

## Exploring the potential of the Plickers tool for Science teaching: an analysis of the assessment of water-related concepts

### ARTICLE

Luan Daniel Silva Ferreira<sup>i</sup> 

Universidade Federal do Pará, Belém, PA, Brasil

Dábila Carla de Almeida Sobrinho<sup>ii</sup> 

Universidade Federal Rural da Amazônia, Belém, PA, Brasil

### Abstract

The objective of the work was to use the Plickers tool in teaching Science and promote an evaluative analysis of learning. The study involved 32 postgraduate students from the Educational Technologies for Teaching Practice in Basic Education course, divided into four teams. Students participated in theoretical and practical classes on the importance of water, with activities using Plickers to assess their understanding of the concepts. Five questions were created and answered by the teams, using the answer cards generated by the tool. The teams' responses were categorized taking into account adherence to the concepts and level of participation. The teams' performance was satisfactory, as there was an overall average of 90% correct answers for the five questions applied. Plickers is an efficient assessment tool and provided immediate feedback to educators, promoted active student participation and encouraged critical thinking.

**Keywords:** Learning. Understanding. Active participation. Critical thinking.

### Explorando o potencial da ferramenta Plickers para o ensino de Ciências: uma análise da avaliação de conceitos relacionados à água

### Resumo

O objetivo do trabalho foi usar a ferramenta Plickers no ensino de Ciências e promover uma análise avaliativa da aprendizagem. O estudo envolveu 32 alunos de pós-graduação do curso de Tecnologias Educacionais para a Prática Docente no Ensino Básico, divididos em quatro equipes. Os alunos participaram de aulas teóricas e práticas sobre a importância da água, sendo aplicadas atividades com o Plickers para avaliar a compreensão dos conceitos. Foram elaboradas cinco questões e respondidas pelas equipes, utilizando os cartões de resposta gerados pela ferramenta. As respostas das equipes foram categorizadas levando em conta a aderência aos conceitos e o nível de participação. O desempenho das equipes foi satisfatório, pois houve uma média geral de acertos de 90% para as cinco questões aplicadas. O Plickers é uma ferramenta avaliativa eficiente e proporcionou feedback imediato aos educadores, promoveu a participação ativa dos alunos e estimulou o pensamento crítico.

**Palavras-chave:** Aprendizagem. Compreensão. Participação ativa. Pensamento crítico.

## 1 Introduction

Assessment goes beyond just a final exam designed to measure knowledge of a piece of content. It represents a systematic collection of information, the purpose of which is to understand the student's development throughout the learning process. In addition, assessment should analyze the effectiveness of the teaching-learning process (Bloom *et al.*, 1971).

Technology has transformed the way education is delivered to students, especially in the context of teaching science in the classroom. Plickers is a low-cost, easy-to-use and highly effective technological tool for assessing students' knowledge in real time and providing immediate feedback to teachers (Ferdig; Kennedy, 2016).

In the field of science teaching, the use of Plickers has shown positive results in several areas, including the understanding of scientific concepts and student motivation. According to a recent survey, teachers reported that Plickers contributed to increasing student participation in science classes and stimulated reflections (Shahid; Jafri, 2022).

In this context, it is crucial to remember the importance of water as a fundamental theme in science teaching. Water represents an essential natural resource for human survival and the maintenance of terrestrial ecosystems. Understanding the relevance of water is essential for students to understand the need to preserve this natural resource and protect the environment (Santos; Marques, 2019).

In addition, the use of Plickers in science teaching can make lessons more interactive and dynamic, allowing students to actively participate in the learning process. Implementing Plickers in the classroom can help improve students' understanding of scientific concepts and promote a culture of active learning (Amri *et al.*, 2021).

With regard to water, it is crucial to highlight that the topic is extremely important for the preservation of the environment and the sustainability of the planet. According to the United Nations (UN), approximately 2.2 billion people worldwide do not have access to

safe drinking water, which makes raising awareness about the importance of water even more relevant (Chen *et al.*, 2020).

Therefore, teaching about water plays a fundamental role in training aware citizens who are committed to preserving the environment. In addition, the application of the Plickers tool in science teaching can be an efficient strategy to engage students and help them understand and remember the importance of water and other relevant scientific topics. This tool provides an evaluative analysis of learning, contributing to the formation of more aware citizens who are committed to the sustainability of the planet.

