Revista Colombiana de Computación
Vol. 23, No. 2. July – December 2022, pp. 6-16
e-ISSN: 2539-2115, https://doi.org/10.29375/25392115.4303

REVISTA COLOMBIANA
DE COMPUTACIÓN

A Presentation Design System to Promote the Lecturer-Audience Interaction in Lessons

Un sistema para diseñar de presentaciones para promover la interacción profesor-audiencia en clases

Alan Ramírez-Noriega[1], Yobani Martínez-Ramírez[1], Samantha Jiménez[2], José Mendivil-Torres[1]

[1]Facultad de Ingeniería Mochis, Universidad Autónoma de Sinaloa, 81223, Los Mochis, Sinaloa, México
[2]Facultad de Ciencias de la Ingeniería y Tecnología, Universidad Autónoma de Baja California, 22260, Tijuana, Baja California, México.
alandramireznoriega@uas.edu.mx, yobani@uas.edu.mx, samantha.jimenez@uabc.edu.mx, jose.mendivil@uas.edu.mx

(Received: 11 November 2021; accepted: 27 October 2022; Published online: 31 December 2022)

Abstract. Slides are material that supports the information expressed by a speaker. Slides have increased their importance in education due to the multimedia information that we can represent in them and their easy access. Most conference or class presentations do not engage participants in an adequate way. Therefore, this research aims to develop a presentation and survey system in a real-time web application that allows interaction between the teacher-lecturer and the audience in an active way during the session. This research evaluated the system from three approaches: usability, acquired knowledge and user experience. The results suggested that SlideCheck could be an excellent option to encourage students to participate during classes, improve knowledge acquisition and improve interaction with the teacher during the session, making the lesson more dynamic.

Keywords: Digital presentations, slides, interaction, usability.

Resumen. Las diapositivas son material que apoya la información expresada por un conferencista. Las diapositivas han aumentado su importancia en la educación debido a la información multimedia que podemos representar en ellas y su fácil acceso. La mayoría de las presentaciones en conferencias o clases no involucran a los participantes de una forma adecuada. Por lo que, esta investigación tiene como objetivo desarrollar un sistema de presentación y encuestas en una aplicación web en tiempo real que permita la interacción entre el profesor-conferencista y la audiencia de una manera más activa durante la sesión. Esta investigación evaluó el sistema desde tres enfoques: usabilidad, conocimiento adquirido y experiencia de usuario. Los resultados sugirieron que SlideCheck podría ser una excelente opción para alentar a los estudiantes a participar durante las clases, mejorar la adquisición de conocimientos y mejorar la interacción con el profesor durante la sesión, haciendo que la lección sea más dinámica.

Palabras clave: Presentaciones digitales, diapositivas, interacción, usabilidad.

Paper Type: Research paper.

1 Introduction

The new Communication and Information Technologies (CIT) support the learning process. Teachers and instructors use these types of tools to improve the learning material during the educational process. These tools are also helpful in improving communication in the distance, asynchronous and synchronous learning when the teacher and the student are in different parts of the world. In universities, it is common to use digital presentations as slides (Maroto Marín, 2008).

The slides are material that supports information expressed by a lecturer. This tool has increased its importance in education due to the amount of digital information on the internet and ease of access. Moreover, the slides include figures, draw, graphs, graphics, and any visual material to improve the lectures.

©2022 Universidad Autónoma de Bucaramanga - UNAB. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY-NC-SA 4.0) license (https://creativecommons.org/licenses/by-nc-sa/4.0/).

At present, the use of computers and projectors makes the slides look sharp and colorful (Mesía Maraví, 2011).

Slides are the best option for teachers to present some information to students. Slides are the primary method used by conferences because it is easy to use and do not need special requirements for the hardware or the operating system to work. It includes text, images, audio, and video in the same presentation or slide. Likewise, the presentation can be printed or used in big spaces with many people using a little investment of resources (Maroto García, 2007; Xin-geng & Jian-xiang, 2011).

Slides emerged in the business field, but they are widely used by most teachers worldwide in the educational field. However, some factors, such as boring slides, too much text or a very fast presentation, could affect the effectiveness of the slides for the audience (Servatyari et al., 2019). Nowadays, many presentations in lessons, conferences, or classes do not involve the participants. The slides are designed to be viewed and read; this affects the participants' attention and learning. Also, lectures are not designed to evaluate the knowledge of the students-participants. So, the lecturer cannot know if the presentation impacts the audience. On the other hand, there is software that considers interaction with the public, but it is paid software.

