



RESEARCH ARTICLE

DISCOVER HOW INFORMATION, COMMUNICATION, KNOWLEDGE AND DIGITAL LEARNING TECHNOLOGIES (ICKDLT) CAN TRANSFORM MICROBIOLOGY TEACHING

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ABSTRACT

Digital tools facilitate collaboration between students, allowing them to work on group projects, exchange ideas and share knowledge. In this way, the development of social and teamwork skills, essential for success in the professional field, is promoted. (Amaro de Chacin, 2011)(TICCADE, 2022). ICKDLT, provide immediate access to a wealth of high-quality educational resources, such as microorganism databases, scientific articles, explanatory videos, and specialized software. This allows students to stay up-to-date on the latest developments in the field of microbiology and delve deeper into specific topics of interest. (Arista J. , 2014),(TICCADE, 2022). Digital platforms make it possible to implement formative assessment systems that provide students with immediate feedback on their progress. This helps them identify their strengths and weaknesses, and focus their efforts on areas that require more attention. (Area, 2009),(TICCADE, 2022). ICKDLT offer a wide variety of resources and tools that cater to different learning styles, allowing students to learn in the way that works best for them. This is particularly beneficial for students with special educational needs or different learning preferences.(TICCADE, 2022).

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INTRODUCTION

The teaching of microbiology, a fundamental discipline for understanding the microscopic world and its impact on human health, the environment and various industrial sectors, has traditionally been based on exhibition and rote methods. However, the rise of Information, Communication, Knowledge and Digital Learning Technologies (ICKDLT) offers endless possibilities to transform the way this fascinating subject is taught. (Arista J. , 1914), (TICCADE, 2022). In this context, this educational proposal integrates three ICKDLT tools of great potential: Kahoot, Google Sites and PowerPoint, with the aim of creating a dynamic, interactive and personalized learning environment that motivates students and significantly improves their understanding of microbiology. (Area, 2009),(TICCADE, 2022).

The choice of these tools is based on the following reasons:

Kahoot: Interactive and fun assessment

- **It encourages participation**, transforms assessment into a playful and engaging experience, motivating students to actively participate in the learning process.

- **Promoting competitive learning**, Kahoot's game dynamics stimulate healthy competition among students, which generates a more dynamic and enthusiastic learning environment.
- **Provide immediate feedback**: Students receive immediate feedback on their answers, allowing them to identify their strengths and weaknesses in a timely manner.(Kahoot, 2024)
- **It facilitates formative assessment**: It allows for continuous and personalized assessments, providing the teacher with valuable information about the individual progress of each student.(Kahoot, 2024)
- **2. Google Sites: A virtual space for comprehensive learning**:
- **Centralize educational resources**: Google Sites allows you to create a custom website where a wide range of educational resources can be stored and shared, such as presentations, videos, articles, infographics, and interactive quizzes.(Google Site, 2024)
- **Encourage collaboration**: The website can become a virtual space for collaboration between students and teachers, allowing the creation of group work, debates and discussion forums.(Google Site, 2024)
- **Anytime, anywhere accessibility**: Students can access the website from any device with an internet connection,

facilitating flexible and autonomous learning.(Google Site, 2024)

- **Seamless communication:** The website can serve as a communication channel between teacher and students, allowing for the sharing of announcements, assignments, and additional materials.(Google Site, 2024)

PowerPoint: Dynamic and engaging presentations

- **Impactful visualizations:** PowerPoint allows you to create presentations with high-quality images, videos, animations, and graphics, which captures students' attention and makes it easier to understand complex concepts.
- **Visual Storytelling:** PowerPoint presentations can be used to tell stories about the world of microorganisms, making learning a more memorable and meaningful experience.(Power Point, 2024)
- **Design flexibility:** PowerPoint offers a wide range of design tools that allow you to create custom presentations tailored to the specific needs of each topic.(Power Point, 2024)
- **Universal Compatibility:** PowerPoint presentations are compatible with most electronic devices, ensuring their accessibility for students.(Power Point, 2024)
- Quizizz is an online educational platform that allows educators to create interactive quizzes, games, and assessments. It is used by teachers, professors, and trainers to engage students, review material, and assess understanding. Quizizz can be used in a variety of settings, including classroom settings, online courses, and business training sessions.(Quizizz, 2024)
- **Quizizz:**
- **Material review:** Quizizz allows you to create quizzes that review key concepts and vocabulary. This can help students solidify their understanding of the material and prepare for exams.(Quizizz, 2018)
- **Assessment of comprehension:** Quizizz can be used to create formative and summative assessments. Formative assessments allow students to verify their understanding during the learning process, while summative assessments measure learning at the end of a unit or course.(Quizizz, 2024)
- **Fostering engagement:** Quizizz allows you to create fun and interactive games that make learning more engaging for students. This can be especially helpful for those who are struggling with a particular concept.(Quizizz, 2018)
- **Feedback Collection:** Quizizz can be used to collect student feedback on their learning. This feedback can be used to improve instruction and make sure students are meeting their learning goals.(Quizizz, 2024)

Objective: To transform the teaching of Microbiology in Dental Surgeon students, promoting active, meaningful and personalized learning through the strategic integration of Information and Communication Technologies, Knowledge and Digital Learning ICKDLT (TICCADE, 2022).