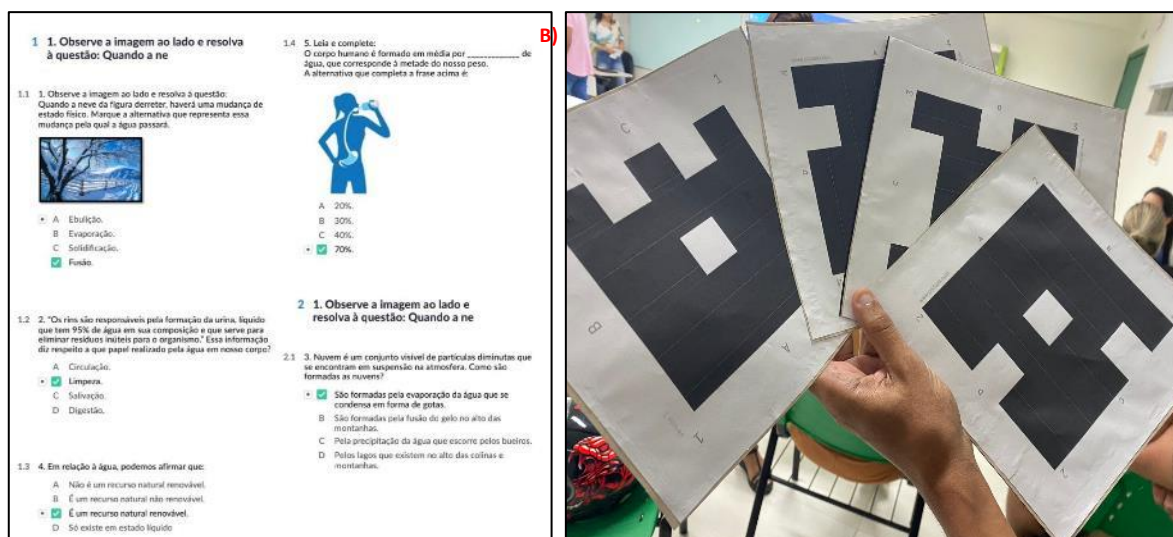
## 2 Methodology

The study was carried out with postgraduate students from the Educational Software subject of the postgraduate course in Educational Technologies for Teaching Practice in Basic Education at the Federal Institute of Education, Science and Technology of Pará (IFPA) Ananindeua campus, located in the metropolitan region of Belém/PA. The sample consisted of 32 students with an average age of 27 and academic backgrounds in a wide range of fields. The students were divided into 4 teams, which were named Ravenclaw, Gryffindor, Hufflepuff and Slytherin.

The Plickers tool was used to apply the activities and assess understanding of the concepts, and the teams received individual cards with codes to record their answers in real time.

The idea is to recall concepts by participating in theoretical and practical lessons on the importance of water. To this end, the students were divided into teams and activities were then applied using the Plickers tool to assess their current understanding and level of knowledge of water-related concepts. The activity consisted of preparing and applying 5 questions, which were answered by the teams using answer cards generated by the tool itself (Figure 1). The data was collected using commands and observation of the teams' answers using the Plickers tool, which generated a report on each team's performance.

**Figure 1** - Questions and answer cards generated by Plickers.



4

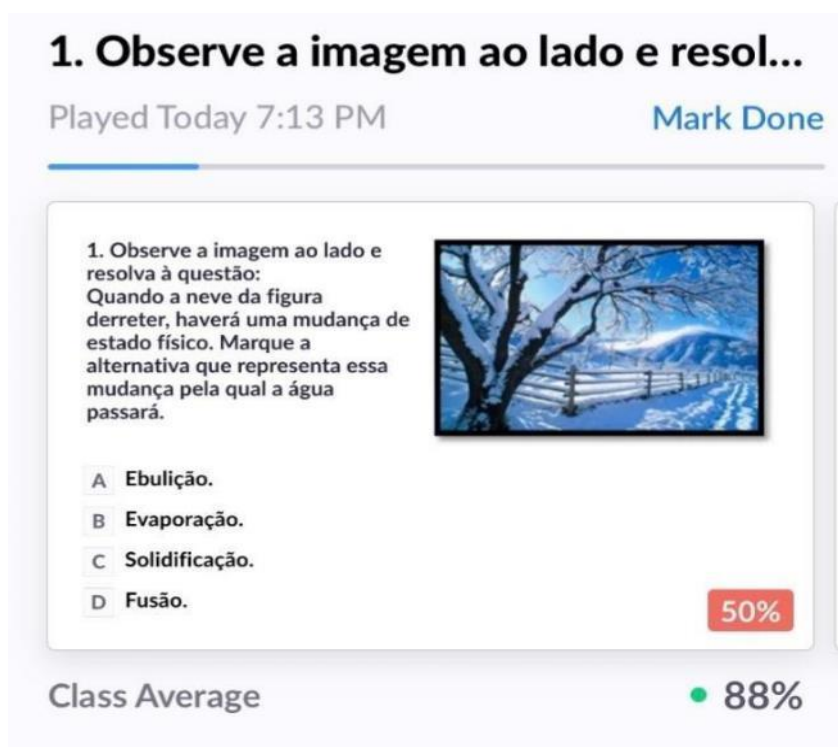
A) Water-related issues applied to teams. B) Cards used by teams to answer questions. Source: Elaborated by the authors (2023).

