[2] N. Ameziane, N. Lamhasni "Place of the Environment in the Moroccan Curricula of Life and Earth Sciences in the Secondary Education", The Journal of Quality in Education, Vol. 8, No. 11, pp. 11-30, April 2018.

[3] K. Bentaleb, S. Dachraoui, T. Hassouni, E. Al Ibrahmi, A. Belboukhari, M. Cherkaoui, "Effectiveness of Integration of New ICTs in Teaching/Learning of Quantum Concepts", International Journal on Technical and Physical Problems of Engineering (IJTPE), Issue 51, Vol. 14, No. 2, pp. 314-321, June 2022.

[4] I. Laaziz, "Engineering Program Promoting the Use of Free Software and Educational Resources", Open Education Day Morocco over Strategy Forum Cadi Ayyad University, Marrakech, Morocco, December 2016.

[5] A. Abouzaid, M. Taoufik, A. Moufti, A. Lamsalmi, "Integration of ICTS in the Teaching of Engineering Sciences in the Mechanic Sciences Technologies Sector in Moroccan High Schools: Reality and Obstacles", European Scientific Journal, Vol. 13, No. 13, pp. 476-491, May 2017.

[6] The Higher Council for Education, "Training and Scientific Research", Kingdom of Morocco, National Learning Assessment Program, Booklet of Sciences, p. 61, May 2009.

[7] Ministry of National Education, Higher Education, "Executive Training and Scientific Research", Kingdom of Morocco, For a new Breath of Education and Training Reform, Presentation of the "NAJAH 2009-2012" Programme, Rabat, Ministry of National Education, p. 324, 2008.

[8] Y. El Madhi, B. Chiahou, D. Belghyti, K. El Kharrim, H. El Halouani, "Constraints Related to the Integration of ICT in Teaching Life and Earth Sciences in Morocco", European Scientific Journal, Vol. 10, No. 34, pp. 143-153, December 2014.

[9] Ministry of National Education, Higher Education, "Executive Training and Scientific Research", Kingdom of Morocco, Decree No. 2-11-672 of 27 Muharram 1433, December 2011, Official Bulletin No. 6018, February 2012.

[10] Ministry of National Education, Higher Education, "Executive Training and Scientific Research", Kingdom of Morocco, For a New Breath of Education and Training Reform, Presentation of NAJAH Programme, Detailed Report, Rabat, Morocco, June 2008.

[11] N. Ameziane, W. Iraqi, T. Hassouni, "Integration of new ICTS in Teaching-Learning of Life and Earth Sciences: An Essential Pedagogical Approach", International Conference on Approach to Teaching Work through Didactics and ICT, Regional Center for Education and Training Professions, pp. 17-18, El Jadida, Morocco, May 2017.

[12] Ministry of National Education, Higher Education, Executive Training and Scientific Research, Kingdom of Morocco, Departmental memo No. 101, Creation of high schools of excellence (Qualifying Secondary), Rabat, Morocco, June 2009.

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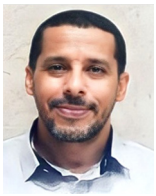

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