QUIZ GAME APPLICATIONS TO REVIEW THE CONCEPTS LEARNT IN CLASS: AN APPLICATION AT THE UNIVERSITY CONTEXT

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Abstract

Nowadays, most of the students have smart phones and tablets, which can support applications (*apps*) for mobile devices. Therefore, why not to make a profitable use of them in order to review the concepts covered in class?

Quiz game applications based on students' response tools are considered as relevant source to build complementary education material that complement master classes. Generally speaking, these tools allow building online quiz games, which can be used in the education area to develop questionnaires for reviewing the concepts already covered during the master class.

A set of six tools are compared in terms of its usability at the University context to offer an overview of their main characteristics and functions depending on the teachers' requirements to support the choice of the most appropriate tool. The tools considered in this study are: *Infuse Learning, QuizSocket, Kahoot, Verso, Socrative and Poll Everywhere.*

Keywords: Quiz game applications, University, Students, Teacher, Comparison, Tools.

1 INTRODUCTION

Currently, education is evolving from a traditional perspective to a digital and web-based perspective characterized by the technological advances in the society in general and particularly in the academic world.

The Survey on Devices and the Use of Information and Communication Technologies (ICTs) in the Spanish households in 2013 [1], reveals that around 50% of the Spanish households have personal computers (desktop or laptop). This percentage increases to 96% if the ICT device is smartphones and intelligent mobile phones. On the other hand, the percentage of Spanish households that has iPads, Android tablets and e-books decrease approximately to 15%. Despite this last value, the study shows that most of the Spanish population has electronic devices related to ICTs, which demonstrates a technologically advanced society. This advancement in society not only influences households but also enterprises and public institutions.

Increasingly, companies use technological tools to manage their daily operations. The same happens to public institutions such as schools and universities that have invested in the provision of technical equipment (computers, tablets, etc ...) for teaching and learning activities. In 2002, there were 13 students per computer while in 2011 there were only 2,8 students per computer in non-university education (primary and secondary levels) [2].

These data provide an insight of the importance that technological devices, the frequency and the capacity of use of them has in these present times. As aforementioned, most of the students have smart phones and tablets, which can support applications (apps) for mobile devices. Therefore, why not to make a profitable use of them in order to review the concepts covered in class?

The main objective of this research is to study the different available free apps focused on quiz game aspects such as free students response systems in order to offer to students alternative resources to review the concepts already learnt in the master classes.

Students' response tools such as quiz game applications are considered as relevant sources to build complementary education material that supplement the master classes. Generally speaking, these tools allow building online quizzes and games, which can be used in the education context to develop questionnaires for reviewing the concepts already covered during the master class. Therefore, with

this kind of tools teachers are able to create quizzes with different questions to assess the students' understanding and comprehension.

In order to analyze the innovation of this topic, some research has been done to identify the different references already published in this area. A research on Google Scholar has been performed with two keywords: "Web-based Learning Quiz" [3] and "Web-based Learning Game" [4]. The results obtained are shown in Figure 1.
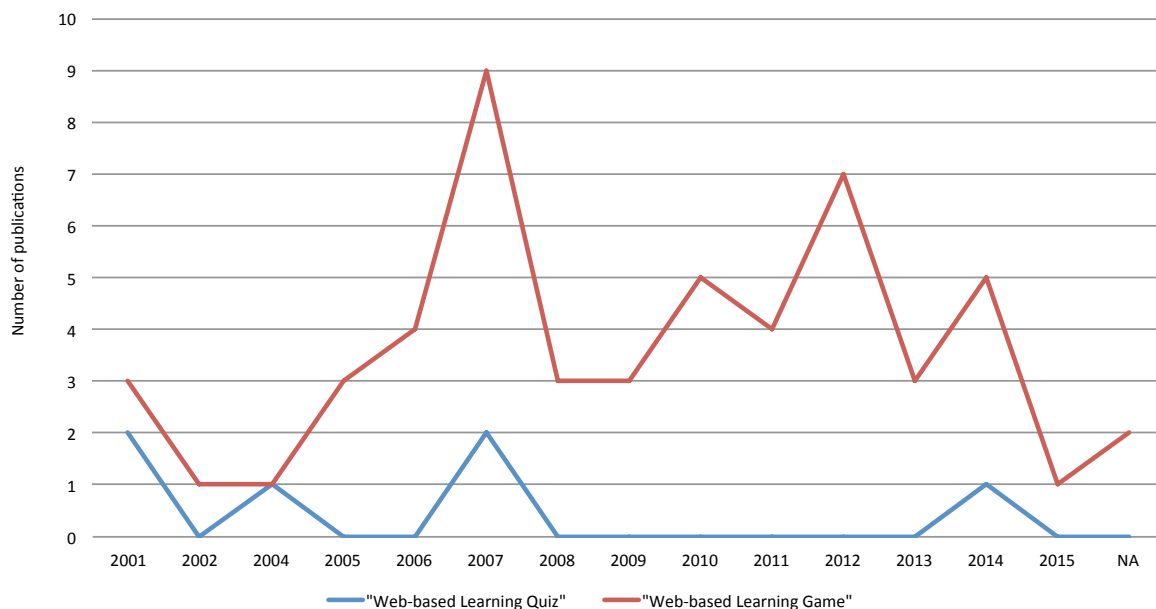

