RESULTS OF THE USE OF KAHOOT! GAMIFICATION TOOL IN A COURSE OF CHEMISTRY

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INTRODUCTION

• Given the strength and interactivity of Information and Communication Technologies (ICT) in all areas of society, the current classroom cannot be conceived without the use of technological tools, as for example is the introduction of mobile devices (tablets, smartphones or laptops) in the classroom. One clear example of the use of mobile devices in education is gamification, which is understood as the use of mechanisms, aesthetics and thinking in order to attract people, encouraging action, promoting learning and solving problems.

•One of the most employed gamification tools is *Kahoot!*, a free tool that has gained popularity among teachers for its simple use and its ability to establish active work dynamics in the classroom. Kahoot! allows teachers to create surveys, questionnaires and discussions, obtaining feedback from students in real time. The questions are projected in the classroom and the students answer them via their mobile devices within the designated time. Each question shows the respective winner and the points are accumulated to offer a final ranking, as if students were in a competition.

•The following is a case study, carried out with two groups of students of a third-year theoretical subject in the Chemistry Degree at the University of Valladolid during the present academic year (2017-2018). The gamification tool *Kahoot!* was applied with different frequency of use. The academic results of these two groups of students were compared, and then these results were in turn compared with those obtained for the previous year in the same subject (2016-2017), in which *Kahoot!* was not used; the aim was to study the potential benefits associated with the use of this tool.

OBJECTIVES

The main goal of this study was to assess the extent to which students´ knowledge developed, by comparing their marks after a new pedagogical approach had been applied.

Moreover, certain secondary goals were proposed:

- To ascertain whether there are differences and whether better learning results are obtained when using the *Kahoot!* tool compared to traditional methods.
- To promote the use of new technologies and digital games in teaching-learning processes via *Kahoot!.*
- To encourage an entertaining and attractive learning environment that captures the attention and interest of the students.
- To improve the understanding of the *Kahoot!* tool in order to use it as a means of evaluation in subjects included in the Chemistry Degree.
- To encourage the motivation and interest among the students to achieve greater active participation and involvement in their own learning process, thereby enhancing their academic performance.

HYPOTHESIS

The study starts from a series of initial hypotheses:

- Kahoot! contributes to improvement in memorizing concepts, thus facilitating students' study process.
- Learning results are better thanks to games in the classroom.
- The effectiveness of Kahoot! depends on the frequency of the questionnaires.

METHODOLOGY

GROUP 1 (42 students)

Played a *Kahoot!* questionnaire once per lecture

GROUP 2 (47 students)

Played a *Kahoot!* questionnaire once every two lectures

- The participation in the *Kahoot!* questionnaires was not mandatory.
- The students played the *Kahoot* questionnaires through their smartphones.
- To verify if *Kahoot!* contributed positively to learning outcomes, questions used in the quizzes were included in the partial and final exams of both groups:
  - Partial examination of both groups. 10 test questions were raised, of which 3 had been previously answered through *Kahoot!*.
  - Final exam included 5 test questions, of which 2 had been previously answered in the *Kahoot!* questionnaires

RESULTS AND DISCUSSION

Students´ participation

Table 1. Overall number of students that participated in each of the *Kahoot!* questionnaires.

Lecture	1	2	3	4	5	6	7	8	9
Group 1	25	29	31	29	29	29	26	28	27
Group 2[A]	NP	23	NP	23	NP	22	NP	21	NP

NP: not played; [A]Group 2 played Kahoot! questionaries once each two lessons.

Table 2. Number of students that participated in each of the *Kahoot!* questionnaires.

Nº of Kahoot! quizzes	9[A]	8	7	6	5	4[B]	3	2	1	0
Group 1	16	6	3	1	2	2	5	1	1	5
Group 2	NP	NP	NP	NP	NP	14	5	6	3	19

NP: not played; [A]maximun number of Kahoot! questionaries for Group 1; [B]maximun number of Kahoot! questionaries for Group 2.

Although the number of participating students was quite similar in all cases, these were not always the same ones: in Groups 1 and 2, these numbered 37 and 28, respectively, figures which are significantly higher than those summarized in **Table 1**; also as can be seen in **Table 2**, there was great variability in the number of *Kahoot!* questionnaires played by each student. the number of students that participated in the *Kahoot!* quizzes was significantly higher for Group 1 (37 of 42 students; 88%) than for Group 2 (28 of 47 students; 60%).

Comparison of the students´academic performance

Table 3. Comparison of the students´ academic performance (Group 1) in the partial exam.

Academic course	Mean mark (SD)	Mean mark of the repeated Kahoot! questions (SD)	% of students that passed the exam
2016-2017	4.32 (1.75)	NP	39
2017-2018 (Kahoot!)	5.98 (1.93)	6.46 (2.57)	61

NP: not played; **SD**: standard deviation.

Table 4. Comparison of the students´ academic performance (Group 2) in the partial exam.

Academic course	Mean mark (SD)	Mean mark of the repeated Kahoot questions (SD)	% of students that passed the exam
2016-2017	4.41 (1.91)	NP	39
2017-2018 (Kahoot!)	5.82 (1.96)	5.70 (2.42)	68

NP: not played; **SD**: standard deviation.

Table 5. Comparison of the students´ academic performance (Group 1) in the final exam.

Academic course	Mean mark (SD)	Mean mark of the repeated Kahoot! questions (SD)	% of students that passed the exam
2016-2017	4.00 (1.75)	NP	44
2017-2018 (Kahoot!)	5.01 (1.74)	5,70 (2.99)	71

NP: not played; **SD**: standard deviation.

Table 6. Comparison of the students´ academic performance (Group 2) in the final exam.

Academic course	Mean mark (SD)	Mean mark of the repeated Kahoot questions (SD)	% of students that passed the exam
2016-2017	4.06 (1.93)	NP	42
2017-2018 (Kahoot!)	5.07 (2.76)	5.10 (2.76)	62

NP: not played; **SD**: standard deviation.

As can be observed in **Tables 3-6**, students' overall marks were significantly higher in both groups in relation to the previous year, and this correlated directly with the percentage of students that passed the exam, representing an increase of more than 25%. In addition, it was found that if only the repeated *Kahoot!* questions were taken into account, the mean mark was higher in Group 1 with respect to the overall mean mark of this group and Group 2. This could be explained by the higher frequency of the *Kahoot!* quizzes.

CONCLUSIONS

✓The use of a simple gamification tool (*Kahoot!*), has proven to be positive for the students' academic performance in a Chemistry course. This can be seen in the significant improvement of their marks or in the number of students that passed the exam in relation to that of a previous year in which Kahoot! was not applied.

✓ It has been also observed that the frequency of playing *Kahoot!* quizzes had an influence on the students' marks, as significant differences were observed in the mean marks obtained in the repeated *Kahoot!* questions in both exams, and in the number of students that passed the final exam. This observation could be related with the students' participation in the *Kahoot!* questionnaires.

✓It may, therefore, be concluded that the goals proposed at the start of the study were successfully achieved and that the initial hypotheses were correct. However, given that the results presented here have been obtained from a pilot study, it is necessary to perform more exhaustive research (different courses and subjects), in order to verify the effectiveness of *Kahoot!* for improving students' academic performance in the Degree of Chemistry.

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