MATERIALS AND METHODS

A wide range of ICKDLT was implemented, among the tools used were Kahoot, Google Sites, Power Point and Quizizz, validated questionnaires were used as data collection techniques (Arribas, 2004) (Bernal torres, 2016), (TICCADE, 2022).

Kahoot: It is an online educational platform that allows educators to create interactive quizzes, games, and assessments. Gamified questionnaires were implemented, transforming the evaluation into a playful and attractive experience, a variety of questions were asked, such as multiple choice, true/false, open questions and questions with images, adapting to various learning styles. There was immediate feedback on their responses, allowing them to identify their strengths and weaknesses in a timely manner. The platform generates scores and rankings in real time, promoting healthy competition and collaborative learning. (Kahoot, 2024)

Google Sites: A website was created using the Google Sites platform, which served as a central repository of content, resources, and activities for the Microbiology course. The website was designed in an attractive and accessible way for students, allowing fluid navigation and easy consultation of information. (Gomez, 2016),(Google Site, 2024). A variety of educational materials were published on the website, including PowerPoint presentations, infographics, concept maps, videos, articles, and links to websites of interest. These materials were carefully selected and organized to support the development of students' competencies and skills in the area of Microbiology. (Google Site, 2024). Discussion forums were created on the website to encourage interaction and exchange of ideas among students. The forums were moderated by the teacher, who guided the discussions and provided timely feedback to the students. (Google Site, 2024)

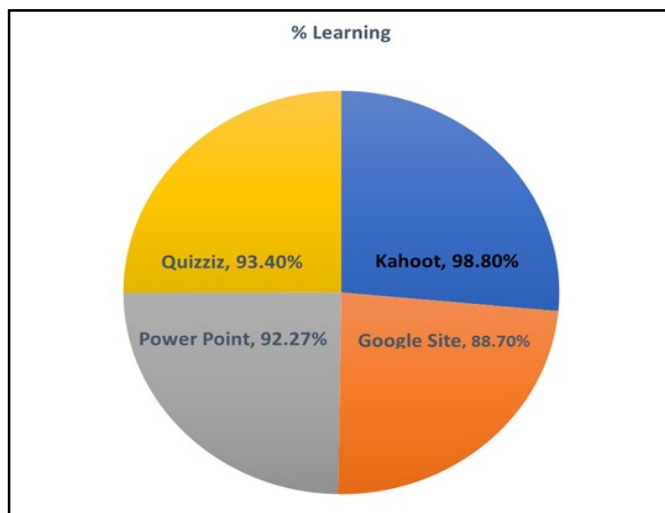
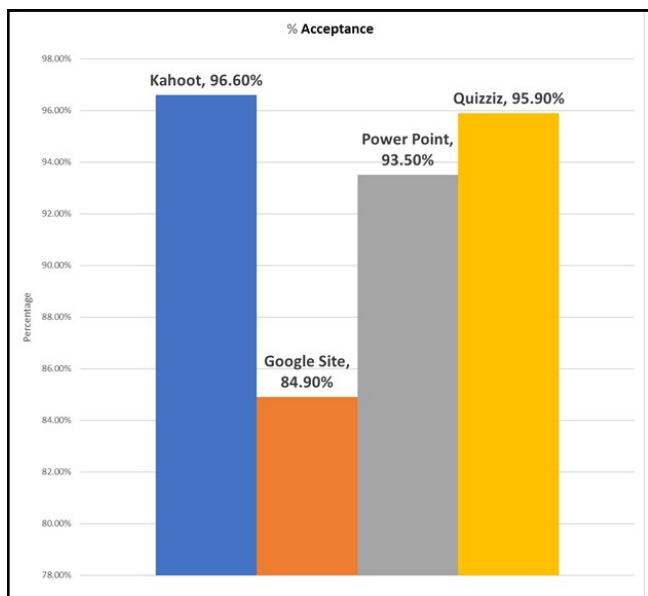
Power Point: PowerPoint presentations were used to present the theoretical contents of the Microbiology subject. The presentations were designed with attractive and dynamic visual resources, such as images, videos and animations, to capture the attention of the students and facilitate the understanding of the concepts, it was an interactive Power Point. (Power Point, 2024)