Figure 1. Number of publications related to web-based learning quizzes and games.

As it can be seen in Figure 1, the theme of learning quizzes and games is a recent topic and it seems that it is an under-researched topic since there are not many references which study in detail this new source of learning. Moreover, as far as we know, in the literature review performed, few evidences about the different apps or tools to develop learning quiz activities and a detail analysis of them [5], have been found. For this reason, this paper is focused on the study and comparison of 6 of these tools to offer an overview of their main characteristics and functions depending on the teachers' requirements.

The use of this type of tools at the university context offers [6] the potential to make learning easier, more enjoyable, more interesting, and, thus, more effective ([7], [8] and [9]).

The paper is structured as follows, section 2 provides a brief description of the quiz and game learning applications based on free students response systems. These descriptions are not based on the main characteristics of each tool but on the main differences among them. That means that each description will be focused on the innovations and differential points that each tool offers. This section also shows a comparison of the 6 tools considered in this study based on 4 different aspects. Section 3 explains the methodology used to chose the most suitable tool (based on the comparison performed in section 2) to create quizzes at the university context. Finally, section 4 offers the conclusions of the experience gained through the development of this study.

2   QUIZ AND GAME LEARNING APPLICATIONS

Some research about the most popular and free quiz and game learning applications has been developed [10]. After an exhaustive study of the available current tools, this paper is focused on 6 main applications: (i) Infuse Learning, (ii) Quiz Socket; (iii) Kahoot; (iv) Verso; (v) Socrative; and (vi) Poll Everywhere.

2.1   Quiz Games Applications Description

2.1.1   Infuse Learning

Infuse Learning is a free student response system available from any device with Internet connection including iPads and Android tablets. With Infuse Learning, teachers could develop quizzes with several different types of questions (the comparison among the different tools analysed in this paper and the types of questions allowed to be created in each tool will be developed in section 2.2.2).

To create a quiz, teachers have to create an account and log in teacher.infuselearing.com. For students, the URL is student.infuselearning.com. Once that the quiz has been developed, a number is assigned to that quiz and students could gain access to the quiz anywhere and at any time. Students only have to insert the number of the quiz and her/his name. But Infuse Learning does not allow competition among students [11].

Moreover, this tool offers an option for students to answer by creating drawings or diagrams. It also supports multiple languages and an audio option with which students could also listen to the questions [12].

2.1.2   Quiz Socket

Quiz Socket is one of the most basic free student response systems since it only offers multiple-choice questions. Teachers do not have to create an account, but could create the quiz directly without any type of requested information. Teachers define the number of questions and then deliver multiple-choice questions to students either verbally or by writing them on a whiteboard (the statements of the questions are not shown in Quiz Socket). The teacher controls the pace of the quiz by simply clicking "next question" to move the quiz along [13]. As Infuse Learning, a quiz code is assigned to the teacher who provides this number to students.

As aforementioned, Quiz Socket is the easiest tool because its simplicity. Its use is very convenient to assess students in a very simple and quick way. On the other hand, Quiz Socket is currently in its test version what means that there are not guarantees for a proper running of the tool [14].

2.1.3   Kahoot

Kahoot, like the other free student response systems, offers several options to develop creative and innovative quizzes. This tool offers an original option that is to release the quiz simultaneously to all the students and they could answer the questions managed by the teacher who controls the pace of the Kahoot quiz by imposing a time limit for each question.

