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PHYSICAL SCIENCE TEACHERS VIEWPOINTS ON SRPCM TEACHING AND LEARNING MODEL

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Abstract- This article aims to identify and discuss the views of middle school physics and chemistry teachers on the effectiveness of an innovative electricity teaching/learning model called (SRPCM). In this study, a survey method was used, including a quantitative data collection through a questionnaire. Eighty-four middle School Moroccan physical science teachers were interviewed. The Statistical Package for the Social Sciences (SPSS) software was utilized for conducting a quantitative analysis in this study. The results show that most of the participating physical science teachers (81%) find this new SRPCM model interesting and believe it can add value to the teaching-learning of electricity concepts in middle school. also, respondents suggested a number of ways of improving this model, such as solving the problem of overcrowded classrooms and providing teachers with a bank of starting situations, teaching sheets that adopt this model and appropriate video relating to the analogy with hydraulics.

Keywords: Teacher Views, Middle Schools, Electricity, Teaching, Learning.

1. INTRODUCTION

Teaching electricity provides an opportunity for teachers to engage students in the subject of physical science by providing simple and interesting experiments, enriching materials, and conclusive investigations. In addition, teaching electricity can introduce students to the scientific process, sparking their curiosity and developing their creativity and critical thinking skills [1]. Thus, electricity is a large part of the middle school physical science curriculum. However, the concepts of electricity present great difficulties, given their abstract nature, which makes their understanding dependent on models, analogies and metaphors [2].

In addition, there is some confusion between the concepts of electricity and the terminology used in everyday life [3], such as the confusion between electricity and light. Indeed, electricity is called light in the Moroccan dialect [4]. Furthermore, students in the first and second year of middle school are not familiar with the concept of the atom and the electron. Therefore, the concept of electric current is presented through simple experiments that show its properties and effects without defining it [1].

In addition, among the physical science teaching methods recommended in official curricula of Moroccan middle school is the inquiry-based learning model [1]. However, traditional approaches to teaching physics still persist [5]. To this end, it appears that many physical and chemical teachers encounter this mode of instruction difficult to implement [6], in particular because of the time needed to put it into operation, lack of learner autonomy [7], crowded classrooms [8], and the insufficient experimental equipment needed to carry out the manipulations [9, 10]. In response to these challenges, numerous educators have embraced a teaching approach centered on knowledge transmission [11].

Table 1. Some difficulties encountered and the solutions suggested by SRPCM model [12]

Difficulties	Suggested solutions
Duration constraints	- Combining inside and outside classroom activities
Problems understanding notions	- Drawing analogies - Utilizing computer simulation
Insufficient of learning materials	- Utilizing computer simulation
Lack of autonomy and motivation	- Limited autonomy and motivation - Utilizing computer simulation
Overcrowded classrooms	- Utilizing computer simulation

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To overcome these problems, Raissouni, et al (2023) designed and tested a new model for teaching and learning electricity notions at Moroccan middle schools. This learning model is the result of combining the inquiry-based, flipped learning models and the electricity-hydraulics analogy [12]. Thus, the proposed solutions are grouped in Table 1. This teaching-learning model was implemented with a sample of 84 middle school students, a quasi-experimental design was meticulously implemented, encompassing the utilization of pre-test and post-test for both the experimental and reference groups. The outcomes unequivocally unveiled that the experimental group exhibited markedly superior mean scores compared to the reference group. However, the opinions of Moroccan physical science teachers regarding the effectiveness of this new model and their expectations for future improvement were not known.

To this end, in the present study, we will try to identify and discuss the views of a sample of physics-chemistry teachers practicing in various colleges in Morocco, about: the relevance of the Model (SRPCM); the main obstacles that hinder the effective use of the Model (SRPCM) and their proposals for a possible improvement. Hence the questions of our research are:

1. What are the teachers' views on the effectiveness of the Model (SRPCM)?
2. What are the main obstacles to the effective use of the Model (SRPCM)?
3. What are their suggestions for possible improvement of the (SRPCM) Model?

2. METHODOLOGY

2.1. Search Design

In this research, we used a qualitative methodology to gather and analysis collected results from the teacher's teachers interviewed through a questionnaire. This questionnaire was drawn up finalized after the conception and experimentation phase of an innovative model for teaching/learning electrical notions in Moroccan schools (SRPCM) [12], and then shared with participating teachers. This design allowed us to explore teachers' perspectives regarding the solutions proposed by our model, barriers that may hinder the implementation of our model and suggestions for improvement.

