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EXPLORATORY STUDY OF MAIN TEACHING-LEARNING DIFFICULTIES IN PHYSICS AND CHEMISTRY AT SECONDARY CYCLE

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Abstract- National and international studies carried out over the last decade on secondary, college, and qualifying levels show that knowledge acquisition appears to be weak in science subjects, suggesting that learners are experiencing serious difficulties in learning these subjects. The aim of this study is therefore to identify the main difficulties in teaching and learning physics and chemistry at the secondary level (college and qualifying level), and then to propose appropriate solutions and alternatives to overcome these difficulties. To this end, we carried out an exploratory and descriptive survey of two samples, one made up of learners and the other of active teachers, all from the secondary cycle. The results show that a significant proportion of learners encounter remarkable difficulties in learning physics and chemistry. This could be due to a number of epistemic, didactic, and pedagogical factors. To overcome these difficulties, proposals were put forward by the teachers and learners interviewed.

Keywords: Teaching-Learning, Physics-Chemistry, Secondary Cycle.

1. INTRODUCTION

The teaching of physics and chemistry in the primary and secondary cycles aims to provide learners, on the one hand, with a solid scientific and technical foundation enabling them to gain a better understanding of the physical world around them and, on the other, to acquire the scientific concepts and skills needed to pursue higher education [9, 10]. This involves teaching and learning based on investigation, problem solving, the use of experiments, controlled and guided experimentation, as well as the use of analog and mathematical modeling [14]. Currently, physics-chemistry as a school discipline occupies a more or less important place in primary and secondary school curricula, as much as a subject involved in the development of the scientific mind [9, 10].

Morocco, like many countries around the world, has long participated in national and international evaluations and studies [12], assessing both the performance of its education system and the impact of its educational policies. TIMSS is one of the main studies in which 58 countries participate [15]. This study, conducted by the IEA, is carried out periodically, every four years. The main aim of this study is to assess the level of learners' achievement in mathematics and experimental sciences (physics, chemistry, life and earth sciences) [15]. The results of the latest TIMSS report [15] show that the commitment to quality education in Morocco is still a long way off, as evidenced by the low scores of learners in both national and international achievement tests [12].

However, the teaching of physics and chemistry in Morocco presents a number of epistemological, institutional, and didactic difficulties that are detrimental to the quality of teaching in this discipline [5]. Teachers of the subject often find that learners have little or no commitment to learning physics and chemistry [5]. Moreover, the problem that most influences the learning of physics-chemistry concepts is their poor understanding [5]. There seem to be several difficulties in teaching and learning physics and chemistry, both for learners and teachers. With this in mind, it is important to identify the origins and causes of these difficulties, which are detrimental to the quality of physics-chemistry teaching and learning in Morocco. To this end, we aim, through this exploratory and descriptive study:

- Identify the main difficulties faced by secondary school learners and teachers in physics and chemistry.
- Formulate appropriate solutions to overcome these difficulties.

2. THEORETICAL FRAMEWORK

The teaching of physics-chemistry in the secondary cycle, according to the programs and pedagogical guidelines for the teaching of physics-chemistry [9 and 10], aims to develop a basic understanding of the fundamental principles of this scientific discipline.

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Indeed, at the primary level, learners can be introduced to basic concepts such as matter, force, energy, and motion [11]. This can be done through hands-on activities and simple experiments. Teachers can use concrete examples to help learners understand physics and chemistry concepts through the use of game pedagogy, the analogical modeling process, the use of analogy, and by carrying out simple, fun experiments [11]. At the secondary school level, learning physics and chemistry becomes more in-depth and complex. Learners can begin to study subjects such as thermodynamics, electricity, magnetism, mechanics, and optics. Physics-chemistry courses at the secondary school level place greater emphasis on abstract concepts, mathematical modeling of phenomena, and practical laboratory experiments. Learners may also be exposed to real-world applications of physics and chemistry, such as engineering and medical sciences.