As students answer the questions, they are awarded for correct answers and the timeliness of their answers. A scoreboard is displayed on the teacher's screen that could be shared with students in order to show to them the ranking. Students do not need to have a Kahoot account in order to participate in a Kahoot quizzes. To participate, they simply have to visit Kahoot.it, then insert the PIN code that the teacher gives to them to join the activity [15].

2.1.4   Verso

Verso differs a little bit from the tools already analysed since it is based on the collaboration principle to share ideas while the rest of the tools are more oriented to reinforce contents already explained in master class. The strategy of Verso tool is that students could not see the contributions and responses made by other students in their class until they have posted their own ideas or responses.

Moreover, when the responses are visible, students could not know who have posted each response (it is anonymous), what encourages participation and ensures that students engage only with the ideas being communicated in each post, rather than being influenced by who is posting [16].

2.1.5   Socrative

The essence of the Socrative tool is very similar to the previous ones, however this app presents some innovations. There are three ways to release the quiz [17].

- Student Paced – Immediate Feedback: Students receive immediate right/wrong feedback and explanations after they answer each question. Students answer questions in order and cannot skip or change their answers. Teachers are able to monitor students' progress.

- Student Paced – Student Navigation: Students have the ability to edit questions, skip questions and navigate the quiz their own way. Once they have completed the activity they can submit the entire assessment.

- Teacher Paced: Teachers control the flow of questions. Teachers send one question at a time, and visualize the responses as they happen.

Moreover, another good difference with the previous tools is that Socrative provides to students an explanation to incorrect answers, what is an optimum manner to offer feedback to students.

2.1.6 Poll Everywhere

Poll Everywhere is also a free response system. However, this tool is not only addressed to educational purposes but it has a broader perspective since it could be used to develop any kind of polls. With the use of this tool, there are examples of polls addressed to conferences, medicine purposes, etc…

Moreover, there is another characteristic that differentiates this tool from the rest analysed in this paper and it is the voting system. All the apps previously analysed, uses web voting. However, this tools, besides the web voting, also offers the SMS text voting [18].

2.2 Quiz Games Applications Comparison

The comparison among the different student response systems of quiz applications has been done taking into account four general features:

- Quiz general properties: These characteristics cover general aspects to develop a quiz such as title of the quiz, description, etc…

- Questions and questions' options: This feature is related to the type of questions: multiple-choice, true or false, etc… and some other properties such as the possibility to randomize the order of the questions or responses, the possibility to upload images to support and clarify the questions, etc…

- Teachers' role: This feature is related to the options, choices, possibilities, rights and preferences that the quiz application offers to teachers.

- Students' role: This aspect is related to the options that the different quiz tools provide to students when they are participating in a quiz.

The following sections show the results obtained after an exhaustive review of the quiz applications taking into account the previous features.

2.2.1 Quiz General Properties

The quiz general properties cover the following characteristics:

- Title: The tool offers the possibility to give to the quiz a title.

- Description: The tool offers the possibility to write a description about the quiz.

- Bad word filter: The tool performs grammatical checking of the questions and responses.

- Display results: The tool displays the results once the quiz has finished.

- Tags: The tools offer the possibility to include tags to describe the quiz.

The comparison of these general properties among the 6 quiz tools is shown in Table 1:

Table 1. Quiz General properties comparison.

	InfuseLearning	Quiz Socket	Kahoot	Verso	Socrative	Poll Everywhere
Title	✓	X	✓	✓	✓	X
Description	✓	X	X	✓	✓	X
Bad Word filter	✓	X	X	X	X	X
Display Results	✓	✓	✓	✓	✓	✓
Tags	X	X	✓	✓	X	✓

✓ Supported in the tool, X Not supported by the tool

2.2.2 Questions and questions' options

This section analyses the different possibilities of the 6 tools studied regarding the type of questions and their options:

- Type of questions:

  o True/False: True-false questions have the objective to measure the ability to identify if questions are correct. The questions are usually statements that the student has to judge as true or false.

  o Multiple-choice: With this type of question, students are asked to select the best possible answer (or answers) out of the choices from a list.

  o Sort & Order: These questions represent a list of statements that should be ordered correctly.

  o Text Response: This type of question allows to write free text with the correct response.

  o Numeric response: This type of questions searches numerical responses.

  o Likert Scale: It is an approach to scale responses, f. ex. 1. Strongly disagree; 2. Disagree; 3. Neither agree nor disagree; 4. Agree and 5. Strongly agree

  o Clickable Images: This question shows an image and students should select different parts of the image depending on what is being asked.

