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Kahoot! in Music and Physical Education Classes in Higher Education

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Abstract. *The Kahoot! platform has been shown to be versatile, easily accessible and user-friendly. According to the scientific literature, the platform is more widely used in theoretical subjects and less employed in more practical disciplines. In this study, therefore, we conducted a survey of 324 students from two Spanish public universities who used Kahoot! in the more practical subjects of Music and Physical Education during the 2019-2020 academic year. For this purpose, we created a questionnaire measuring five dimensions: usefulness, fun, learning, interaction and involvement. Confirmatory factor analysis was used to test the questionnaire's goodness of fit (e.g., CFI=.984), which was found to be adequate. In general, participants rated each of these items positively. Opinions were more favourable in Music than in Physical Education in most dimensions. We observed that second- and third-year students tended to give higher scores, and that their responses are similar regardless of their university and their experience with Kahoot prior to participating in this study. Our conclusions suggest that Kahoot! allows teachers to present this conceptual content in a different way by teaching concepts and procedures through an active, innovative, collaborative methodology that is more attractive to the students. Consequently, students are able to learn more effectively.*

Keywords: *gamification; Kahoot; Higher Education; Music Education; Physical Education*

Kahoot! en asignaturas de Música y Educación Física en Educación Superior

Resumen. *La plataforma Kahoot! se ha revelado como una herramienta versátil, accesible y de fácil manejo. No obstante, su uso está más extendido en disciplinas de corte teórico y no tanto de características procedimentales. La presente investigación pretende conocer la opinión de 324 alumnos de dos centros universitarios públicos españoles, que utilizaron la herramienta Kahoot! en disciplinas de Música y Educación Física durante el curso académico 2019-2020. Para ello, se elaboró un cuestionario con una estructura factorial de 5 dimensiones: utilidad, diversión, aprendizaje, interacción e implicación. Mediante un análisis factorial confirmatorio se validó esta estructura y los resultados mostraron un adecuado ajuste del modelo a los datos (CFI=.984). Los participantes obtuvieron puntuaciones positivas para cada uno de los ítems señalados. Las opiniones fueron más favorables en las disciplinas de Música que en las de Educación Física en la mayoría de las dimensiones. Se observó que a mayor curso las puntuaciones tienden a ser más elevadas y que sus respuestas son similares independientemente de la universidad a la que estén matriculados y a la experiencia previa con el uso de la herramienta antes de participar en el presente estudio. Las conclusiones sugieren que Kahoot! permite presentar los contenidos conceptuales de modo diferente, integrando conceptos y procedimientos en una metodología activa, innovadora y colaborativa, siendo, a su vez, más atractivos y repercutiendo en la mejora del aprendizaje.*

Palabras clave: *gamificación; Kahoot!; Educación Superior; Educación Musical; Educación Física*

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Introduction

In the context of the historical, political, cultural and technological changes that have taken place in recent decades, teaching and learning at all educational levels have become more focussed on the characteristics and real needs of students (Guzmán-Gómez & Saucedo-Ramos, 2015). In the current context of innovation and technological transformation of the teaching profession, the modern university and its agents are no longer removed from the broader interests of a global and hyper-connected society (Barnett, 2020). Similarly, current teaching methodologies take into consideration the real digital environment in which the teacher and the student are immersed, and on this basis, or within this context, create resources for practical and theoretical teaching (Gértrudix-Barrio et al., 2017). Hence the importance of gamification strategies, or, in other words, the use of elements typical of games and video games in non-recreational environments. These game-like elements include competition or reward mechanisms and audio-visual stimuli. Such strategies can be used at all stages of education (Kapp, 2012).

It is important to remember that gamification does not mean turning the classroom into a setting focussed mainly on leisure strategies, but rather involves channelling the structure of games to benefit the teaching and learning process in many ways, such as by increasing student motivation and enthusiasm for learning (Quintanal, 2016). Faiella and Ricciardi (2015) emphasize that this methodology: a) improves learning outcomes, b) increases teaching effectiveness, and c) increases students' commitment, understanding and autonomy. In addition, some gamification tools are free and can be used to explore and evaluate skills (Pérez-López & Rivera-García, 2017). In a meta-analysis that explored whether gamification improves learning performance, Bai et al. (2020) showed that in addition to building enthusiasm, these strategies also provide performance-enhancing feedback; the game fulfils the student's need for recognition and promotes goal-setting. On the downside, however, these games can also cause anxiety and jealousy, and they may therefore be rejected by some students.