2.1. Teaching-Learning Difficulty

According to Brousseau [30], a teaching-learning difficulty refers to "a condition, a character of a situation that significantly increases the probability of non-response or erroneous response by the acting subjects involved in this situation. This actor may be a learner, but also the teacher, who may experience difficulty obtaining the learning he or she is planning". These difficulties, often temporary, are often the result of a complex interaction between biological, psychological, and environmental factors [30]. During the course of their schooling, learners may experience difficulties in their learning, leading to a limited understanding of the knowledge being taught. As a result, assessments carried out during the year may reveal performances that could lead to academic failure. For this reason, official documents [9, 10] encourage the introduction of an effective remedial approach for learners in difficulty [32]. These measures include a diagnostic assessment at the start of the school year to shed light on the learner's difficulties and ensure appropriate remediation, as well as developing cognitive and metacognitive strategies [33], facilitating the adoption of assistive technology tools, and maintaining self-confidence to stimulate their desire to learn in order to overcome their difficulties and regain an appropriate level of learning.

2.2. Towards a Category of Teaching-Learning Difficulties in Physics and Chemistry

The teaching and learning of physics and chemistry at the college and qualifying secondary level can be faced with several different types of difficulties [16]. These difficulties can be grouped into five main categories:

2.2.1. Lack and Inadequacy of Prerequisites and Prior Knowledge

Physics-chemistry, like any school subject, is based on fundamental, elementary concepts that present a foundation for acquiring and developing other, more complex ones. If learners have not mastered these basics, they may encounter difficulties in assimilating more advanced concepts [2, 3].

2.2.2. Conceptualization Problems

Physics and chemistry can sometimes seem abstract and complex, especially if learners fail to make concrete links with the world around them. A lack of hands-on demonstrations, laboratory experiments, or visualizations can make learning less engaging and more difficult [20].

2.2.3. Unsuitable Teaching Strategies

Some learners may find it difficult to adapt to the teaching method used for physics and chemistry. If teaching materials are not adapted to learners' level of understanding or if there is not enough interaction or exchange in class, this can lead to learning difficulties. Indeed, some teachers may use traditional teaching methods that focus on memorization rather than conceptual understanding. More active and interactive teaching approaches have been proposed to foster a better understanding of physics and chemistry [4, 19].

2.2.4. Lack of Motivation and Interest

Interest and motivation play a crucial role in learning physics and chemistry. If learners don't see the relevance of the concepts studied or aren't encouraged to explore their scientific curiosity, they can lose interest and face learning difficulties. Studies have shown that learners' engagement and interest in science have an impact on their academic performance [1, 17].

2.2.5. Difficulties Linked to Educational Environment

Either due to a lack of teaching resources and suitable didactic materials and well-equipped laboratories that can hinder physics and chemistry teaching and hands-on experimentation [7, 18] or due to traditional assessment focused on memorization that does not allow adequate assessment of practical skills and conceptual understanding in physics and chemistry. Indeed, learners who are not regularly exposed to practical exercises and concrete problems may find it difficult to apply theory in real-life contexts [6].

3. RESEARCH METHODOLOGY

In this study, we adopted an exploratory and descriptive method to identify the main difficulties associated with teaching and learning physics and chemistry at the secondary level (college and qualifying level) and to propose solutions and alternatives to overcome some of these difficulties.

3.1. Sample Study

The survey targets two samples: learners and practicing physics and chemistry teachers. Sampling for both populations was purposeful and snowballed. For the first sample, 247 teachers completed the questionnaire, and for the second, 311 learners. Both samples were spread over the twelve regions of Morocco. We present below some socio-demographic and socio-professional data for the two samples:

Table 1. Teachers' socio-professional data

Factor/Modality		Number	Percentage
Genre	Man	143	58%
	Woman	104	42%
Cycle	Middle school	151	61%
	High school	96	39%
Professional experience	Less than 5 years	76	31%
	From 6 to 9 years	72	29%
	From 10 to 14 years	42	17%
	From 15 to 19 years	35	14%
	More than 20 years	22	9%
Number of hours taught per week	Less than 10 h	17	7%
	From 10 to 20 h	85	34%
	From 21 to 24 h	145	59%
Average number of learners per class	Less than 20	21	8%
	From 20 to 30	51	21%
	More than 30	175	71%

3.2. Research Tool

Data collection was carried out using two pre-established, pre-validated questionnaires already employed in another study [21] on a restricted sample (30 teachers and 120 learners) and a restricted location (Casablanca-Settat region). The first questionnaire is aimed at practicing secondary school teachers, and the second at secondary school learners. Both questionnaires were self-administrated. They are composed of closed-ended questions, using the same scale, and open-ended questions. The questionnaire for teachers covers four fields:

- Teachers' socio-professional data
- Teaching methods and techniques
- Textbook structure and use
- Proposed solutions to overcome the difficulties identified.

The questionnaire for learners also covers four fields:

- Learners' socio-demographic data
- Learning difficulties are linked to the complexity of the concepts taught, the use of the textbook, and a lack of prerequisites.
- Learning difficulties linked to the teaching techniques used by the teacher
- Proposed solutions to overcome difficulties identified.

3.3. Statistical Processing

The data collected is processed and analyzed using Excel software. This enabled us to display the various graphs and calculate the various statistical coefficients associated with the study. The percentages in the various tables are expressed as a proportion of the number of people surveyed.

4. RESULTS AND DISCUSSION

4.1. Questionnaire for Teachers

The survey shows that only 28% of teachers (Question 1) recall prerequisites, yet prerequisites play a crucial role in understanding and interpreting new knowledge [22]. Only 26% of teachers (Question 2) use the problem situation, yet the problem situation is a learning situation that enables learners to construct their own learning and overcome misconceptions [23].

Table 2. Learners' socio-demographic data

Factor/Modality		Number	Percentage
Genre	Boy	103	33%
	Girl	208	67%
Cycle	Middle school	168	54%
	High school	143	46%

Only 20% of teachers (Question 3) manage learning based on the problem-based approach, i.e., the investigation method or the problem-solving method. These so-called active methods put the learner in activity by becoming the actor of his or her learning [24]. 17% of teachers (Question 4) only re-explain the lesson in the event of non-comprehension, of which 20% (Question 5) use another way to re-explain the lesson or part of it. This re-explanation forms a mode of pedagogical remediation that enables the learner to overcome the difficulties encountered during the lesson taught [25]. Only 36% of teachers (Question 6) use experimentation in their teaching, yet experimentation plays a very important role in learning physics and chemistry, helping to understand complex phenomena by isolating the phenomenon we want to observe to make it simple, training learners in the experimental approach, and developing in learners a set of experimental abilities and skills [9 and 10]. Only 14% (Question 7) of teacher's state that the textbook's pedagogical and didactic structure enables learners to achieve autonomy, yet one of the main functions of the textbook is to develop learner autonomy [26].

The survey also shows that only 38% of teachers (Question 8) surveyed claim to use ICT, although ICT offers several avenues of exploitation in physics and chemistry, namely diversifying teaching aids, facilitating understanding of complex scientific concepts through simulation, and modeling physical phenomena [13 and 27]. Only 24% of teachers (Question 9) support their learners as they work on learning activities. The aim of this support is to help the learner construct learning and overcome learning difficulties and obstacles [31]. Only 23% of teachers (Question 10) take account of inter-individual differences by resorting to pedagogical differentiation, yet this differentiation plays a very important role in academic success via the diagnosis and adaptation of inter-individual [28].

