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MOROCCAN TEACHERS' PERCEPTIONS TOWARDS STUDENTS' DIFFICULTIES WHILE LEARNING A FUNDAMENTAL CONCEPT IN BIOLOGY

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ABSTRACT

While numerous global studies have examined difficulties in learning homeostasis, there has been a notable lack of attention to this issue within the Moroccan educational context. Serving as a preliminary exploration, this study aims to examine Moroccan teachers' perceptions of students' difficulties in learning homeostasis and its role in maintaining the proper functioning of an organism. To do so, a sample of 87 Life and Earth Sciences high school teachers completed an online questionnaire. The research findings indicate that most teachers confirmed the difficulties faced by high school students, in understanding the concepts of "feedback" and "homeostasis in the whole body." To overcome these issues, teachers proposed the following: Increasing the time amount allocated to this unit, starting with fundamental ideas related to the hormonal and nervous systems, which are covered in middle school, and incorporating Information and Communication Technology (ICT) tools into the teaching of homeostasis among others.

INTRODUCTION

The comprehension of scientific phenomena, particularly students' misconceptions or alternative conceptions, has become a focal point in science education research (Westbrook & Marek, 1992). This emphasis extends to intricate concepts like homeostasis, integral to understanding the complexities of the human body and increasingly prioritized in secondary education (Tripto et al., 2013).

Over time, researchers have scrutinized students' perceptions of physiological homeostatic systems, revealing challenges in grasping the fundamental principles of homeostasis across the entire body (Klein & Zion, 2015). The concept of homeostasis stands as a cornerstone in comprehending the various regulatory mechanisms in physiology.

A comprehensive analysis of research findings from diverse global contexts akin to this study underscores the recurrent challenge of learners struggling with the concept in question. However, there is a notable scarcity of studies addressing this matter in the Moroccan context. This study aims to bridge this gap by investigating teachers' perceptions of the difficulties faced by first-year baccalaureate students (experimental science branch) in comprehending the notion of homeostasis.

To achieve this objective, the study addresses the following research questions:

1. What are the perceptions of high school earth and life sciences teachers regarding the difficulties encountered by students in learning the concept of homeostasis?
2. How do these teachers justify these difficulties?

METHODOLOGY

As stated above, this paper aims to explore Moroccan teachers' perceptions regarding the challenges encountered by first-year baccalaureate students in comprehending the concept of homeostasis. To gather insights, we employed a quantitative data collection method through an online questionnaire designed with precise, targeted inquiries. The data was gathered using a self-administered Google Form

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featuring a Likert scale and was disseminated across various platforms, including Gmail, WhatsApp, and Facebook teacher groups. The survey's execution was facilitated by a collaborative brainstorming session held within the ENS's laboratory, involving the research team (ERIPDS). This method was selected due to the suitability of questionnaires in quantifying data effectively into numerical representations.

The questionnaire used for data collection consists of two main parts, with the total of 16 questions. The first part contains10 closed-ended questions, while the second part contains 6 open-ended questions that leave enough floor for the respondents to elaborate more their answers.

The sample of this study consisted of 87 high school life sciences and earth sciences teachers, 43.3% of them are women and the other 56.7% are men. All the teachers hold Moroccan nationality, and affiliated with the various regional academies of education in Morocco, including Tangier-Tetouan-Alhoceima, Fez-Meknes, Casablanca-Settat, Rabat-Sale-Khenifra among others. At the time the data was being collected, the majority of teachers, 51.4%, have already had a notably good professional experience, with minimum of five years.

Respondents provided their answers anonymously online following ethical consent instructions. Data collection took place during the academic year 2020-2021. The collected data was processed using SPSS (Statistical Package for the Social Sciences), a tool utilized for statistical analysis, percentage calculation of responses, and drawing conclusions.