The data collected was analyzed quantitatively and qualitatively with an emphasis on understanding the concepts considered and the teams' participation in the proposed activities. The analysis was carried out by categorizing the teams' responses, taking into account compliance with the concepts and the level of participation. Finally, graphs were generated and plotted in order to better visualize the teams' performance.

### 3 Results and Discussion

The teams' answers to the first question had an average score of 50%, with only Hufflepuff and Slytherin getting the question right (Figure 2).

Figure 2 - Teams' percentage of correct answers to question 1.



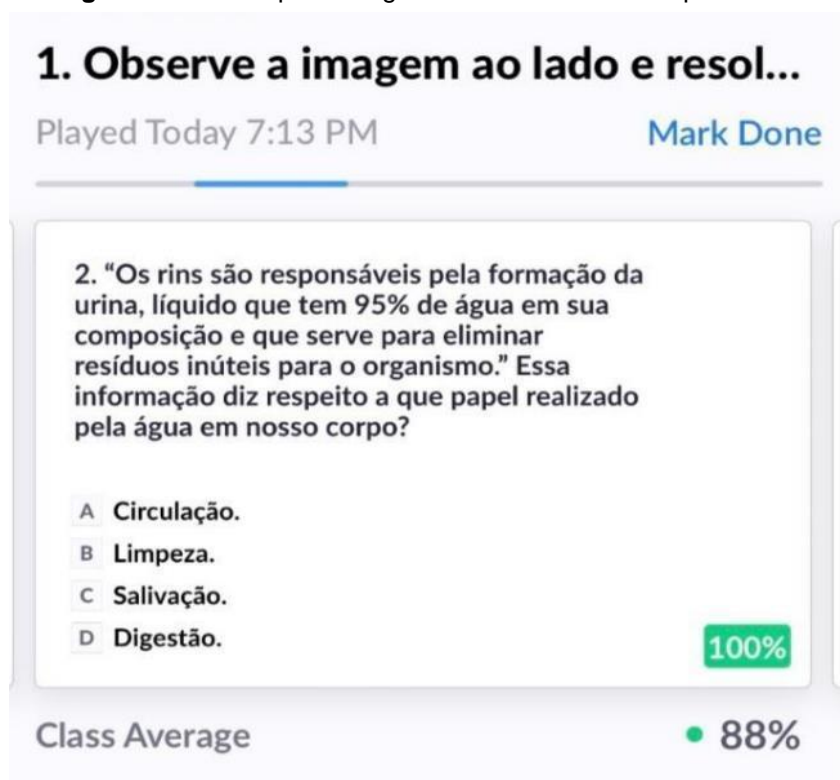
Source: Elaborated by the authors (2023).

The physical state of water is an important topic, but one that can be difficult for some people to understand. Most people think of water as a liquid because that's how we see it in our everyday environment. However, water can exist in three physical states - solid, liquid and gas - depending on its temperature and pressure (Johnson, 2021).

Furthermore, this subject is often taught only theoretically, without practical experiments, which can make it even more difficult to understand. Theory is fundamental, but practice is essential to ensure that students really understand how each physical state of water works (Allday, 2019).

When looking at the answers to question two, the teams scored 100%, as shown in figure 3.

Figure 3 - Teams' percentage of correct answers to question 2.



