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PROFILING OF MOROCCAN HIGH SCHOOL PHYSICAL SCIENCE TEACHERS FOR IN-SERVICE TRAINING IN ICT: A CROSS-SECTIONAL EXPLORATORY STUDY

(Research Article)

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Abstract

In this article, we have addressed the question of determining the general profile of the concrete practices of our participants in relation to the pedagogical use of computers. To achieve such an objective, we worked with a sample composed of 50 teachers of physical sciences from different high schools in the region of TETOUAN. For this purpose, the content of the initial and continuous training of these teachers was analyzed in order to draw a general profile of their actual practices in this context. The results showed that our participants are not sufficiently equipped for the pedagogical use of computers in the classroom. On the contrary, they have more of a didactician profile. The contents of the training received were mainly focused on the didactics of a particular subject, either physics or chemistry. Faced with this situation, it seems to us that proceeding with the continuous training of teachers in the pedagogical use of computers in general, and ICT in particular, would be a good way to compensate for the low computer level of our teachers. This would also make up for the lack of initial training of the latter in the pedagogical use of computers.

Keywords: computer science, physical sciences, teacher training, teacher profile, ICT

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1. Introduction

1.1. Introduction to the problem

Despite the fact that societal and political evidence argues in favor of the integration and use of ICT in educational institutions, many teachers rarely use them for learning purposes (Larose, Grenon, Pearson, Morin and Lenoir, 2004). These technologies represent a key device for ensuring the development of intellectual and methodological skills. Even if the integration of ICT into schools is considered an innovation, it has yet to be fully implemented (Adamezewski, 1996). On this subject, Larose, Grenon and Palm (2004) had already pointed out that teachers have a low level of computer literacy and that the use of ICT in the classroom remains minimalist. This conclusion by these authors is sufficient proof of the relevance of continuing research into the process of implementing ICT in the school environment, and especially into the in-service training offered to teachers in relation to their professional development (Deaudelin et al., 2005).

Faced with this situation, a number of studies have been carried out in Western countries, taking a fresh look at the profile of teachers in relation to the integration of ICT in schools (Leclerc, 2007; Desjardins, 2005; Hall and Hard, 1987 and Rogers, 1995). Leclerc's (2007) study, in particular, identifies six teacher profiles: initiators, collaborators, observers, apprentices, hesitators and refractory. These profiles provide a clearer picture of teachers' attitudes to ICT integration.

There is also the UNESCO ICT Competency Framework (2022) for teachers. The aim of this repository is to provide the necessary support to countries around the world, enabling them to put in place comprehensive national policies and standards for teachers' ICT skills. It also aims to integrate ICT into all educational plans. In fact, the use of these technological tools in the educational sector can cover six main areas:

- Understanding ICT policies in education;
- Teaching programs and assessments;
- Pedagogy;
- The application of digital skills;
- Organization, administration and professional training of teachers.

Aware of the importance of ICT in this context, the Moroccan authorities have stepped up their efforts to promote the integration of these tools in order to improve the quality and effectiveness of teaching in their education system. Indeed, the authorities' manifest determination to achieve such a goal can be seen in lever 10 of the Education and Training Charter (National Education and Training Charter, 1999). In the same vein, we could also mention the GENIE 2009-2013 program, whose mission was to consolidate the widespread use of information and communication technologies (ICTs) and integrate them into the education and training system. Then there's the 2009-2013 Emergency Plan and the 2015-2030 Strategic Vision, both of which aimed to increase school enrolment, improve the quality of teaching and enhance the

performance of the education system. It is in fact within this logic of integrating ICT into the educational sector that the present study fits. Indeed, this study is a continuation of the one we carried out on the teaching of physical sciences in Moroccan secondary schools (Boumediane et al., 2022). The aim is to identify the obstacles and difficulties encountered by Moroccan teachers in using ICT in their work. In the present study, our aim is to determine the general profile of teachers' pedagogical use of IT. It must also be said that the results obtained from this survey will enable Moroccan universities to better adjust the content of initial and in-service teacher training programs on the pedagogical use of ICT. We will also be able to get a clear idea of our teachers' IT skills, with a view to adapting the technological solutions that will be proposed as part of our thesis work, or to offering them further training on this subject. This will give them the opportunity to update or develop their skills in this area.