RESULTS

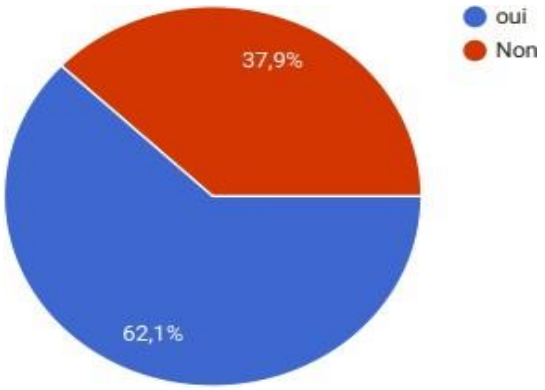

Figure 1: Teachers who are currently teaching first-year baccalaureate, experimental sciences.

The results obtained (figure1) show that 62.2% of respondents are currently teaching experimental sciences classes in the first year of the baccalaureate, while the other 37.9% of teachers are not currently teaching the level under study.

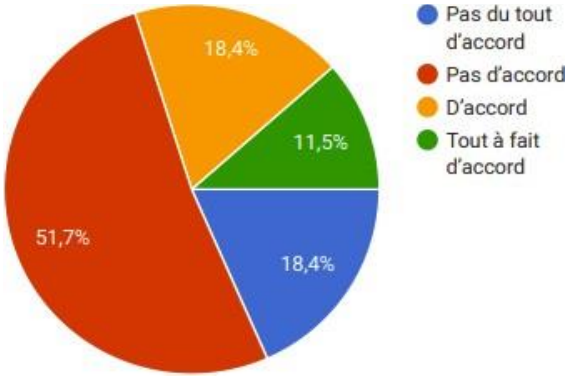

Figure 2: Teachers' Perspective on Learners' Difficulties in Understanding Blood Glucose as a Physiological Constant

Figure 2 shows that the majority 70.1% of participants in this survey confirmed that learners do not have any problems in understanding blood glucose as a "physiological constant". Only a small proportion 29.9% indicated that learners have difficulty with this notion.

Figure 3: Teachers' insights on learners' difficulties to grasp the notion "self-regulated system"?

As this graph indicates (figure 3), most of teachers 52.8% declared that learners have never had any difficulties in understanding the "self-regulated system". At the same time, 47.1% of them claimed that learners have difficulties in this regard.

Figure 4: Teachers' feedback on learners' understanding of the concept of "Feedback"

Figure 4 shows that 55.1% of teachers admitted that learners have problems in understanding "the notion of feedback". Yet, 44.9% of them said the opposite.

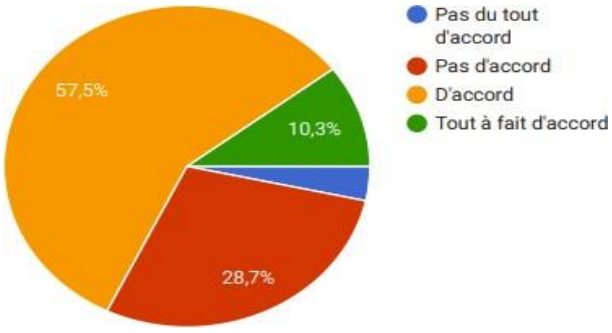

Figure 5: Teachers' feedback on learners' understanding of the concept of homeostasis throughout the body.

The results collected in this graph (figure 5) reveal that 67.8% of respondents said that learners find it difficult to assimilate the notion of homeostasis in the whole body. While a small portion, which represents 32.2%, of these teachers declared the opposite.