This work aims to develop a presentation and survey system in a real-time web application that allows interaction between the lecturer and the audience in an active way during the lesson. The system is named SlideCheck. The system was evaluated using three approaches: usability, acquired knowledge, and user experience.

The rest of the paper is organized as follows. In section 2, the authors described the related work on the slides field. Section 3 presents the software development, considering the most critical phases of the process. Section 4 shows three experiments to evaluate the performance of the proposal. Finally, Section 5 concludes the work and presents future work.

2 Related Work

Nowadays, several tools are available on the Internet to design interactive presentations to make more efficient information and knowledge transmission during a class or a conference in any private or public institution. The audience can access this presentation from a mobile device capturing the user's attention and involving them in the subject of the class or conference. The following paragraphs describe some of these tools.

Swipe (Graham, 2015) is a responsive web application that creates, presents, and shares presentations. The presentations can include surveys that the people can answer in real-time from a mobile device; this allows the audience to interact during the exposition. However, Swipe is commercial software with different plans and different prices. It is important to note that Swipe has a free version, but it has many limitations.

Mentimeter allows creating interactive presentations from a website. The presentation can include questions, surveys, interviews, and slides. The users connect from a mobile device to the presentation, and they can participate in real-time, asking questions or consulting the results. The system can export the results for further analysis. Mentimeter is commercial software, and it has a price for use. The free version presents a limitation in the number of questions and the export option (Kuritza et al., 2020).

Wooclap is a web tool that allows users to interact with a mobile device's presentation in real-time. Wooclap has an editor to design surveys, create open-ended questions and multiple-choice questions. Moreover, it can import PDF documents, images, videos, PowerPoint slides, and google slides. Although it is a complete tool, it has an annual cost. Wooclap has a free version but with several limitations with the number of questions and the survey design (Grzych & Schraen-Maschke, 2019).

MS PowerPoint is software for presentation, and it is part of the Microsoft Office suite. It allows creating slides, collaborative work, 3D graphs, and export presentations in different formats. It supports the survey design for active participation from mobile devices, but it requires software complements compatible with MS PowerPoint. In any case, the user needs a license for the use of the systems and the complements.

Slides is a Google application for creating presentations online. It allows collaborative work; it has a different option to incorporate animations and videos. Also, it can manage surveys, and the users can answer them from a mobile device. Google Slides is compatible with MS PowerPoint and is free.

SlideCheck is based on these applications. The tool integrated the interactivity that the other applications do not have for creating questions and answering them in real-time. Also, SlideCheck is free and is in

Spanish. However, the authors are working on the English version. A summary of the applications is represented in the Table 1.

Table 1. Application summary.

App	Create questions	Language	free
Swipe	✔	English	✔ (With limitation)
Mentimeter	✔	Many	✔ (With limitation)
Wooclap	✔	Many	✔ (With limitation)
MS PowerPoint	✕	Many	✕
Slides	✕	Many	✔

3 SlideCheck Software

SlideCheck construction followed the basic software development process: analysis, design, implementation, and testing (Pressman, 2010). The details of the phases are described as follows.

3.1 Analysis

In the analysis, the developers defined the problem that needs to be solved and all the system functionalities. The developers defined which aspects need to be considered for developing dynamic and interactive presentations. The most important aspects are described below:

- Design: The system led the teacher to show, manage and design slides and the questions.
- User management: The system led the teacher to manage the users in real-time while asking questions.
- Survey management: The system led the user to manage the survey prior, during, and post-execution. The system could include a repository with questions classified by topic, and the teachers can use them to create surveys.
- Survey personalization: The system led the teacher to personalize the survey by changing the colors.
- Results: The system led the user to see the current state of the survey in real-time.
- Graphic results: The system led the teacher to see a graphic representation of the survey results.
- Participants' comments: The system led the participants to give their opinion about the survey once the presentation was over.
- Presentation request: The system led the teacher to send a survey request to the participants.
- Group request: The system led the teacher to request a group of students for the questions section.
- Personalize mobile app: The system has a mobile application associated with the system to participate in the surveys.
- The unlimited number of participants: The system supports an unlimited number of participants in the same survey under the supervision of one teacher.