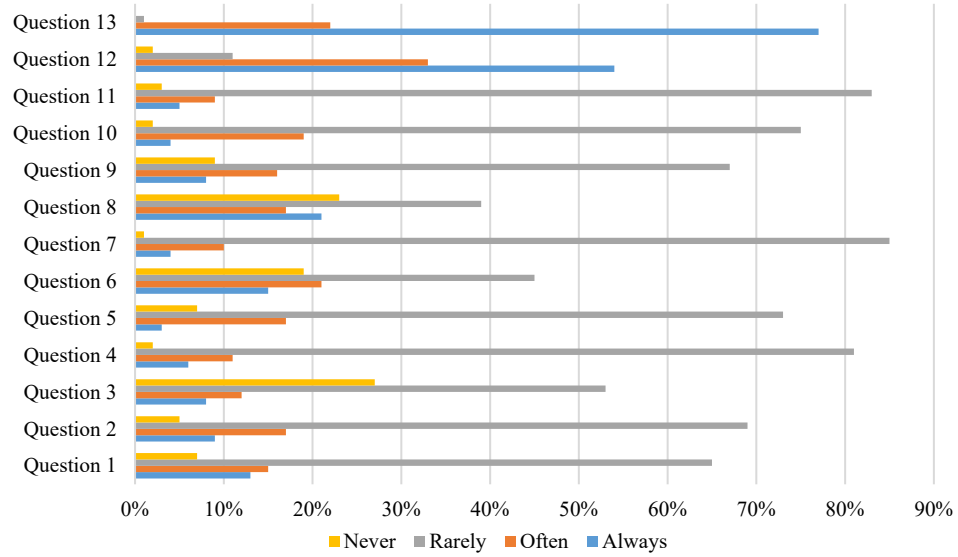

Figure 1. Teachers' responses concerning their teaching practices

Only 14% of teachers (Question 11) correct their learners' misconceptions, yet all effective and successful teaching and learning aim to change conceptions [29]. The majority of teachers surveyed (87%) (Question 12) carry out formative and summative assessments, yet learning assessment plays a crucial role in guiding teaching and learning actions and helps to regulate and improve these actions on an ongoing basis [8]. The teachers interviewed are all aware (Question 13) that a good understanding of scientific concepts is a crucial factor in academic success. Figure 2 shows the proposals put forward by the teachers surveyed, presenting suitable alternatives for overcoming the difficulties mentioned in Figure 1.

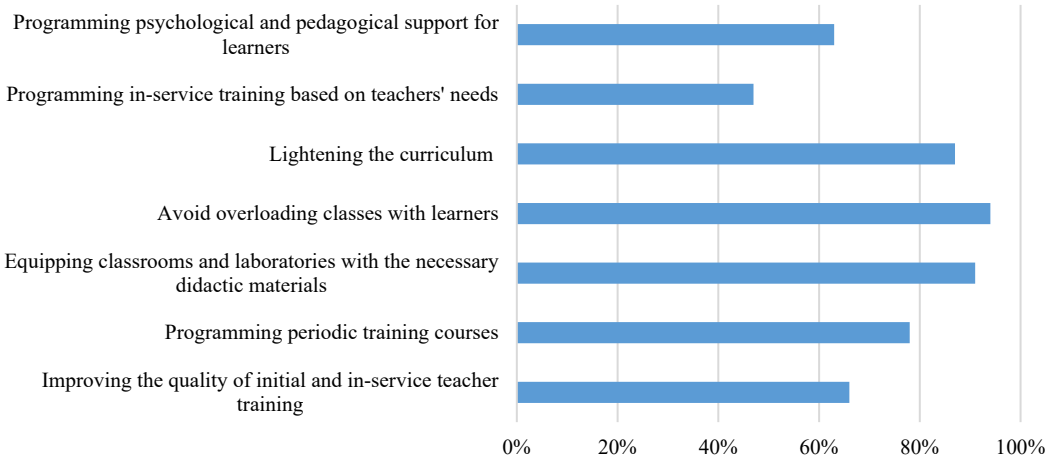

Figure 2. Teachers' suggestions for overcoming teaching-learning difficulties in physics and chemistry

The responses from the teachers surveyed highlighted a number of different problems affecting the quality of physics and chemistry teaching in the secondary cycle and suggested the following alternatives and solutions: 94% of teachers suggested reducing the number of learners per class. 91% of teachers suggested equipping classrooms and laboratories with the necessary teaching and learning materials, as well as chemicals. 87% of teachers recommend reducing the content of school curricula. 78% of participants suggest periodically scheduling in-service training to improve their teaching practices, 66% of whom suggest improving the quality of in-service training, preferably based on teachers' needs and constraints (47% of participants). For 63% of teachers, they recommend programming pedagogical and/or psychological support for learners whenever necessary.