That said, we have formulated our main question as follows:

What is the general profile of our participants' concrete practices in the pedagogical use of IT?

To unpack our research question, we have broken it down into several sub- questions relating to the content of our teachers' initial and in-service training in this specific context. In addition, we formulated other questions relating to our respondents' level of expertise in the use of different computer applications.

1.2 LITERATURE REVIEW

These days, IT tools are used in almost every area of society, including the education sector. In the field of teaching and learning, we now speak of Information and Communication Technologies (ICT), which enable teachers to run their courses smoothly. They also help to improve the quality of teaching and learning (IICD1, 2007). However, it is important to determine the true level of these teachers' use of these technologies, which they regularly use both in their private lives and in their professional practices. This will enable us to situate them in relation to pedagogical innovation. It should be pointed out that we are concerned here with the level of science teachers, especially those of natural sciences (physics and chemistry) in secondary schools. To address this concern, a number of studies have been carried out in Western countries, and in our theoretical framework, we have selected a few of these works to serve as a fundamental basis in the preparation of our research.

According to a study carried out in France by Gentil and Verdon (2003), almost 70% of primary and secondary school teachers criticize the lack of in-service training in the integration of ICT into teaching. They have never been trained in the use of these tools. This is a major obstacle to the use of such technologies in the classroom. The aim of this study was to analyze the relevance and contrast in the use of information and communication technologies (ICT) in teaching.

Another example is the study carried out by Leclerc (2007) to profile teachers in a French-language elementary school in Ontario with regard to ICT integration. In fact, the study sought to categorize the teachers consulted according to their degree of digital or technological competence. The final results of this research led to the classification of six distinct profiles:

initiators, collaborators, observers, apprentices, hesitators and refractory. It has to be said that these profiles enabled the researcher to gain a better understanding of her respondents' reactions to the use of ICT in the classroom, and to help those in charge of the school concerned to intervene more effectively.

Steiner and Mendelovitch (2016), in their published article on science and computer science teachers' attitudes towards integrating ICT into teaching with the aim of fostering meaningful learning in Israel, interviewed twelve science teachers following an open protocol to reveal attitudes towards ICT and its use in the classroom. The results showed that the majority of teachers in this study were not computer literate. Therefore, they only use ICT to visualize their teaching, such as upgrading classroom demonstrations.

The study prepared by Napal Fraile et al (2018), in Spain, also highlighted the lack of digital competence among secondary school teachers in that country. This study involved the participation of 43 pre-service secondary school teachers and aimed to assess their true level of competence in 21 sub-competencies relating to the five areas identified by the DIGCOMP project, using the rubrics provided in the Common Digital Competency Framework for Teachers (Spanish Ministry of Education). The results showed that these participants' conceptions of their level of digital competence were very low indeed.

Another study carried out in this context is by Tomczyk (2019). The aim of this cross- country research was to assess teachers' level of digital literacy (digital competence). To achieve this objective, the researcher used a competency test and a diagnostic survey to measure certain aspects of digital literacy, such as knowledge of the mechanisms of communication with other Internet users and the threats they pose. It should also be noted that 421 lower secondary school teachers from different countries were interviewed as part of this research. The results obtained at the end of the study showed that teachers of technical subjects (including ICT) had the best results, while those of natural sciences scored poorly.

In conclusion, all these studies have shown that science teachers need ongoing training to better integrate ICT into their teaching. In short, this training will enable them to innovate their teaching methods.

2. Method

The main aim of this research is to gain an insight into the opinions of our Moroccan high school physical science teachers regarding their skills in the pedagogical use of IT tools. This section focuses on the research procedures used to achieve the objectives of the study, and even the methodology deployed, the population, the sample, the tool and the verification of its validity and reliability, as well as the analysis of the results.

2.1. Study design

In order to achieve our research objectives, the descriptive-exploratory approach (Dufour, n.d.) was used for data collection, compilation and presentation. This method enabled us to gain a

clear idea of the use of these technologies in educational settings. It then enabled us to gain a better understanding of the phenomenon of ICT use in the teaching of physical sciences at secondary school level, and to draw significant and important conclusions.