Also, SlideCheck is free to use.

3.2 System Design

This section presents the system design using block diagrams, mockups and describing the specifications of the system (Fowler & Scott, 2000; Pressman, 2010).

3.2.1 Architecture

Figure 1 shows the interaction between all the system modules to achieve the defined goals. This structure helps to divide the programming work into smaller modules. Each one of the modules should be as independent as possible to reduce the development complexity (Sommerville, 2015).

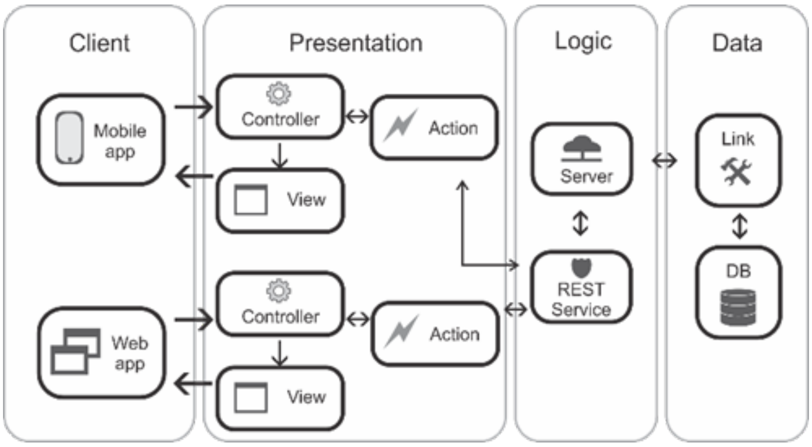


Figure 1. SlideCheck architecture.

The architecture has four layers:

Layer 1. Client: This module has what the user can see and is where the user interacts. The client layer has communication with the presentation layer. The presentation layer decides what content will be presented and when. The client layer uses the Framework Ionic, and it is divided in:

- **Mobile App:** The software presented in a mobile device such as Smartphone or Tablet; this module communicates with the controller because the controller generates the views presented on the mobile device.
- **Web application**: It is the place where the user can interact from a web browser. This module communicates with the controller because the controller generates views.

Layer 2. Presentation: The layer manages all from the client-side, but the user cannot interact with this layer directly. This module manages all the data and information entered by the user. Also, the module listens to the server-side to trigger events according to the user's actions.

This layer communicates with the logistic layer, sending the instructions to communicate with the database and waiting for a server response to change the system's views. Also, it communicates with the client because it decides which views will be presented to the user. This layer uses the Framework Ionic and is divided in:

- **Controller:** It is a set of instructions that controls the views and the user actions in the view.
- **View:** It is the display presented to the user after being processed by the controller. It could be presented on the mobile app or the website.
- **Action:** It is a set of functions called by the controllers to use the REST services.

Layer 3. Logistic: This module manages the queries to the database and the responses to the clients. It communicates with the data and presentation layer because it manages all the communication between data and the presentation layer. This layer uses Firebase backend, and it is divided in:

- **REST service:** It is the intermediate between the actions and the server. It uses APIs to call server functions and wait for a response.
- **Server:** It is the remote environment where all the backend functions run. It also connects to the database and queries data.

Layer 4. Data: This layer is responsible for storing and managing the data. It communicates with the Logistic layer because it manages the communication between data and the rest of the system. This layer uses Firebase database. This layer is divided in:

- **Connection**: It is a middleware between the backend and the database that allows the data query.
- **Database:** It is where the data is stored, queried, and updated.

3.2.2 System Interfaces

The graphic interfaces are responsive, which means that the website is adaptable according to the device's size, such as a computer, tablet, or smartphone. Using the responsive design, the developers only implemented one design. However, in the future, they want to implement a mobile app.

The colors implemented in SlideCheck are Orange, White, Red, Pink. These colors were chosen considering the warmth they represent, and the combination is aesthetically pleasing. Also, the system uses different shades of gray to highlight some parts of the interface. Figure 2 depicts the login page of SlideCheck.