- Questions' options:

  o Upload an image: The tool allows to upload images to complement questions (to facilitate students the understanding of the question) or as a part of a question, f. ex. as clickable images.

  o Upload a video: The tool has the possibility to upload a video in order to explain part of the question or to write the question with regard to what has been shown in the video.

  o Unlimited question text: The tool has no characters'' limitation to write questions.

  o Edit: After writing a question, teachers could edit questions in order to update information.

  o Delete. Teachers could delete questions already created in a quiz.

  o Randomize questions order: The tools provide the possibility to randomize questions, that is, the tool allows to change questions order randomly.

  o Randomize Answer order: This option is similar to the previous one. For example, in multiple-choice questions, the tool allows to change the order of one question's responses.

  o Explanations for wrong answers. Once students have answered the questions, when the results are displayed, the tools offers the option for teachers to write an explanation about the response in order to clarify why the response answered by students was wrong.

A comparison among the 6 quiz applications with regard to the different types of questions and their options is shown in Table 2:

<p style="text-align:center">Table 2. Questions and their options comparison.</p>

			InfuseLearning	Quiz Socket	Kahoot	Verso	Socrative	Poll Everywhere
Type of questions		True/False	✓	X	✓	X	✓	✓
		Multiple choice	✓	✓	✓	X	✓	✓
		Sort & Order	✓	X	X	X	X	X
		Text Response	✓	X	X	✓	✓	✓
		Numeric response	✓	X	X	X	X	X
		Likert Scale	✓	X	X	X	X	X
		Clickable Images	✓	X	X	X	X	✓
Questions' options		Upload an image	✓	X	✓	✓	✓	✓
		Upload a video	✓	X	✓	✓	X	X
		Unlimited question text	✓	X	X	✓	✓	✓
		Edit	✓	X	✓	✓	✓	✓
		Delete	✓	X	✓	✓	✓	✓
		Randomize questions order	✓	X	✓	X	✓	X
		Randomize Answer order	X	X	✓	X	✓	X
		Explanations for wrong answers	X	X	X	X	✓	X

*Only four responses available

2.2.3 Teachers' role

Depending on the quiz application used, teachers have different alternatives or possibilities. The main of them are the following ones:

- Create an account (Sign up): It is mandatory to create a quiz that teachers create an account with their data.
- Tutorial /Support Guide: Some tools offer a tutorial to support teachers in the development of quizzes (at least the first time a teacher logged in).
- Multiple languages: Some tools support multiple languages environments.

A comparison among the potentials offered to teachers by each of the 6 quiz tools is shown in Table 3:

<p style="text-align:center">Table 3. Teachers' role comparison.</p>

	InfuseLearning	Quiz Socket	Kahoot	Verso	Socrative	Poll Everywhere
Create an account (Sign up)	✓	X	✓	✓	✓	✓
Tutorial /Support Guide	✓	X	✓	✓	✓	✓
Multiple languages	✓	X	✓	X	✓	✓

*Support to foreign languages

2.2.4 Students' Role

The study of the 6 quiz game tools is related to the following students-oriented aspects:

- Code: The tools provide a code to make the quiz accessible to students.

- Name: it is not mandatory that students create and account but they have to define their nickname in order to get access to the quiz.
- Audio: The tools offer the possibility to make the questions audible.
- Competition simultaneously: The tool offer a simultaneous session in which all the students could gain access in real time in order to encourage competition among them.
- Student Paced - Immediate Feedback: Students receive immediate information about their responses and the correct ones after they answer each question.
- Student Paced: Student Navigation: The results are only displayed once students have completed the quiz. However, they could navigate through the different questions as they wish before submitting all their responses.
- Web Voting: The tools offer that the responses to the quiz questions by students could be done through a web browser.
- SMS text voting: The tools offer that the responses to the quiz questions by students could be done through a SMS services.

A comparison among the possibilities available to students by each of the 6 quiz tools is shown in Table 4:

Table 4. Students' role comparison.