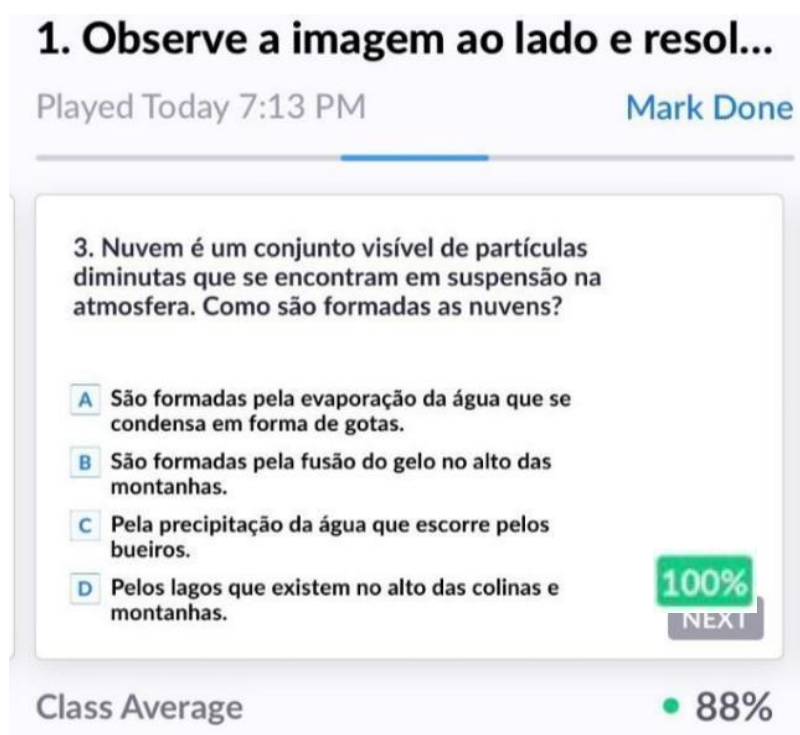
Source: Elaborated by the authors (2023).

To ensure more effective learning about the role of water in our bodies, it is essential to provide students with concrete and didactic experiences. Therefore, carrying out practical activities, such as measuring the amount of water consumed and its effects, can help students visualize the direct effects of hydration on human physiology (Rodrigues, 2019).

In addition, it is important to use visual resources, such as graphs and illustrations, to elucidate metabolic processes and the benefits of water for the human body. In this way, by adopting more interactive and contextualized educational approaches, it is possible to improve students' understanding of the vital role of water in our bodies.

In the third question, all the teams got the correct alternative, with a 100% success rate, as can be seen in figure 4.

Figure 4 - Teams' percentage of correct answers to question 3.



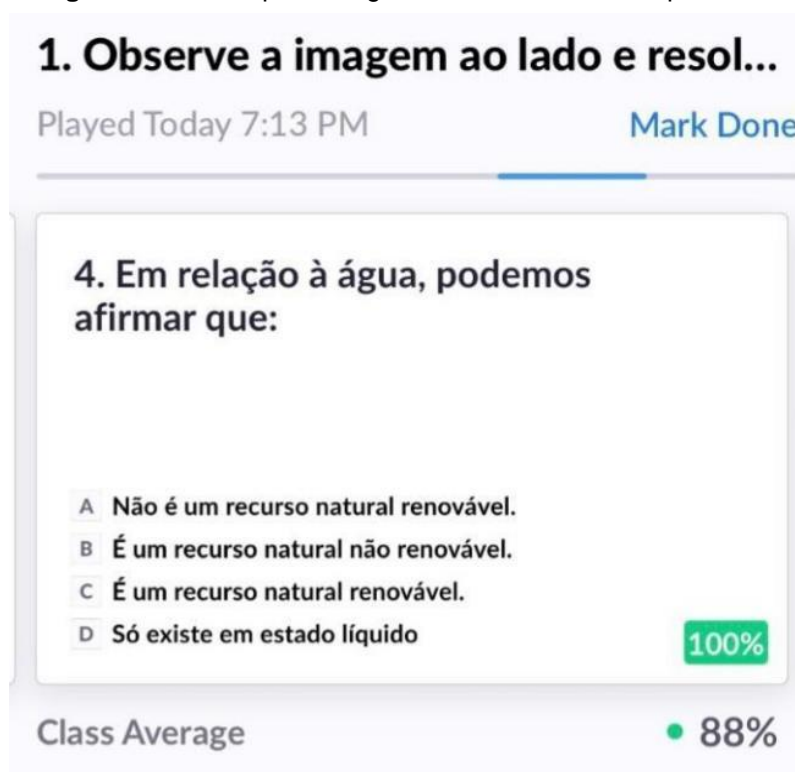
Source: Elaborated by the authors (2023).