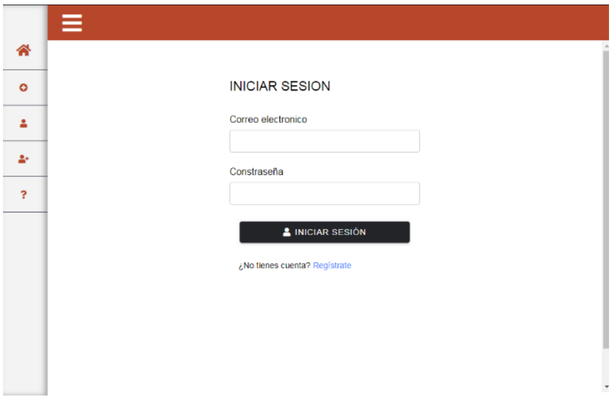


Figure 2. SlideCheck home page

The interfaces use Arial as a font family because it has a minimalist style but also formality. The system is image-free to keep the screen's balance and density when a presentation is loaded or created. The only image in the app is the SlideCheck logo.

The menu is on the very left of the screen. It could be minimized to use less space and to have more workspace. Figure 3 shows the interface to design a new slide.

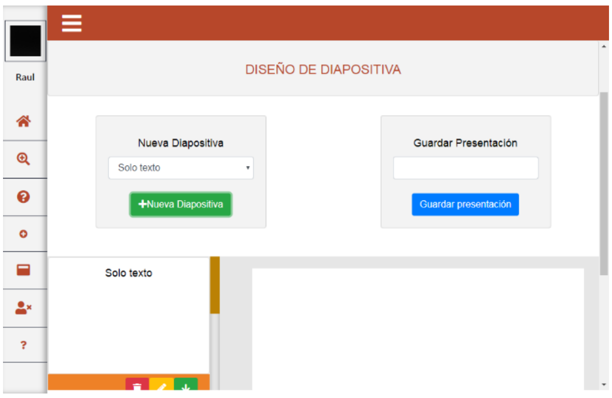
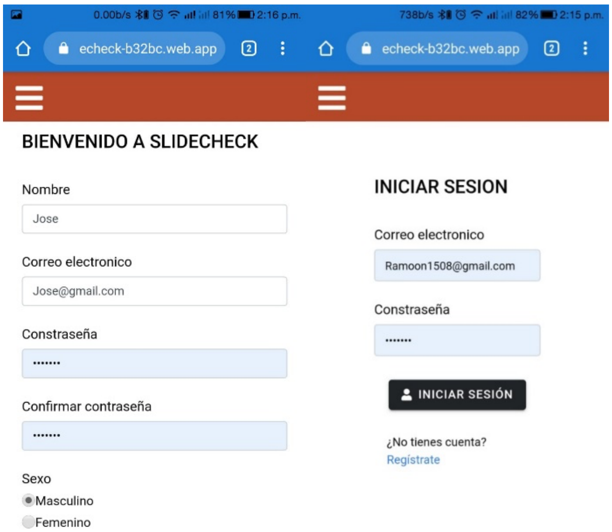


Figure 3. Slide design in SlideCheck.

The interfaces for the mobile view and the web system are the same. However, the system layout depends on the screen size, so the interface can be adaptable to maximize functionality, productivity, and usability.

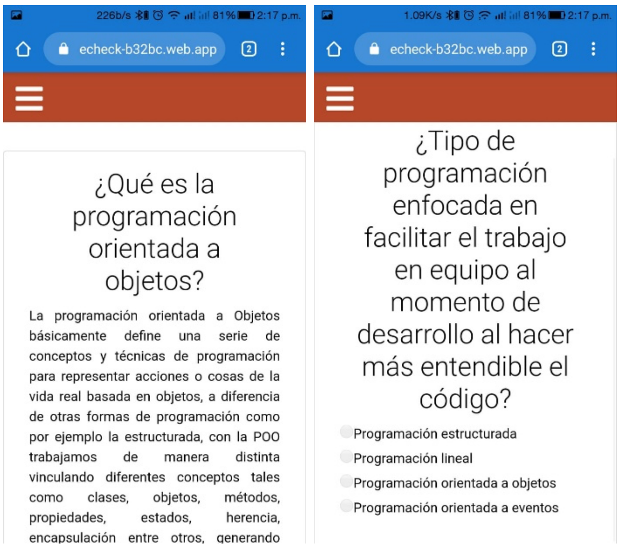
The users need to register on the system, entering some primary data (see Figure 4a). Then, the users can log in to the system using the entered email and password (see Figure 4b). This record allows for the analysis of the user's performance.