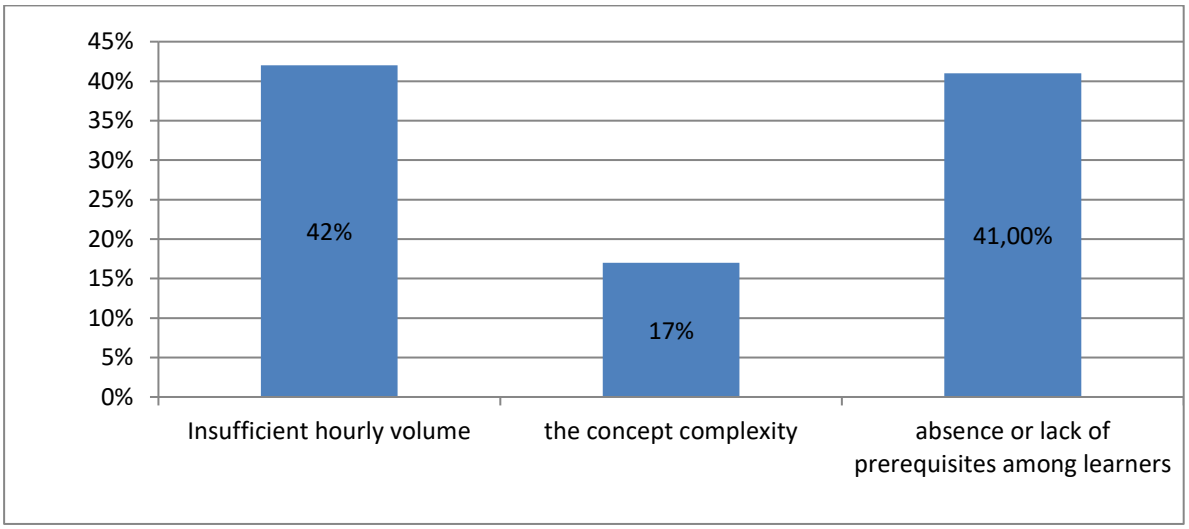

Figure 6: teachers' justifications of these difficulties

This weakness is justified in figure 6 as the majority of teachers argue that the amount of time allocated to teaching homeostasis is insufficient. Another group stresses the lack of prerequisites necessary to understand this concept, while the rest of respondents believe that the concept is difficult to understand.

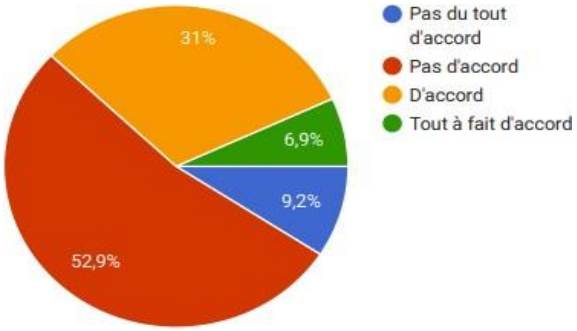

Figure 7: Teachers' feedback on learners' scores in the Hormonal and Nervous Communication Unit

Figure 7 indicates that 37, 9% of our respondents confirmed that learners' scores are low in the unit "hormonal and nerve communication" comparing to other units, while the majority, which represents 62.1%, deny this relationship.

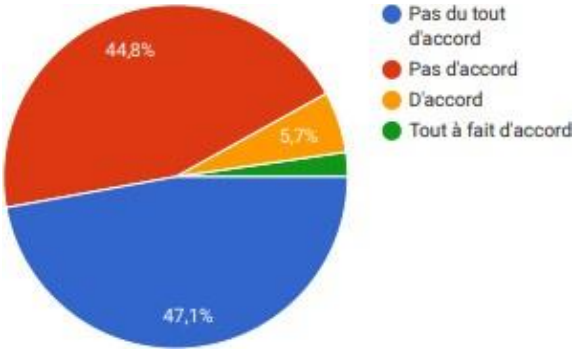

Figure 8: Teachers' understanding of the notion of homeostasis

Finally, figure 8 shows that 91.9% of the respondents report that they don't have any problems in understanding the concept of homeostasis, while a small minority 8,1% declare that they-themselves-find it hard to grasp this notion.

DISCUSSION

The initial phase of our investigation sheds light on the intricate challenges faced by Moroccan high school students, particularly those in the first-year baccalaureate program focusing on experimental sciences. Our primary objective is to delve into teachers' perspectives regarding the hurdles encountered by these students in grasping the concept of homeostasis within the Moroccan educational framework. Notably, this stage constitutes a preliminary study; subsequent phases will encompass interviews with students to corroborate teachers' perceptions.

Regarding our primary inquiry into teachers' views on students' difficulties with homeostasis, a consistent observation emerges. Teachers note that students struggle particularly with comprehending the terms "self-regulated" and "feedback," The teachers' observations resonate with the challenges articulated by Klein & Zion, who highlight the intricate terminology associated with homeostasis, including regulation, coordination, control, negative feedback, and dynamic balance.