2.2. Instrument

In this study, we used a survey questionnaire (18 items) validated by three experts (two physical science inspectors and a teacher with long experience in teaching). It is mainly composed of four sections: The first one explains to the respondents the main features of our model (the steps and the solutions provided). The second section addresses the respondents' personal data and includes gender, teaching experience, academic level, and work area. The third section includes 11 items that address the opinions of the participating teachers towards the solutions proposed by our model. The fourth section discusses the participating teachers' opinions regarding this model, the barriers that may hinder its implementation, and suggestions for improvement. A five-point Likert scale was employed, encompassing the following response: 1: Strongly Disagree, 2: Disagree, 3: Neutral, 4: Agree and 5: Strongly Agree. was used in the third section. In the second section, closed questions were used. While in the fourth section the questions were open-ended in order to gather the maximum of the respondents' proposals. About the reliability of internal consistency, the value of Cronbach's alpha index was found to be 0.846, which shows that the homogeneity of our questionnaire is satisfactory ($\alpha \geq 0.8$).

2.3. Procedure of the Data Collection

After testing the SRPCM model with two groups of learners (reference and experimental) by [12], our questionnaire was developed using the Google-Forms tool, we shared the questionnaire via WhatsApp and Messenger with middle school physical science teachers at the start of the 2022/2023 school year. Data collected from respondents were analyzed using Microsoft Excel and SPSS 25.

2.4. Participants

The total number of respondents to the questionnaire was 84 physics-chemistry teachers. Table 2 provides background information on the teachers in question.

Table 2. General information about the participants

Factors		Percentage (%)
Gender	Male	75
	Female	25
Teaching Experience	< 5 years	15.4
	From 5 to 10 years	34.6
	From 10 to 20 years	16.7
	> 20 years	33.3
Academic level	baccalaureate + 2	7.1
	Bachelor	45.2
	Master	38.1
	Doctorate	9.6
School Area	Rural	38.1
	Urban	61.9
Regional Academy	Tanger-Tetouan-Al Hoceima	38.1
	Rabat-Sale-Kenitra	37.1
	Casablanca-Settat	14.3
	Fes-Meknes	3.6
	L'oriental	2.4
	Souss-Massa	2.4
	Beni Mellal-Khenifra	3.6
	Draa Tafilalt	2.4
	Marrakech-Safi	3.6

The total population (n = 84) is composed of three quarters of men against one quarter of women. Also, it is made up of experienced teachers (33.3%) who have been teaching for more than 20 years compared to only 15.4% who have less than 5 years. Among all respondents by academic level, 7.1% have a baccalaureate + 2's degree, 45.2% are licensed, 47.7% are Master's degree or above holders, which shows that among the subjects of our survey there are quite a few teachers with high-level degrees. Of the total population based on school zone, most respondents are from the urban school zone (61.9%) compared to respondents from the rural school zone

(38.1%). In the end, our population is predominantly distributed across the three regions: 38.1% from Tangier-Tetouan-Al Hoceima, 37.1% from Rabat-Sale-Kenitra and 14.3% from Casablanca-Settat.

3. RESULTS

Our survey findings can be categorized into two sections. The first part focuses on the perspectives of the surveyed teachers regarding the solutions proposed by the SRPCM model. The second part revolves around the potential obstacles that could hinder its implementation and the suggested improvements put forth by the respondents.

3.1. Opinions of the Participating Towards the Solutions Proposed by SRPCM Model

Through this questionnaire we want to know the teachers' opinions about our model. Thus, the opinions of the physical science professors regarding the solutions proposed by our model are presented in Tables 3 to 5. Table 3 presents teachers' views on the benefits of computer simulations in overcoming the challenges of implementing active methods in the classroom. This table shows that many respondents (82.9%) agree or strongly agree that using simulations in teaching helps overcome the lack of experimental equipment. In addition, most participants (75.6%) agreed or strongly agreed that computer simulations help improve motivation and interest in the classroom. Also, almost (67%) of respondents strongly agree or agree that computer simulations help to overcome problems related to overcrowding. On the other hand, most respondents (74.7%) either strongly or in agreement that the investigation approach based on Computer simulations can aid learners in surmount learning difficulties and offer a partial solution to misconceptions.