This understanding is essential for students to develop environmental awareness and understand the impacts of climate change. In addition, learning about cloud formation stimulates students' critical thinking and scientific curiosity, promoting investigation and questioning about the natural processes that occur on our planet (Smith, 2020).

Science plays a fundamental role in learning about cloud formation, giving students the opportunity to understand atmospheric phenomena in a more comprehensive way. Therefore, the study of clouds in science enables students to understand the importance of these elements in regulating the climate and the water cycle.

In question four, all the teams got it right. They therefore scored 100% on this question (Figure 5).

Figure 5 - Teams' percentage of correct answers to question 4.



Source: Elaborated by the authors (2023).

The learning process plays an essential role in the formation of students, providing them with fundamental knowledge about the importance of this resource for life on the planet.

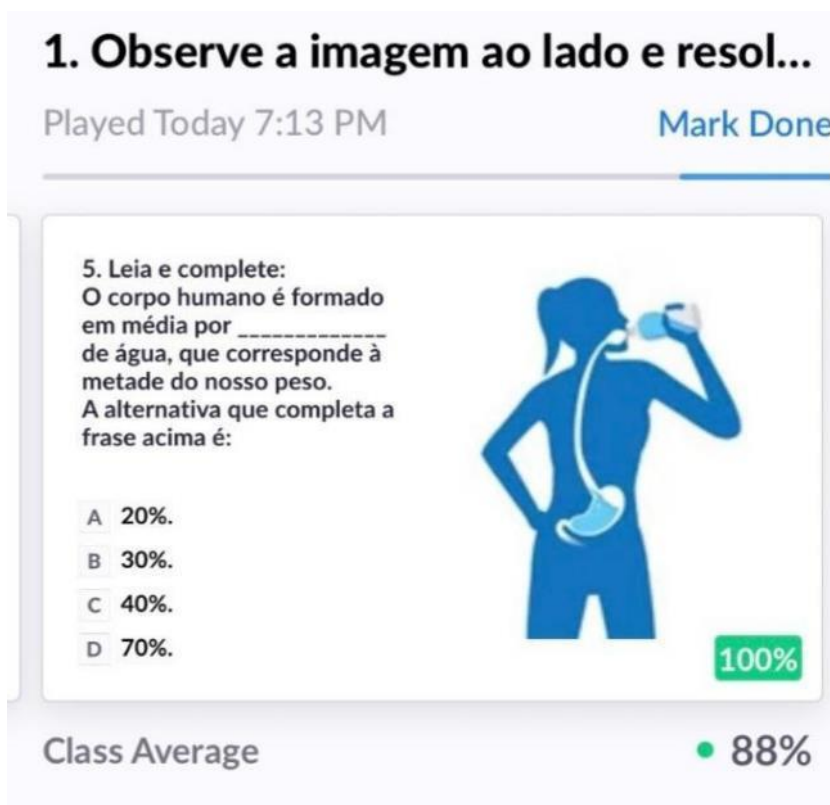
According to Johnson (2017), understanding water as a precious natural resource allows students to recognize its relevance to sustaining biodiversity, producing food and ensuring access to clean water. In exploring this theme, students also develop an environmental conscience and become more aware of their individual and collective responsibilities in the conservation and preservation of this vital resource.

In addition, as noted by Davis (2020), learning about water as a natural resource promotes interdisciplinarity, allowing connections to be made with other areas of knowledge, such as geography, economics and health, thus broadening students' understanding of the complexity of this topic.

In the fifth question, 100% of the teams got the correct alternative (Figure 6).



Figure 6 - Teams' percentage of correct answers to question 5.



Source: Elaborated by the authors (2023).

Learning about the human body and its water composition is extremely important for students, as it enables them to understand the importance of this vital liquid for the proper functioning of the body. As highlighted by Rodrigues (2019), the knowledge that the human body is mostly composed of water enables students to understand the importance of this element in maintaining hydration, regulating body temperature and transporting nutrients.

This understanding is fundamental for students to adopt healthy water consumption habits and take care of their health in a more conscious way. Furthermore, as stated by Santos (2020), learning about the composition of the human body in water encourages scientific curiosity and stimulates research into the biological processes related to hydration and the body's balance.