2.2. Study participants

The population of this study is made up of 50 physics teachers from Moroccan high schools (54% male, 46% female). The majority, 66%, had less than 5 years' professional experience in the profession. They come from various high schools in the Tétouan region. The selection of these participants followed the snowball principle (Lafont, 2016).

2.3. Study tool

The tools used in this research are doctoral theses, scientific books and scientific journal articles related to the study variables. The other study tool used is the questionnaire prepared by the researcher and composed of two axes. It was delivered during the academic year 2022-2023 to people with the characteristics sought by the researcher.

2.4. Validity and reliability of the search tool

After completing the questionnaire with a panel of experts in physical science teaching, we checked the relevance of each question in the tool to the research objectives. The latter made modifications by reformulating, deleting or adding certain questions. They also helped structure the content. The final version of the questionnaire was only obtained at the end of this process.

2.5. Analysis of results

In order to successfully complete this stage of our research, and to better present the various data collected through the questionnaire, we used two data analysis and processing software packages: Excel and SPSS 26.

2.6. Microsoft Excell

It is the most basic tool used in terms of data analysis and processing, as it is directly incorporated into the Microsoft office package (HT Pratique, 2021). In fact, in the scientific context, this software enables the researcher to carry out multiple simple and practical operations such as the presentation, analysis and interpretation of data from spreadsheets. For our study, we used it to organize and structure our quantitative data.

2.7. SPSS

It is one of the most comprehensive statistical data analysis software packages available (HT Pratique, 2021). Indeed, from a scientific point of view, this software possesses a wide repertoire of automated functionalities facilitating the various operations of the researcher for descriptive and predictive analysis relative to the data collected in this context. For our study, this tool was

important in that it enabled us to carry out an efficient analysis and static processing of the data collected with the questionnaire.

3. Results

Our survey of teachers showed that 74% of them had taken courses specifically on the pedagogical use of computers during their initial teacher training. Only 26% had not.

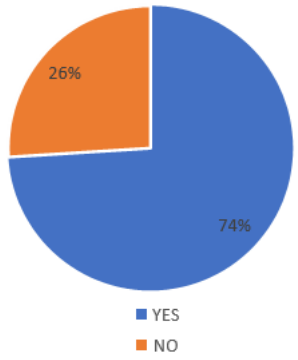

Figure 1: Respondents' opinions on the use of computers in their initial teacher training.

As for the actual number of training courses taken by the teachers who answered "Yes" to question number one of our questionnaires, a high rate of 48.8% of these participants indicated that they had taken three such courses. Another 32.6% confirmed that they had taken two specific courses of this type during their initial teacher training. However, the proportion of those who had taken it repeatedly was only 2.3%.

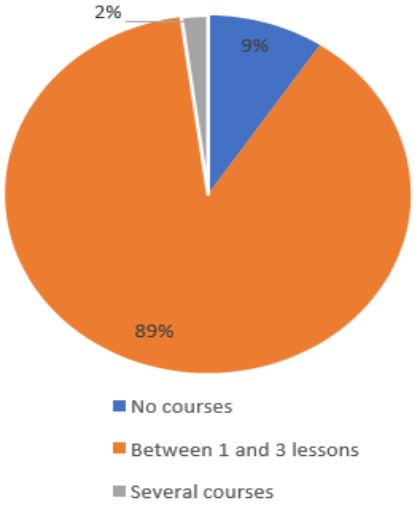

Figure 2: Respondents' opinions on the question of determining the actual number of computer training courses taken.

The results of this survey showed that 78% of our teachers have taken courses specifically focused on the use of ICT. Whereas 22% of them had never received such training in their initial training for their current profession.

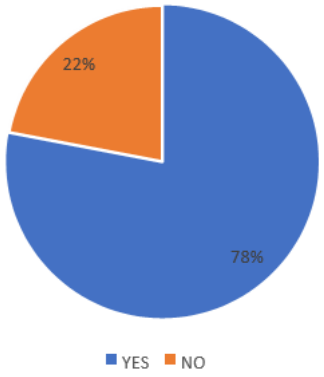

Figure 3: Respondents' opinions on the question of incorporating a specific ICT course into their initial teacher training

Our results show that in the category of teachers who had received ICT training, the majority (48.8%) said they had only received three specific courses on these technologies. On the other hand, 23.3% said they had only taken two courses on ICT in their teacher training. On the other hand, only 2.3% of teachers had taken several ICT courses.