4.2. Questionnaire for Learners

The learner survey shows that 74% (question 1) of learners consider physics-chemistry concepts to be complicated. Only 34% (question 2) of learners understand the course during a teaching-learning session. Only 17% (question 3) of learners ask teachers to re-explain the course to them if they don't understand it. The majority of learners (98%) find it difficult to do exercises on their own after a lesson (question 4). 56% of learners (question 5) say they revise their lessons outside of class.

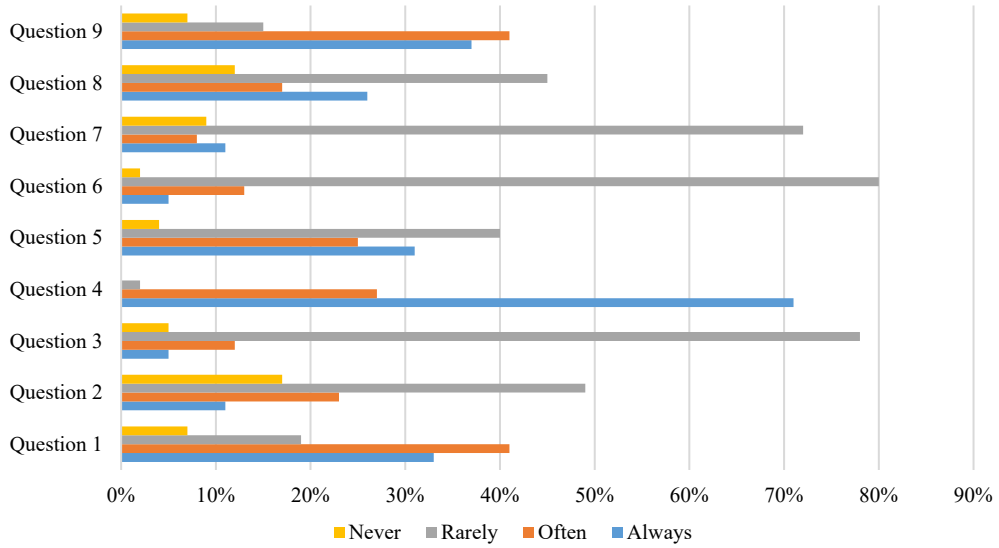

Figure 3. Learners' responses concerning their difficulties in learning physics and chemistry

The survey also shows that only 18% (Question 6) of learners can transfer their learning to everyday situations. Only 19% of learners (Question 7) state that their misrepresentations are corrected by the teacher. 43% of learners (Question 8) affirm their mastery of the mathematical tools used in physics-chemistry. 78% of learners declare that the textbook is easy to use. Taking into account the cycle variable, there is a strong presence of difficulties in number and gender in the qualifying secondary cycle compared to the college secondary cycle, which confirms the result obtained previously. For the gender variable, there is a slight predominance of boys over girls in terms of the presence of difficulties (52% for boys and 48% for girls). Figure 4 shows the suggestions made by learners to overcome their teaching and learning difficulties.