Quizizz: Quizizz promotes active learning by turning assessment into a playful and engaging experience. Students are actively involved in the learning process, answering questions, competing with each other, and receiving immediate feedback. This encourages greater participation, motivation and retention of knowledge, personalized questionnaires were created that were adapted to the individual needs and interests of each student, the level of difficulty, the type of questions and the pace of the assessment could be adjusted, ensuring that all students had the opportunity to learn and progress at their own pace, it allowed students to monitor their progress in real time. The results of the questionnaires revealed the areas in which students have strengths and weaknesses, allowing them to adjust teaching and offer personalized support. (Quizizz, 2018)

RESULTS

The most accepted application was Kahoot with 96.6%, followed by Quizizz with 95.9%, Power Point with 93.5% and Google Site with 88.7%. (Bernal torres, 2016). The application where the most learning was obtained was; Kahoot 98.8%, Quizizz with 93.4%, Power Point with 92.27% and Google Site with 88.7%.(Bernal torres, 2016)

| ICKDLT | % Acceptance | % Learning |
|-------------|--------------|------------|
| Kahoot | 96.6% | 98.8% |
| Google Site | 84.9% | 88.7% |
| Power Point | 93.5% | 92.27% |
| Quizizz | 95.9% | 93.4% |



Analysis of Results and Relationship between Educational Applications: This analysis is based on the data provided on the acceptance and level of learning achieved with the educational applications Kahoot, Quizziz, Power Point and Google Sites. The aim is to identify the relationships between these results and to establish conclusions about their effectiveness in the teaching process.(Box y otros, 2017)

Acceptance Analysis

- **Kahoot:** The application with the highest acceptance among users, with 96.6%. This indicates a high rating for its engaging, dynamic, and gamified interface.(Kahoot, 2024)
- **Quizziz:** It comes in second with 95.9%, confirming its popularity as a tool for creating interactive quizzes and playful assessments.(Quizziz, 2018)
- **Power Point:** It reached 93.5%, positioning itself as a traditional presentation tool still valued for its ease of use and versatility.(Power Point, 2024)
- **Google Sites:** It scored 88.7%, suggesting that while it's less well-known, it offers value as a platform for building educational websites.(Google Site, 2024)

Learning Level Analysis

- **Kahoot:** It presents the highest level of learning with 98.8%, which corroborates its effectiveness in promoting knowledge retention through interaction and play.(Kahoot, 2024)
- **Quizziz:** It follows with 93.4%, demonstrating its ability to facilitate the understanding of concepts through dynamic questionnaires.(Quizziz, 2018)
- **Power Point:** It reached 92.27%, confirming its potential to convey information in a clear and organized manner, although its impact on learning may depend on how it is used (Power Point, 2024)
- **Google Sites:** It scored 88.7%, suggesting that while it may be useful as a supplement, its direct impact on individual learning may be less.(Power Point, 2024)

Relationship between Acceptance and Learning Level: A positive correlation is observed between the acceptance of applications and the level of learning achieved. Kahoot and Quizziz, the apps with the highest acceptance, also have the highest levels of learning. This suggests that the features that make these apps engaging for users also contribute to more effective learning.(Box y otros, 2017)

CONCLUSIONS

ICKDLT offer a wide variety of resources and tools that cater to different learning styles, allowing students to learn in the way that works best for them. This is particularly beneficial for students with special educational needs or different learning preferences (TICCADE, 2022).

- Educational apps such as Kahoot and Quizziz, with their interactive and gamified designs, have a positive impact on users' acceptance and learning level.(Kahoot, 2024) (Quizziz, 2024)
- Power Point, despite being a traditional tool, is still valued for its versatility and ease of use, but its impact on learning depends on its effective implementation.(Power Point, 2024)
- Google Sites, while offering value as a platform for creating educational websites, may have a smaller direct impact on individual learning compared to interactive applications.(Google Site, 2024)

RECOMENDACIONES

- It is recommended to encourage the use of educational applications such as Kahoot and Quizziz in the teaching process, taking advantage of their potential to improve motivation, the level of learning of students.
- It is important to train teachers in the effective use of these tools, ensuring that they are properly integrated into curricula and used strategically to achieve learning objectives.
- Combining different educational tools, such as Kahoot, Quizziz, Power Point, and Google Sites, can create more dynamic, comprehensive, and personalized learning experiences.

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