(a) (b)

Figure 4. Sing up (a) and access (b) to SlideCheck.

Figure 5a displays a slide on a student's cell phone. This view is the same that the professor has in his view. In this way, SlideCheck led the users to ask questions or answer questions in real-time regarding the information on the slides (see Figure 5b).



(a) (b)

Figure 5. Slide with the information (a) and the question regards to the same information (b).

After the students answered the question (see Figure 5b), the teacher can display the general results (see Figure 6). Moreover, the system displays the name of the quickest student that answered the question correctly. It led the student to get feedback in real-time.

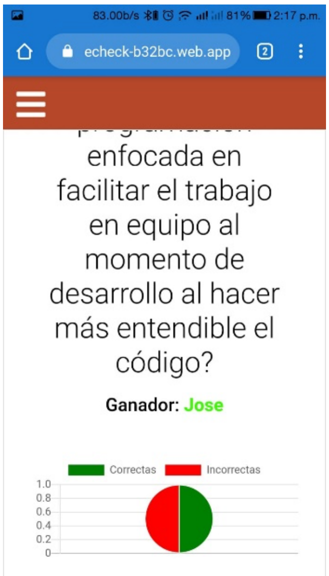


Figure 6. Interface of a question in a teacher view.

4 Experiments with SlideCheck

This section presents the experimental design and the results based on the user-system interaction.

Authors evaluated SlideCheck from the following approaches: 1) Usability. 2) the level of knowledge acquired using SlideCheck and compared to other presentation software. 3) The user experience from the SlideCheck mobile view.

This study used convenience sampling due to the COVID pandemic, it was easiest and safeties, and it is also a valid sampling method.

4.1 System Usability

This experiment evaluates SlideCheck system usability using the System Usability Scale (SUS). SUS is a reliable tool that evaluates the usability of an object, device, or app (Brooke, 1996).

According to Nielsen and Molich (1990), a usability test can be conducted with only five users. This proposal is widely accepted because this number of users reveals 85% of the usability problems. In this context, the sample included six subjects aged 20 years on average. All the participants were Computer Science undergraduate students from a university in Mexico. According to the users' profiles, they had previous experience using mobile devices and mobile apps. Each one of the participants has a mobile device.

The experiment had four tasks:

- **Task 1.** The participants' signup to the SlideCheck system providing the following information: (a) email; (b) password; (c) name; (d) gender; (e) birthdate; and (f) profile photo.
- **Task 2.** The participants added questions regards a specific topic from their mobile device to create a personal repository.
- **Task 3.** The participants created a presentation using the SlideCheck system templates (text, two-column text, text and images, and question). Then, they personalized the slides and saved them.
- **Task 4.** The participants joined a meeting organized by the developers. The developers played the lecturer role, and the participants were connected from the mobile device to the conference and answered questions about the topic.

After completing the four tasks, the participants answered the SUS test. The instrument has ten questions. The Likert scale has values from 1 (Strongly disagree) to 5 (Strongly agree).

The sum of all the responses ranged from 0 to 100 SUS points. The total of points needs to be situated in the scale to interpret the results (Brooke, 1996). The result of this experiment was 92.08 SUS points.

4.2 Knowledge Acquired

This experiment evaluated the knowledge acquired using the SlideCheck system. The results were compared with similar software like MS PowerPoint, one of the most popular presentation systems. Also, most of the students participating in the experiment use MS PowerPoint.

A total of 48 students participated in this experiment, the participants aged 20 years on average. The participants were students from a computer undergraduate program, so they had experienced mobile devices. Each one of the participants used their mobile devices with an Internet connection. The experiment uses the topic Object-Oriented Paradigm (OOP). The participants were enrolled in the OOP course, so they had almost 39% of previous knowledge in the topic.