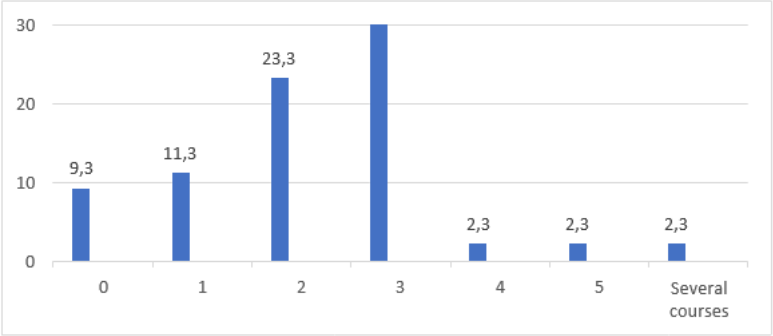

Figure 4: Respondents' opinions on the question of determining the actual number of ICT training courses they have taken.

The results of this survey also showed that, after their initial training in the current teaching profession, our participants benefited respectively from the following in-service training courses:

- Project-based approach (40%);
- Subject-specific didactics (92%);
- Collaborative learning (8%);
- Creation and management of learning communities (6%);
- Searching for information on the Internet (28%);
- Selection and evaluation of educational sites (2%);

- Use of educational software (16%).

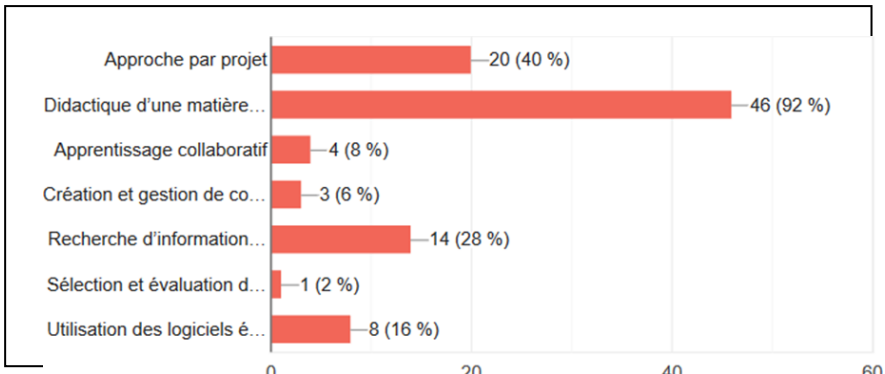

Figure 5: Our teachers' opinions on the in-service training they have received to date

The results of our survey show that since the end of their initial training, only 39.1% of teachers have improved their pedagogical skills in the use of computers. It should be pointed out that these teachers have attended only three training courses in this category. Another 32.6% of our teachers confirmed that they had received only two further training courses in this area.

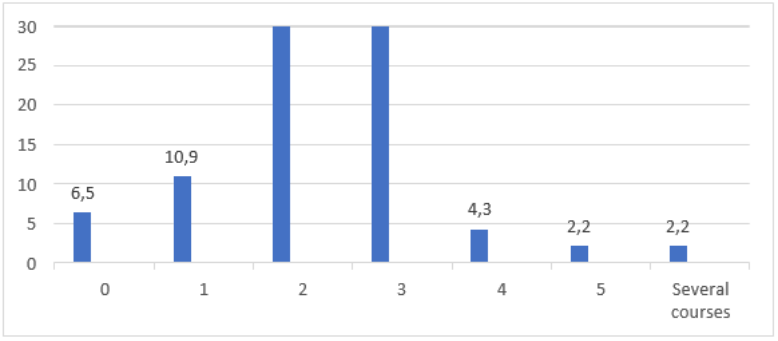

Figure 6: Teachers' opinions on the amount of in-service training they have received on the pedagogical use of computers.

Our results also show that since the end of their initial training, only 34.8% of our respondents have taken three training courses to improve their level of ICT use. Another considerable proportion (32.6%) of these teachers have taken only two further training courses in this respect.