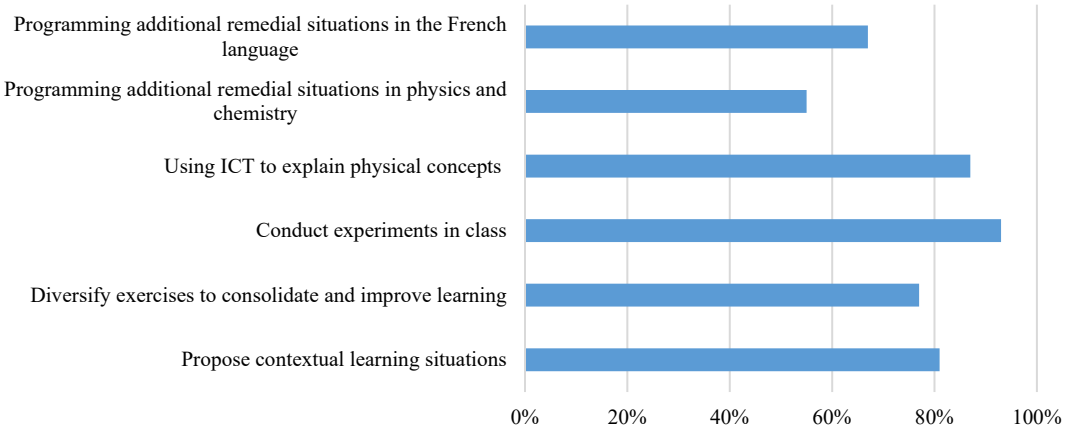

Figure 4. Learners' suggestions for overcoming teaching-learning difficulties in physics and chemistry

Analysis of the learners' responses shows that 93% of them suggest carrying out experiments themselves in order to shed light on the complexity of physical and chemical phenomena and develop experimental knowledge. 87% of learners suggested integrating information and communication technologies (ICT) into the teaching and learning of physics and chemistry to make the process more varied and interactive. For 81% of learners, they suggest adopting contextual learning situations in a way that makes learning motivating and of interest to them. As for 77% of learners, they suggest diversifying exercises to consolidate learning and remedy any difficulties encountered. 67% of learners suggest scheduling French language support sessions. For 55% of learners, they suggest offering additional support and remedial sessions in physics and chemistry to remedy difficulties encountered during the course taught and practice exercises.

5. CONCLUSION AND PROSPECTS

The results of this study highlight the most influential difficulties in teaching and learning physics and chemistry for learners and teachers in Morocco's secondary cycle. According to the teachers interviewed, teaching-learning conditions are not optimal, as the transmissive approach dominates and the pedagogies adopted do not take account of learners' individual cognitive and socio-cultural

differences. Teachers find it difficult to use so-called active teaching methods, such as the investigative and problem-solving approaches, as suggested by official pedagogical documents. So, it's up to teachers to involve their learners in socio-constructive learning by diversifying teaching-learning methods, accompanying each learner on his or her learning journey, and taking into account the school's resources and constraints. It is also important to involve learners in carrying out experiments, to recommend a system of remediation and psychological and pedagogical support, and to use information and communication technologies in the teaching and learning of physics and chemistry concepts. Curriculum overload has led to an emphasis on the memorization of definitions and formulas, to the detriment of an investigative, problem-solving approach and the development of skills and attitudes. The teachers interviewed are therefore calling for a reduction in curriculum content. What's more, current teaching practices may not allow for adequate development of the scientific mind due to the lack of time allocated to teaching and learning and the emphasis placed on knowledge rather than skills in current school curricula. In addition, learners' weakness in the French language leads to difficulties in expression and communication.

Faced with the difficulties encountered in teaching and learning physics and chemistry, learners and teachers propose similar solutions, including appropriate didactic transposition, simplification of content and physical and chemical concepts through the use of several alternatives such as analogical modeling, an increase in the amount of time devoted to teaching physics and chemistry, the use of manipulatives and experiments in the classroom with the learner, and the integration of information and communication technologies by mobilizing appropriate digital resources to facilitate understanding of scientific concepts.

The work carried out showed the urgent need for a reform aimed at improving teaching and learning conditions for physics and chemistry in Morocco. In this perspective and with the aim of proposing alternatives to some of the difficulties, we aim to design a training device based on the competency approach in order to orient and guide teachers to improve their teaching practices in physics-chemistry teaching.