The process was the next:

- Firstly, authors divided the participants into two groups, one experimental group with 23 students and a control group with 25 students.
- Then, authors designed an OOP presentation using SlideCheck, and they designed the same presentation using MS PowerPoint. The presentations included general definitions of OOP, class concepts, object concepts, inheritance, encapsulation, and polymorphism.
- After that, authors conducted a lesson using the SlideCheck system with the experimental group. During the lecture, the presentation showed multiple-choice questions about the OOP definitions previously mentioned. The participants answered the questions from their mobile devices. The grade ranged from 0 to 100.
- Finally, authors conducted a lecture with the control group using the MS PowerPoint presentation about OOP. At the end of the lesson, participants answered the same test as the experimental group.
- Table 2 shows the comparison between the evaluation results of the control and experimental group. The percentage values represent the grades for each one of the topics about OOP.

Table 2. Results of the level of knowledge acquired evaluation.

OOP questions by topic	Experimental Group SlideCheck System	Control Group MS PowerPoint
General Definition	100%	92%
Classes Concepts	87%	28%
Object Concepts	91%	92%
Inheritance Concepts	100%	100%
Encapsulation Concepts	74%	52%
Polymorphism Concepts	96%	76%
Average	**91.3%**	**73.3%**

To determine a significant difference between the two groups, the authors conducted a student t-test for independent samples. The significant level stated was 95%. Table 3 shows the descriptive analysis.

Participants who interacted with SlideCheck (N=23, M = 91.29, SD = 13.18) compared to participants in the control group (N=25, M = 73.32, SD = 16.66) demonstrated significantly better grades scores, t (46) = 4.12, p = 0.001.

Table 3. Results of t-test: comparison of means in SPSS.

Group statistics				
Group	N	Mean	Standard dev.	Standard error of the mean
Experimental (SlideCheck)	23	91.29	13.18	2.75
Control (MS PowerPoint)	25	73.32	16.66	3.33
Difference	-	17.98	3.49	-

4.3 Knowledge Acquired

This experiment aims to evaluate the user experience using SlideCheck from a mobile device. The authors used the experimental group in the knowledge acquired experiment. In this context, the participants answered an instrument with five questions about SlideCheck use. The questions were regarding the usefulness, fluidness, user satisfaction, encouragement to participate. The items used a 5-points Liker scale from Strongly disagree (1) to Strongly Agree (5). Table 4 presents the results.

Table 4. Results of the user experience evaluation.

Questions	Results
This application is useful	4.3
This application is intuitive	4.1
The system is fluid	4.3
I am very satisfied with the experience using the app	4.5
The questions in the application encourage me to participate in the session	4.7
Average	**4.4**

4.4 Discussion

The usability test result was 92.08 SUS points. According to Sauro (2018), the SUS points ranged between 84.1 to 100 points. The labels assigned to these values are “Acceptable” and “Best Imaginable” Based on these results, the SlideCheck usability was good. The participants agreed that the app was exciting and would like to use it again in the future. However, several participants needed support on the signup and adding questions sections.

In the experiment for evaluating the knowledge acquired, the SlideCheck system participants got 92.29 points while the control group got 73.32. According to the student t-test, SlideCheck helps students to acquire knowledge better than the popular presentation software. It could be because the participants are not just listeners, they were part of the lecture, and they ask questions, answer questions, and feel committed to paying attention to the class because they are interacting all the time.

On the other hand, the standard deviation of the control and experimental group were quite different. The standard deviation of the SlideCheck group was 13.17, while the standard deviation of the control was 16.67. It means that the experimental group results were more homogeneous than the control group results. In this way, SlideCheck contributed to the acquisition of knowledge during the lesson.

It is essential to mention that the SlideCheck system surpassed MS PowerPoint software in almost all the results. In the questions about Object concepts, MS PowerPoint surpassed with 1% to SlideCheck. Moreover, in the inheritance section, both groups had the same grades.

In the experiment to evaluate the SlideCheck user experience in a mobile device, the average results from all the questions were four, which in the linguistic scale means “Agree”. It means that the participants agreed that the SlideCheck mobile view was useful, fluid, and intuitive. They also agreed that the app encourages them to participate in the class and feel satisfied.

Although there are still aspects to improve in the application, SlideCheck aims to eliminate the monotony of presentations through an interactive system between the presenter and the listener. This way, learning is enjoyable, and the teaching process is completed.