Finally, a report was generated with an overview of the teams' mistakes and successes. This showed that the class average was 90%, which was considered excelente for this subject (Figure 7).

**Figure 7** - Overview of the teams' performance.

# Nome ^	Total	1. Observe a imagem... Segunda-feira 19:14 • 88 %				1. Obser...
		1. Observe a imagem ao lado e resolva	2. "Os rins são responsáveis pela formação	4. Em relação à água, podemos	5. Leia e complete: O corpo humano	3. Nuvem é um conjunto visível de
Média da turma	• 90 %	50 %	100 %	100 %	100 %	100 %
3 Corvinal	4/5	A	B	C	D	A
1 Grifinória	4/5	C	B	C	D	A
2 Lufa Lufa	5/5	D	B	C	D	A
4 Sonserina	5/5	D	B	C	D	A

Source: Elaborated by the authors (2023).

The results of applying the Plickers app to assess learning revealed significant insights into its potential to promote active student participation. As highlighted by Sánchez-Mena and Sáez-López (2018), the use of Plickers offers an interactive approach to assessment, in which students can answer questions via response cards, allowing the teacher to instantly monitor the class's understanding. This interactivity promotes student engagement and gives the teacher the opportunity to adapt their teaching based on the answers in real time.

In addition, the research by Lachappelle, Reid and Arseneault (2017) highlighted that Plickers has proven to be an effective tool for formative assessment, as the data collected can be used to identify gaps in learning and guide subsequent lesson planning. However, it is important to note that the discussion also emphasized the need to ensure equal access to technology, as some students may not have compatible devices. Therefore, the success of applying Plickers to learning assessment depends on a balanced combination of technological resources and traditional teaching strategies.

## 4 Conclusions

The use of the Plickers platform to evaluate science teaching on the subject of water-related concepts brought significant benefits. It offered educators a quick and efficient way of obtaining information about students' understanding, allowing for immediate and targeted feedback. In addition, Plickers promoted an interactive and dynamic approach to assessment, encouraging active student participation and stimulating critical thinking.

This technology also contributes to creating a more engaging and motivating learning environment, in which students can express their opinions and build knowledge collaboratively. However, it is important to combine the use of Plickers with other assessment strategies, ensuring a complete and balanced approach to formative assessment. As a result, Plickers emerges as a valuable tool in science teaching, enhancing student interaction and meaningful learning.

## References

AMRI, S.; OUZIZI, L.; JILAL, A. O uso de Plickers para melhorar a aprendizagem do aluno no ensino de ciências. **Journal of Physics: Conference Series**, v. 1808, n. 1, p. 012086, 2021.

ALLDAY, S. Ensinando os Estados da Matéria com Demonstrações Simples. **Teachwire**, 2019. Disponível em: <https://www.teachwire.net/news/teaching-the-states-of-matter-with-simple-demonstrations>. Acesso em: 06 maio 2023.

BLOOM, B. S.; MADDAUS, G. F.; HASTINGS, T. **Handbook on Formative and Summative Evaluation of Student Learning**. New York: McGraw Hill, 1971.

CHEN, C. Y. et al. Incorporando a educação hídrica ao currículo para cultivar a consciência dos cidadãos sobre a conservação da água. **Água**, v. 12, n. 11, p. 2948, 2020.

DOE, J. A importância da água no corpo. **Healthline**, 2022. Disponível em: <https://www.healthline.com/health/importance-of-water-in-the-body>. Acesso em: 06 maio 2023.

FERDIG, R. E.; KENNEDY, K. Manual de pesquisa sobre práticas e métodos emergentes

para ensino K-12 online e misto. **IG Global**, 2016.

JOHNSON, J. Os Três Estados da Matéria: Sólido, Líquido e Gás. **Science Trends**, 2021. Disponível em: <https://sciencetrends.com/the-three-states-of-matter-solid-liquid-and-gas/>. Acesso em: 06 maio 2023.

LACHAPPELLE, P.; Reid, N.; Arseneault, D. Plickers and Peer Instruction: A low-tech student engagement tool for the flipped classroom. **Innovative Higher Education**, v. 42, n. 3, p. 249-260, 2017.

MILLER, C. L.; GREENE, B. A.; LEE, C. Integração de tecnologia na educação científica K-12: Uma revisão sistemática de Plickers. **Jornal Internacional de Pesquisa Educacional**, v. 100, p. 101538, 2020.