NOMENCLATURES

TIMSS	Trends in Mathematics and Science Study
IEA	International Association for the Evaluation of Educational Achievement

REFERENCES

[1] M.H. Bakhat, "Teachers' Perceptions of Students' Motivation and Outcomes in the Moroccan Physics Classrooms", International Journal of Educational Development, No. 40, pp. 317-324, 2015.

[2] R. Barrass, "Physics Teaching Methods and Students' Performance and Attitudes", Studies in Science Education, Vol. 38, No. 2, pp. 201-232, 2002.

[3] A. Boutekiout, "Learning Difficulties in the Teaching of Physical Sciences and Mathematics in the 4th Year of Secondary School in Morocco: The Case of Learners in the Province of Agadir Ida-Outanane", International Journal of Innovation and Applied Studies, Vol. 22, No. 3, pp. 762-772, 2018.

[4] R.R. Hake, "Interactive-Engagement Versus Traditional Methods: A Six-Thousand-Student Survey of Mechanics Test Data for Introductory Physics Courses", American Journal of Physics, Vol. 66, No. 1, pp. 64-74, 1998.

[5] M. Jarmouni, "Learning Physics-Chemistry in the First Year of University in Morocco: Between Difficulties and Solutions", Moroccan Journal of Educational Research and Evaluation, Vol. 6, pp. 426-441, 2022.

[6] H. Lamsaadi, "Teaching Physical Sciences in Morocco: Between Theory and Practice", Questions Vives, Vol. 26, No. 1, pp. 1-15, 2017.

[7] M. Maha, S. El Jaafari, N. Taouil, "Critical Analysis of Factors Hindering the Teaching of Physical Sciences in Moroccan Public High Schools", Education Sciences and Society, Vol. 2, No. 2, pp. 127-139, 2020.

[8] M. Serghini, N. Mjahed, K. Raouf, L. Kamal, A. khyati, "Pre-Analysis of Teaching Practices: An Approach that Promotes Development of Reflexivity Case of Physics Chemistry Teachers", International Journal on Technical and Physical Problems of Engineering (IJTPE), Issue 54, Vol. 15, No. 1, pp. 140-147, March 2023.

[9] Ministry of National Education, Vocational Training, Higher Education and Scientific Research (MEN), "Programs and Pedagogical Guidelines for the Teaching of Physics and Chemistry in Qualifying Secondary Schools", Curriculum Department, Rabat, Morocco, 2007.

[10] Ministry of National Education (MEN), "Programs and Pedagogical Guidelines for the Teaching of Physics and Chemistry at the Secondary School Level", Curriculum Department, Rabat, Morocco, 2015.

[11] Ministry of National Education, Vocational Training, Higher Education and Scientific Research (MEN), "The new Primary School Curriculum", Curriculum Department, Rabat, Morocco, 2021.

[12] Ministry of National Education, "Preschool and Sports", The Roadmap 2022-2026, Rabat, Morocco, 2022.

[13] S. El Bakkali, K. Raouf, M. Serghini, M. Barkatou, H. Nebdi, "Gamification and Mathematics: Playing for Better Learning", International Journal on Technical and Physical Problems of Engineering (IJTPE), Issue 57, Vol. 15, No. 4, pp. 189-197, December 2023.

[14] J. M. Boilevin, "Teaching Physics Using Problem Situations or Open-Ended Problems", Aster, Vol. 40, No. 1, pp. 13-37, 2005.

[15] International Association for the Evaluation of Educational Achievement, "TIMSS 2019 International Results in Mathematics and Science", TIMSS and PIRLS International Study Center - Lynch School of Education and Human Development Boston College, USA, 2020.

[16] B. Willame, P. Snauwaert, "Difficulties Encountered in Learning the Concept of Concentration in Chemistry - Construction of a Didactic Tool to Highlight Student Errors when Using the Concept of Chemical Concentration", Spiral-E, Journal of Educational Research, Vol. 55, No. 1, pp. 177-205, 2015.