5 Conclusions

This work presents a technological tool to design interactive presentations, where it is possible to use mobile devices to improve student dynamic and participation during the lecture. The system was called SlideCheck.

SlideCheck is an academic tool to design interactive presentations in a web platform where the users can create surveys and questions. The users with a lecturer role (teachers) can design presentations with questions about the discussed topic. On the other hand, participants can be enrolled in the lesson from their mobile devices and answer the questions during the presentation.

The results indicated an excellent percentage of usability in the linguistic scale known as "Best Imaginable". All the users completed 100% of the assigned tasks.

On the other hand, SlideCheck demonstrates that it could improve knowledge acquisition during the lesson compared to the PowerPoint software. This statement was proved with a statistical test. Moreover, the users considered the app useful, intuitive, and fluid, encouraging them to participate during the lesson.

Finally, it is essential to mention that this study generates future research lines applying Artificial Intelligence to improve the system: (1) Automatic classification of presentations. (2) Automatic classification of the questions. (3) Adaptive presentation and questions considering user profile. (4) Export of presentations and questions to external systems.

The results suggested that SlideCheck could be an excellent option to encourage students to participate during classes, improve their knowledge acquisition and improve the interaction with the lecturer during the session, making the lesson more dynamic.

Statement of conflict of interest

The authors declared no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

Acknowledgment

We appreciate Amity University, Jaipur, India, for providing study materials and resources and Anjuman-I-Kalsekar Islam's Technical Campus, Mumbai University, Navi Mumbai, India, for providing a research laboratory.

ORCID iD

Alan Ramírez-Noriega1 https://orcid.org/0000-0002-8634-9988
Yobani Martínez-Ramírez https://orcid.org/0000-0002-4967-9187
Samantha Jiménez https://orcid.org/0000-0003-0938-7291
José Mendivil-Torres https://orcid.org/0000-0002-7621-8722

References

Brooke, J. (1996). SUS-A quick and dirty usability scale. Usability Evaluation in Industry, 189(194), 4–7.

Fowler, M., & Scott, K. (2000). UML Gota a Gota. Pearson.

Graham, K. (2015). TechMatters: Beyond Basic Presentations: Using Swipe to Engage and Interact With Your Audience, Wherever They Might Be. LOEX Quarterly, 42, 4.

Grzych, G., & Schraen-Maschke, S. (2019). Interactive pedagogic tools: evaluation of three assessment systems in medical education. Annales de Biologie Clinique, 77(4), 429–435. https://doi.org/10.1684/abc.2019.1464

Kuritza, V., Cibich, D., & Ahmad, K. A. (2020). Interactive presentation digital tool Mentimeter perceived as accessible and beneficial for exam preparation by medical students. Advances in Educational Research and Evaluation, 1(2), 63–67. https://doi.org/https://doi.org/10.25082/AERE.2020.02.002

Maroto García, M. de la N. (2007). Las Relaciones Conceptuales en la Terminología de los Productos Cerámicos y su Formalización Mediante un Editor de Ontologías.

Maroto Marín, O. (2008). El uso de la Presentaciones Digitales en la Educación Superior: Una Reflexión sobre la Práctica. Actualidades Investigativas En Educación, 8(2), 23.

Mesía Maraví, R. (2011). Teaching use of the power point of slides. Investigación Educativa, 14(26), 161–171.

Nielsen, J., & Molich, R. (1990). Heuristic Evaluation of User Interfaces. Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, 249–256. https://doi.org/10.1145/97243.97281

Pressman, R. (2010). Software Engineering: A Practitioner's Approach (7th ed.). McGraw-Hill, Inc.

Sauro, J. (2018). 5 Ways to Interpret a SUS Score. MeasuringU. https://measuringu.com/interpret-sus-score/

Servatyari, K., Mardani, N., Servatyari, B., & Yazdanpanah, H. (2019). The study of factors affecting concentration in classroom among high school students in Divandarreh City, Iran, in 2018. Chronic Diseases Journal, 7(3), 153–159. http://cdjournal.muk.ac.ir/index.php/cdj/article/view/425

Sommerville, I. (2015). Software Engineering. Pearson.

Xin-geng, D., & Jian-xiang, L. (2011). Advantages and Disadvantages of PowerPoint in Lectures to Science Students.