Table 3. The benefits of computer simulations

Cronbach's alpha	0.908						
Solutions proposed	Agree	Strongly Agree	Neutral	Disagree	Strongly Disagree	Standard Deviation	Mean
	Percentage (%)						
1- Computer simulations help overcome the lack of experimental equipment	29.3	53.6	6.1	9.7	1.2	4	0.93
2- Computer simulations help improve motivation and interest in class	28	47.6	14.6	8.5	1.2	3.93	0.94
3- Computer simulations help overcome overcrowding problems	14.6	52.4	10.1	18.3	7.3	3.51	1.091
4- The investigative approach based on computer simulations can aid learners in surmount learning difficulties	10.1	64.6	13.4	14.9	1.2	3.94	0.829

The results in Table 3 show that most participants (over 67%) selected "Strongly Agree" or "Agree" as their response to all items, however only a minority (less than 3.8%) selected "Strongly Disagree". Among the four items, the lowest mean was for item 1 (Computer simulations help overcome lack of experimental materials) with a mean value of 4 and SD (Standard Deviation) of 0.93, followed directly by item 2 (Computer simulations help improve motivation and interest in class) (M = 3.93; SD = 0.94). In contrast, the highest mean was for item 3 (Computer simulations help overcome problems related to overcrowding) (M = 3.51; SD = 1.091).

Table 4. The benefits of combining inside and outside classroom activities

Cronbach's alpha	0.934						
Solutions proposed	Agree	Strongly Agree	Neutral	Disagree	Strongly Disagree	Standard Deviation	Mean
	Percentage (%)						
5- Combining inside and outside classroom activities saves time	23.2	61	3.7	10.1	1.2	3.9	0.924
6- Students' work outside the classroom allows them to develop their individual work in terms of autonomy, research and scientific spirit	43.9	43.9	4.9	6.2	1.2	4.23	0.893
7- The students' work in class allows them to develop their collective and collaborative work	29.3	56.1	8.1	6.1	0	4.09	0.789

Table 4 presents teachers' views on the benefits of combining in-class and out-of-class work to overcome the challenges of implementing ABI in the classroom. This table illustrates that many respondents (84.2%) agree or strongly agree that combining inside and outside classroom activities saves learning time. In addition, most (87.8%) agree or strongly agree that students' out-of-class work helps develop their individual work in autonomy, research, and scientific thinking. Also, almost (85.4%) of the respondents strongly agree or agree that students' in-class work helps develop their collective and collaborative work. Thus, the lowest mean was item 6 (Students' out-of-class work develops their individual work in autonomy, research, and scientific thinking) with a mean value of 4.23 and SD of 0.893, followed directly by item 7 (Students' in-class work develops their collective and collaborative work) with a mean value of 4.09 and SD of 0.789. However, the highest average was for item 5 (Combining inside and outside classroom activities saves time) (M = 3.90; SD = 0.924).

Table 5. The importance of collaborative activities and the use of analogy

Cronbach's alpha	0.838						
Solutions proposed	Agree	Strongly Agree	Neutral	Disagree	Strongly Disagree	Standard Deviation	Mean
	Percentage (%)						
8- The rational utilization of hydraulic analogy allows to overcome the complexity of electrical concepts	108	46.4	29.8	13.1	1.2	2,48	0,898
9- Classroom debates improve students' analytical reasoning skills	34.5	32.4	6.1	6.1	1.2	1,89	0,865
10- Creating an environment of communication, interactive activities and social discussion helps to keep learners interested and involved	6.1	60.7	10.1	8.3	3.6	1,93	0,779
11- the new SRPCM model can add value to the teaching-learning of electricity concepts in college	13.1	67.9	10.7	6	2.4	2,17	0,819

3.2. Obstacles and Avenues for Improvement

Finally, for the main obstacles that may hinder the implementation of the model (SRPCM), here is a collection of teacher responses:
- Overcrowding of pupils;
- the absence of simulation equipment;
- Low involvement of learners;
- The insufficient hourly envelope;
- Communication problems;
- the low level of learners;
- Low student engagement, especially outside the classroom;
- The very busy programmer;
- Difficulties of concepts;
- The difficulty of properly using the analogy;
- The lack of continuous training for teachers in the field of computer science.
- Preparing simulators takes a lot of time and effort
- The teacher's lack of material motivation to make a double effort.