[17] U. Schiefele, "Situational and Individual Interest", K.R. Wentzel, A. Wigfield, (Eds.), Handbook of Motivation at School, Routledge, pp. 197-222, 2009.
[18] M. Taoufik, A. Abouzaid, A. Moufti, "Experimental Activities in the Teaching of Physical Sciences: The Case of Moroccan Secondary Schools", European Scientific Journal, Vol. 12, No. 22, pp. 190-212, 2016.
[19] N. Zqat, M. E. Afilal, Y. El Asri, "Analysis of Teaching Practices in Physics Class in Moroccan High School: Case of an Energy Teaching Sequence", Moroccan Journal for Educational Research and Development, Vol. 12, No. 2, pp. 77-99, 2019.
[20] K.S. Taber, "Exploring Conceptual Integration in Student Thinking: Evidence from a Case Study", International Journal of Science Education, Vol. 30, No. 14, pp. 1915-1943, 2008.
[21] N. Nasser, M. El Khouzai, M. Taoufik, "Physical Science Learning Difficulties Among Qualifying Secondary School Students in Morocco", American Journal of Innovative Research and Applied Sciences, Vol. 5, No. 2, pp. 119-125, 2017.
[22] A. Abbes, A. B. Belkaied, "Role of Prior Knowledge in the Understanding of Scientific Tets in 10-Year-Old", El Omda Journal of Linguistics and Discourse Analysis, Vol. 7, No. 1, pp. 698-715, 2023.
[23] C. Guyard, "Problem-Based Teaching", Master's Dissertation, pp. 9-22, High School of Teaching and Education, Paris, France, 2017.
[24] F. Salle, "Active Methods - A Factor in Student Success and Empowerment", Master's Dissertation, pp. 11-19, High School of Teaching and Education, Paris, France, 2019.
[25] C. Durand, "Remediation and Consolidation: The Place of Remediation and Consolidation Activities in the Learning Process", Master's Dissertation, pp. 6-15, High School of Teaching and Education, Paris, France, 2018.
[26] R. Baiben, D. Abadi, "Second-Generation Textbooks: Towards Learner Autonomy - The Case of the 5th Grade French Textbook", Multilinguals, No. 18, 2022.
[27] M. Mastafi, "Roles and Impacts of ICT in Teaching and Learning Mathematics: Perceptions of Secondary School Teachers", Training and the Profession: International Scientific Journal of Education, Vol. 28, No. 2, pp. 60-74, 2020.
[28] M. Moldoveanu, N. Grenier, C. Steichen, "Differentiated Instruction: Representations and Reported Practices of Elementary School Teachers", McGill Journal of Education, Vol. 51, No. 2, pp. 745-769, 2016.
[29] P. Dupliss, "Student Conceptions at the Heart of Information Didactics?", The 2nd GRCDI Seminar: Contexts and Issues of Information Literacy, Approaches and Issues in Information Didactics, pp. 1-18, Rennes, France, 2008.
[30] G. Brousseau, "Errors, Difficulties, Obstacles", DAEST Bordeaux 2 University, pp.1-7, Bordeaux, France, 2003.
[31] L. Lafortune, "Accompaniment-Research-Training of a Change in Education: A Process Requiring a Reflective Practice Approach", Training and Teaching Practices in Questions, No. 5, pp. 187-202, 2006.
[32] C. Berzin, C. Brisset, "The Status of Learning Difficulties: The Representations of Specialized and Non-Specialized Teachers", Education Crossroads, No. 25, pp. 91-101, 2008.
[33] M. S. Bosson, M. G. P. Hessels, C. H. Schlatter, "The Development of Cognitive and Metacognitive Strategies in Students with Learning Difficulties", Developments, Editions De Boeck Superior, No. 1, pp. 14-20, 2009.

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