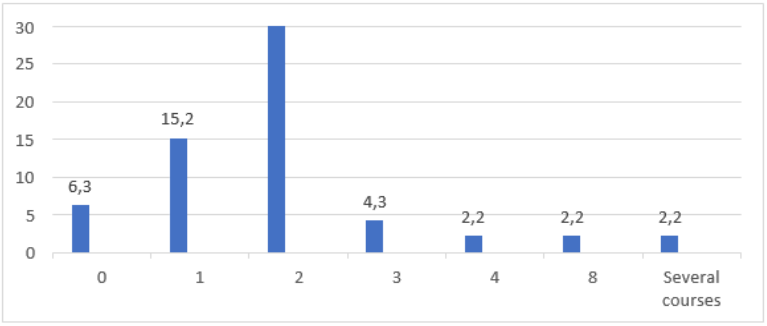

Figure 7: Our teachers' opinions on the amount of in-service training they have received on the use of ICT

For the question relating to the use of communication environments (Internet, e-mail), our results show that 58% of our participants have a "Beginner" level for this use. Only 22% have a "good" level in this respect.

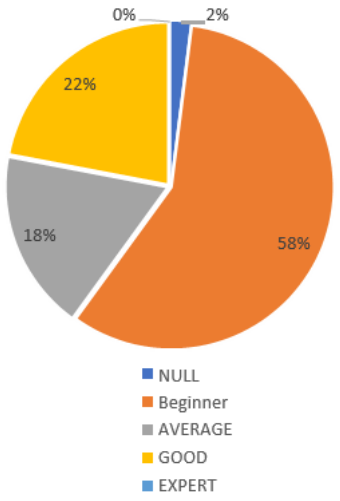

Figure 8: Teachers' opinions on the question in relation to their level of use of communication environments

Our results show that the majority (54%) of our teachers have a "Beginner" level when it comes to using current software (word processing, spreadsheets, etc.). Only 24% have a "Good" level.

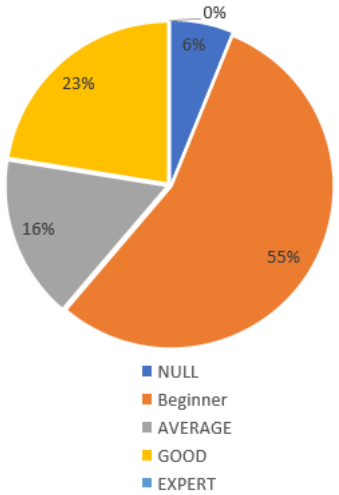

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Figure 9: Opinion of the teachers consulted on their level of use of current software (word processing, spreadsheet, etc.)

These results also show that most (55.1%) of our teachers have a "zero" level when it comes to using educational software. Only 6.1% have a "good" level of use

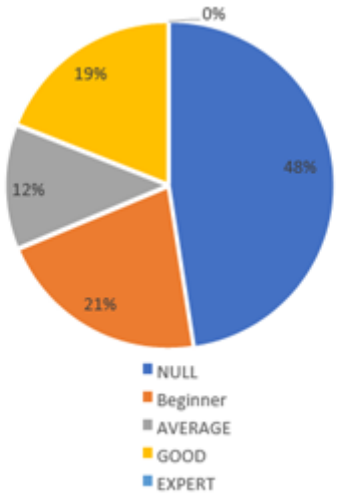

Figure 10: Teachers' use of educational software

In response to the question about the support teachers would like their school board or principal to provide for the pedagogical integration of ICT in the classroom, the majority of teachers suggested strengthening their working environment by:

- IT tools;
- Educational websites;
- Ongoing training on educational software;
- The use of computer simulators;
- Animations, etc.

4. Discussion

In this part of our work, we examine in turn the various numerical results of our survey. This discussion will enable us to better appreciate the level of competence of our teachers in the pedagogical use of ICT in their profession. Indeed, our study showed the following results:

- 74% of our participants were originally specifically trained in the pedagogical use of computers. Nowadays, the computer is considered a teaching tool. Therefore, the teacher's mastery of this tool is a beneficial asset for the success of the teaching-learning act. This, insofar as it helps to foster interaction between the teacher and his or her learners. This is why we suggest that the Moroccan authorities regularly organize these kinds of training sessions for our teachers. This will ensure that these teachers are sufficiently equipped to meet such a challenge. Less than half (48.8%)

of our respondents had taken more than three courses on this subject during their teacher training. These results are in line with those of the study conducted by Karsenti and Collin (2011).