About the main points of improvement that teachers suggest, here is a collection of teachers' responses:
- The right choice of triggering situations;
- Leave the learners a wide range of initiative;
- Organize continuous training for teachers of the subject and motivate them;
- Equip schools with adequate computer equipment;
- Reducing the number of lessons;
- Working in workshops to carry out practical projects related to each lesson in order to motivate the students;
- Realization of model lessons by teachers using this model to learn more about the methodology of working with this model;
- Providing a tablet for each student to participate in the interaction with the simulation;
- Providing sufficient time for each of the lessons planned at each grade level.

4. DISCUSSION

The results of our study show that most of the participating physical science teachers (81%) find this new model interesting, it can add value to the teaching - learning of electricity concepts in college. Regarding the computer simulation as a solution to the problems of ABI implementation, most of the participants (more than 67%) selected "Strongly agree" or "Agree" as their answer to all related questions. To this end, the majority of teachers confirm that computer simulations help to overcome the lack of experimental material, these findings align precisely with the outcomes reported by other researchers in their respective studies [13, 14]. It helps to improve motivation and interest in the classroom [15] and that the investigative approach based on computer simulations can assist learners in surmounting learning challenges and partially address misconceptions that may arise, which is in similarity with the research findings of [16]. However, the question approved by the smallest number of respondents is "do computer simulations help overcome the problems associated with overcrowding?" This result is confirmed by the suggestions of the teachers interviewed, who call on the competent authorities to solve the overpopulation problem if the model is to function correctly.

In terms of the combination of inside and outside classroom activities, all questions were approved by the majority of respondents (over 84%). Thus, they accept that the combination of the work of pupils inside and outside classroom activities saves time, that the work of pupils out of class allows them to develop their individual work in terms of autonomy, research and scientific spirit and that the work of students in class allows them to develop their collective and collaborative work. These views are consistent with the findings of [17] who agree that merging Thus, they accept that the combination of the work of pupils inside and outside classroom activities saves time and empowers students. Regarding the analogy, just 57.2% of the respondents to the questionnaires agree or strongly agree that it allows to overcome the complexity of the concepts of electricity, this comes back to the facts that the analogy, if not adequately introduced, it can confirm some misconceptions, such as the conception of "exhaustion" of the current. This observation is consistent with the proposals of [18] who states that an analogy "can simplify complex phenomena, but it can also have drawbacks - providing false results when used outside its range of validity. To this end, some participants suggested producing and equipping teachers with suitable videos concerting the analogy with hydraulics.

With respect to the importance of collaborative activities, teachers agree that classroom discussions improve students' analytical thinking skills and the creation of a communication climate, interactive activities and social discussion helps to keep learners interested and involved, these results coincide with the conclusions of [19, 20]. At the end, the respondents propose some ways to improve this model, mainly to solve the problem of overcrowding, to lighten the curriculum of the physical sciences, to give more time to the lessons of electricity, to organize continuous training for the benefit of the teachers and to put at the disposal of the teachers of a bank of starting situation, pedagogical cards which follow this model, suitable digital resources and suitable videos concerting the analogy with the hydraulics.

5. CONCLUSION

This study attempted to examine the views of physical science teachers about a new mode of teaching and learning electricity at the middle school level, known as SRPCM. The results of this research show that this new model can help overcome the problems of teaching-learning electricity concepts in college, as indicated by the positive views expressed by the teacher respondents to our questionnaire. Research has clearly shown that physical science teachers agree that simulations help to overcome the lack of experimental material, help to improve motivation and interest in the classroom and that the investigative approach based on computer simulation can be used to help learners to surmount their learning problems and overcome some of the difficulties associated with misconceptions. Also, the combination of inside and outside classroom activities saves time and thus overcome the problem of lack of time. On the other hand, the integration of collaborative activities into electrical education will result in significant benefits for teachers and students.

However, there are several barriers to the effective use of this model in the classroom. For example, our research showed that not all respondents agree that simulations can solve the problem of classroom crowding, they suggest that the department solve the problem of overcrowding for the proper execution of the model. Also, the analogy must be properly introduced, otherwise it may confirm some misconceptions. In addition, the lack of technological tools, the lack of continuing education and the length of the physical science curriculum were major obstacles influencing the implementation of the new model in the classroom. Therefore, these barriers must be properly addressed by the appropriate authorities in order for the model to achieve the desired results.

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