A significant majority, 67.8% of surveyed teachers in our study, collectively acknowledge their students' challenges in grasping homeostasis. This shared perspective aligns with broader international research, ranging from Barrass (1948), Simpson & Marek (1988), Westbrook & Marek (1992), to recent studies like Mor & Zion (2019), affirming the universal struggle to comprehend homeostasis across diverse educational levels and age groups.

Turning to our second research question exploring teachers' justifications for these difficulties, our findings provide nuanced insights. Respondents highlight factors such as limited instructional time (only 13 hours dedicated to teaching homeostasis in the official curriculum), absence of prerequisite knowledge among learners. Additionally, teachers emphasize the inherent complexity of the concept itself as a substantial impediment.

These identified challenges align with broader research findings on the complexities of understanding homeostasis. Numerous studies delve into why homeostasis remains a significant challenge for learners, shedding light on the cognitive aspects involved in comprehending this concept.

According to Westbrook & Marek (1992) contend that understanding homeostasis necessitates several cognitive abilities, emphasizing the need to discern simultaneous occurrences and recognize various stages within each process. This underscores the multifaceted nature of cognitive processing involved in understanding the dynamic balance within living organisms.

Assaraf et al. (2011) argue that comprehending the mechanisms maintaining a stable inner environment goes beyond an individual's life experiences, requiring abstract thinking. This underscores the fundamental cognitive demand that students must meet to grasp the intricacies of homeostasis.

Moreover, Tripto et al. (2013) reveal that learners often perceive the body's internal processes, including thermal regulation, as a "black box," contributing to the conceptual opacity associated with homeostasis and its challenges in comprehension.

Building on these perspectives, researchers Klein & Zion (2015) posit that homeostasis is inherently difficult due to its fusion of concrete sensory aspects

and abstract scientific elements, posing a cognitive challenge for learners navigating between tangible experiences and theoretical principles.

In summary, our study on the difficulties faced by Moroccan high school students in learning homeostasis aligns with the broader discourse on the cognitive demands and conceptual intricacies of this foundational physiological concept. These varied perspectives collectively emphasize the complexity of homeostasis and its potential impact on learners' perceptions and understanding.

Moving forward, our study will progress with interviews with students to validate and enrich the findings from teachers. Additionally, a didactic analysis of the relevant curriculum will enhance our understanding of how homeostasis is presented in educational materials. In conclusion, while this study is preliminary, it sets the stage for a comprehensive exploration of the challenges surrounding the understanding of homeostasis among Moroccan high school students.

CONCLUSION AND RECOMMENDATION

In conclusion, the findings of our study shed light on the perceived challenges faced by Moroccan high school students in comprehending the intricacies of homeostasis, as reported by their teachers. These results, though preliminary, underscore the need for further validation through interviews and assessments involving students at the same academic level and within the same field. This iterative process aims to bolster the reliability of our conclusions and gain deeper insights into these difficulties.

Aligned with the insights provided by participating teachers, we propose a multifaceted approach to address the identified difficulties in understanding homeostasis. Our recommendations include increasing dedicated teaching hours, devoting time to teaching the basics of the “hormonal and nervous system” in the secondary school; and integrating Information and Communication Technology (ICT) for more effective education. Additionally, we suggest a shift in the curriculum towards practical activities to reinforce theoretical knowledge. We advocate for careful consideration and implementation of these measures to improve the efficacy of homeostasis education in Morocco.

This preliminary study serves as a foundational element within a broader research framework. Future investigations will delve deeper into students' perspectives through oral interviews, providing valuable insights into the challenges they face. Furthermore, a comprehensive didactic analysis of the textbook will be conducted to scrutinize instructional materials thoroughly. Looking ahead, our subsequent study will prioritize exploring the pivotal role of Information and Communication Technology (ICT) in teaching and learning life sciences and earth sciences. Despite the inherent limitations of the current study, it establishes a robust foundation for continued exploration of this issue within the Moroccan educational context, contributing to the ongoing dialogue on enhancing science education.

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