	InfuseLearning	Quiz Socket	Kahoot	Verso	Socrative	Poll Everywhere
Code	✓	✓	✓	✓	✓	✓
Name	✓	X	✓	✓	✓	✓
Audio	✓	X	X	X	X	X
Competition simultaneously	X	X	✓	X	✓	X
Student Paced: Immediate Feedback	✓	✓	✓	✓	✓	✓
Student Paced: Student Navigation	X	X	✓	X	✓	X
Web Voting	✓	✓	✓	✓	✓	✓
SMS text voting	X	X	X	X	X	✓

2.2.5 Summary

In the previous section, a brief description of 6 tools has been performed and a comparison of the main options and characteristics of them has been defined. This analysis supports the choice of the appropriate tool depending on the educational objectives pursued. Although these tools are very similar, they present differences that could be the key to choose one tool or another. Depending on the teachers' intention, one or another tool will be selected to try to achieve the educational objectives. For example, teachers interested in making her/his students collaborate, will probably choose Verso. However, for a teacher who wishes to develop a simple quiz very quickly, the most appropriate option would be Quiz Socket.

3   APPLICATION AT THE UNIVERSITY CONTEXT

A real implementation has been carried out in a subject of an Engineering Master Degree performed at the *Universitat Politècnica de València*.

This subject consists of master classes in which theoretical concepts were explained by the teacher. The students were concerned because there were several new concepts very similar that they have to learn and some of these concepts only have slight differences. Therefore, it was detected the need to develop activities to make students understand and remember the concepts already learnt in class.

After the identification of this need, the methodology used to address this problem was to search the most popular free response systems and analyse them carefully taking into account the following aspects that were very important for the teacher:

- The questions should be multiple-choice (in order to have different alternatives of responses with some of the concepts explained during the master classes).
- The quiz should be performed simultaneously by all the students (in order to develop this activity during a class).
- The names of the students should be visible in the quiz so that the teacher could assess students' responses.
- The quiz should have a time limit for each question in order to make the activity, dynamic.
- The results of the quiz should show the scores based on two aspects: (i) the correct or incorrect number of questions answered by students and (ii) the speed of answering in order to promote the healthy competition among students.
- The scoring should be available after each question response to be visible by all the students.

Taking into account these requirements and based on the tools' comparison already performed (section 2), it was decided that the most appropriate tool that fulfil all the previous teacher's needs was Kahoot.

This tool was used from two different perspectives: teacher and students. The main activities carried out for both roles were:

Teacher Role:

- Register in the web page https://getkahoot.com/
- Start to develop the quiz.
- Define questions: The number of characters in order to formulate the question was limited to 79 but images and videos could be uploaded, allowing personalizing as much as possible the questions.
- Prepare tricky answers. Short ones in order to encourage students to quickly answer.
- Decide the length of time that students have in order to answer the questions.
- The tool automatically provided a random identification number and the teacher gave this number to the students in order to gain access to the quiz game.

Students Role:

- In a personal device (computer, phones, tablets, etc.) students got access to their browser and went to kahoot.it
- Students did not need to register in the web page.
- They inserted the identification number of the quiz given by the teacher.
- They also wrote their nickname.
- And, finally they answered the questions within the time allowed by the teacher (also defined in Kahoot).

After answering each question the Kahoot app showed the winner person/team. Each student/team had an associated score. The score increased if the question was properly answered and according also to the response rapidity.

The experience gained with this type of activity (and after an opinion survey among the students) was that most of them state that Kahoot quizzes were very useful to review concepts already held during the master classes. Moreover, it encourages healthy competition among students and it seems to be a motivational and educationally effective tool.

4   CONCLUSIONS

In this technological era, teachers do not need to waste time in order to create a personalised application since there exist many open source applications, above compared, to collect students' responses. The free students response tools are applications that offer relevant benefits to students such as:

- Reviewing the concepts already held in the master class.

- Students playing while learning.
- Students realise what the most relevant concepts are in the subject.
- Enhancing teamwork, reach consensus if playing with teams.
- Students think in a short period of time as regards the contents covered in the master class.
- Students give an idea of the concepts that may appear on the exam.
- The promotion of healthy competition and the increase of students' interest in the subject.

Moreover, from the teachers' point of view, the creation of quizzes is very simple and most of the tools analysed in this paper offer tutorials and a very friendly interface to create quizzes.

The choice of the most appropriate tool depends on many factors but basically teacher will be the responsible to define their needs and based on these requirements and in the comparison performed in this paper, chose the most suitable tool that fulfils their expectations.

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