- 78% of our respondents had taken specific courses on the use of ICT in their initial training for their current profession. Of these, only 48.8% had taken such a course three times in their initial teacher training. Today, ICT has become an indispensable tool for teaching and learning. From this point of view, it's a very good thing that teachers can benefit from such training. This will enable them to better adapt to the technological changes currently taking place in their profession. What bothers us, however, is the insignificant number of such training courses offered to our teachers. We believe that this type of training should absolutely be multiplied, and on a regular basis, to enable all these teachers to reinforce their intellectual skills in the use of ICT. We also believe that these technologies offer many possibilities to teachers, for example, by simplifying tasks, facilitating access to different sources of information, encouraging creativity and innovation, and so on. These results are in line with those of the study carried out by Amel Nejjari and Imane Bakkali (2017).

- Only 16% of our participants have benefited from ongoing ICT training. This mainly concerned training in the use of educational software. Ongoing training in ICT is a real opportunity for teachers, as it enables them to learn new pedagogical practices, acquire new theoretical knowledge, expand their technical culture and develop other skills related to the use of these technologies in the classroom (VILLEMONTEIX, 2005). However, if we look at the percentages of our teachers who have been equipped in this precise area, we can only say that this leaves something to be desired. We therefore need to think about strengthening their skills by offering them regular opportunities for such training. For this type of training will enable these educational actors to better perform their pedagogical tasks by responding correctly to the needs of their learners (Touria, 2019).

- Only 39.1% of our participants have improved their pedagogical training in the use of computers in the classroom. As we said earlier, the computer is an indispensable tool for teaching and learning. Indeed, this tool contributes to improving the quality of courses and learners' results (Bibeau, 2007 and Archambault, 2013). However, in our case, we find that most (60.9%) of our teachers have no mastery of this IT tool. Indeed, only 22% of these teachers have a "Good" level in this area. What's more, only 24% of our participants are good at commonly-used software such as PowerPoint, Word, Excel, etc. In view of all these figures, it's only logical that we should question the very quality of the teaching delivered to their learners. In view of this, we believe it is important to improve their computer skills through the organization of various continuing education courses linked to the pedagogical use of computers. These should focus on the teacher's use of new media in the classroom.

These results coincide with those of studies presented by ("The computer, an ally in school learning ", n.d.).

- The majority 55.1% of our teachers have no knowledge of the use of educational software. Indeed, educational software is software or computer applications put at the service of teachers in order to help them improve the academic performance of their learners (SJÖDÉN, 2015). From this result, we can quickly understand that there is a real problem with the quality of teaching delivered by our teachers. Based on the premise that IT in schools promotes learning, we can therefore deduce that their learners are certainly experiencing difficulties in their expected learning. Indeed, the teaching they receive is not at all modern, as it is not based on computers or ICT. These results are in line with those of the study conducted by Coulibaly (2019).

5. Conclusions

This study has shown that the teachers questioned are not equipped for the pedagogical use of computers, as the content of their initial and in-service training has been essentially oriented towards the didactics of a particular subject: physics or chemistry. In other words, this study has highlighted the inherent shortcomings in the computer skills of Moroccan high school physics teachers. Another finding of the study is the lack of in- service training in ICT, designed to enhance the ability of these teachers to use these technological tools in the classroom. In fact, for our respondents, this is a major obstacle to the development of their technological skills, as these abilities are nowadays prerequisites for teaching. The other bitter fact revealed by our study is that our respondents did not perform well when it came to using computers in the classroom. This is due to the inadequacy of the initial training program, which is fundamentally focused on pedagogy and didactics. In fact, this program places no emphasis on the mastery of computer tools, and software in particular, for future teachers. This being the case, the idea of in-service teacher training in the pedagogical use of IT in general, and ICT in particular, becomes an absolute necessity for us. Indeed, such training will certainly help to compensate for the low level of computer literacy among our teachers, given their lack of initial training in the pedagogical use of IT. In other words, the teachers in our study feel a strong need to update themselves regularly in terms of technology applied to teaching and learning. Furthermore, the present study has several limitations, but the most notable of all is the size of our sample. This is why, in future research, it would be important to assess the profile of Moroccan high school physical science teachers while working on a different and more representative sample than ours.

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