ORGANIZAÇÃO DAS NAÇÕES UNIDAS (ONU). **Relatório Mundial das Nações Unidas sobre Desenvolvimento dos Recursos Hídricos 2019: Deixando ninguém para trás**. 2019. Disponível em: <http://www.unwater.org/publications/world-water-development-report-2019/>. Acesso em: 05 maio 2023.

RODRIGUES, A. A importância da aprendizagem sobre a composição do corpo humano em água. **Revista Brasileira de Educação em Ciências**, v. 42, n. 2, p. 187-202, 2019.

RODRIGUES, D. O Papel da Água no Corpo Humano. **Verywell Fit**, 2019. Disponível em: <https://www.verywellfit.com/water-as-a-nutrient-2506745>. Acesso em: 06 maio 2023.

SÁNCHEZ-MENA, A.; SÁEZ-LÓPEZ, J. M. The use of Plickers as an interactive learning tool in higher education. **Interactive Learning Environments**, v. 26, n. 2, 226-234, 2018.

SANTOS, B. Estimulando a curiosidade científica por meio do estudo da água no corpo humano. **Cadernos de Pesquisa em Educação**, v. 36, n. 1, p. 120-135, 2020.

SANTOS, L. Desafios do ensino da água como recurso natural em regiões com escassez hídrica. **Revista de Educação Ambiental**, v. 20, n. 1, p. 56-69, 2018.

SANTOS, P.; MARQUES, F. A importância da água para a vida. **International Journal of Development Research**, v. 9, n. 7, p. 28854-28857, 2019.

SHAHID, S.; JAFRI, S. F. A. O efeito de Plickers na participação do aluno e discussões significativas nas aulas de ciências. **Jornal de Educação e Prática**, v. 13, n. 4, p. 70-79, 2022.

SILVA, M. A importância de atividades práticas no ensino da água como recurso natural. **Revista Brasileira de Ensino de Ciências**, v. 44, n. 3, e20190123, 2021.

SMITH, J. Promovendo o pensamento crítico por meio do aprendizado sobre a formação de nuvens. **Jornal Internacional de Educação em Ciências**, v. 32, n. 4, p. 520-535, 2020.

UNESCO. **Água**. 2021. Disponível em: <https://pt.unesco.org/themes/agua>. Acesso em: 04 maio 2023.

13

<sup>i</sup> **Luan Daniel Silva Ferreira**, ORCID: <https://orcid.org/0000-0001-9187-6988>

Graduação em Ciências Biológicas (Licenciatura), pela Universidade da Amazônia (UNAMA – 2022).  
Especialista em Microbiologia e Imunologia, pela Escola Superior da Amazônia (ESAMAZ – 2022).  
Mestrado em Genética e Biologia Molecular (UFPA - 2022).  
Authorship contribution: Writing, Revision and Elaboration.  
Lattes: <http://lattes.cnpq.br/0794526919642626>.  
E-mail: [luan.ferreirabio@gmail.com](mailto:luan.ferreirabio@gmail.com)

<sup>ii</sup> **Dábila Carla de Almeida Sobrinho**, ORCID: <https://orcid.org/0009-0003-7747-2989>

Engenheira Agrônoma, pelo Instituto Federal de Educação, Ciência e Tecnologia do Pará (IFPA – 2018).  
Graduanda em Pedagogia, pela Universidade Federal Rural da Amazônia (UFRA).  
Pós-graduanda em Tecnologias Educacionais para a Prática Docente do Ensino Básico, pelo Instituto Federal de Educação, Ciência e Tecnologia do Pará (IFPA).  
Authorship contribution: Writing, Revision and Elaboration.  
Lattes: <http://lattes.cnpq.br/5902500358497858>.  
E-mail: [dabilacarla@gmail.com](mailto:dabilacarla@gmail.com)

**Responsible publisher:** Genifer Andrade

**Ad hoc expert:** Daniela Marques Alexandrino e Walk Loureiro

### How to cite this article (ABNT):

FERREIRA, Luan Daniel Silva.; SOBRINHO, Dábila Carla de Almeida. Explorando o potencial da ferramenta plickers para o ensino de Ciências: uma análise da avaliação de conceitos relacionados à água. **Rev. Pemo**, Fortaleza, v. x, n. x, 2024. Available at: <https://revistas.uece.br/index.php/revpemo/article/view/11878>

Received on October 30, 2023.

Accepted on March 7, 2024.

Published on June 8, 2024.