Kahoot! as a tool for active learning

One of the gamification tools that can be useful in education is Kahoot!, a free, highly versatile and useful digital quiz platform on which teachers can determine both the type of questions used (multiple choice, or true/false) and the response time limit. The program can create activities for teams or for individual players, and every Kahoot! activity can be shared via the platform and even modified by other members of the learning community. For each Kahoot! competition, the platform also creates an Excel spread sheet that shows each player or group's results, including the number of correct answers and the time taken to respond (Yürük, 2019).

The scientific literature has shown that the use of this platform can have a direct impact on teaching and on the acquisition of conceptual and practical strategies by students in all stages of education (Bryant et al., 2018; Cameron & Bizo, 2019; Guardia et al., 2019). Specifically, the tool encourages both positive competitiveness and collaborative learning among different classroom sub-groups (Castro et al., 2018). The platform also includes a highly user-friendly assessment function. This intuitive user experience is crucial if the tool is to be used to offer effective feedback, since the specificity and accuracy of the platform would be worthless if users (students and teachers) did not know how to use it. Specialists also draw attention to the versatility of Kahoot!, which can be used on different mobile devices (iPhones, Android phones, tablets, iPads, etc.), as well as on desktop computers. It is essentially compatible with any operating system with an Internet connection. This allows the quizzes and games to be used outside the classroom to optimize study time, as users can choose when and where to complete them. This strategy also brings teachers closer to their students, and it allows the former to revise contents and strategies while providing continuous feedback (Gursoy & Orhan, 2019). Specifically, some studies have reported the following results of the use of Kahoot! in higher education classrooms (Ismail et al., 2019; Wang & Tahir, 2020):

1. The platform makes learning an active and attractive activity, and for many students the electronic gamification format and the accompanying visual stimuli represent a new way of learning.
2. The platform allows educators to implement effective evaluation processes, in most cases involving redesigning the teaching contents to go beyond the traditional questionnaire format so that they can be reliably evaluated using Kahoot!.
3. This type of evaluation has a significant effect on performance and, therefore, on student motivation, provided that the quizzes are designed to develop the extrinsic aspects of motivation.
4. Kahoot! is one of the key elements of the latest teaching methodologies, and therefore plays a fundamental role in face-to-face and semi-distance learning.
5. Kahoot! is a learning tool designed for a new generation of digital natives and is therefore an Education 3.0 tool.
6. The involvement of electronic devices requires teachers to undergo continuous and in-depth training in both digital skills and in the use of specific educational methodologies and resources in their subject of expertise.

Although Kahoot! is extremely popular in the educational community, it can be stressful for some users, who report feeling some anxiety or fear of error when answering the questions (Saracoglu & Kocabatmaz, 2019). Other reservations come from authors such as Pérez and Hortigüela (2020), who are in favour of innovation in the classroom, but at the same time ques-

tion the tendency among some teachers to credit such methodologies with "magic powers" to ensure the acquisition of key skills. Meanwhile, other authors have pointed to some negative effects of the use of these tools, including: a) an association with competitiveness, b) relative demotivation among the lowest-ranking students, and c) excessive use of rote learning to participate in these games (Hanus & Fox, 2015). Nonetheless, other researchers such as Castro et al. (2019) have drawn attention to the fact that students themselves often prefer their Kahoot! scores to be taken into account when calculating their final grade.

In addition, Kahoot! can be part of a broader methodology for active learning that requires students' involvement in tasks and helps them self-regulate their learning process. It also fosters the generation of meaningful learning and of dynamics that allow feedback (Pintor, 2017).

Based on a constructivist paradigm, focused on the active construction of knowledge and the development of competences via the active participation of the student in his own learning (Taber, 2006), it may be suggested that gamification in general as an educational methodology, and Kahoot! in particular, benefit the construction of students' learning.

There are abundant studies in the academic literature on the creation of conceptual contents, on formative and summative assessment, and on lectures or presentations (Kim & Gurvitch, 2018). However, less research has been conducted on practical concepts (Curto-Prieto et al., 2019). This is important, since it seems that university students consider Kahoot! to be more effective for theoretical than for practical contents (Ranieri et al., 2018). Despite this, Kahoot! has also been used as a didactic tool with positive results in subjects which, by their nature, could be considered to have a greater amount of procedural than conceptual content. Such is the case of Music and Physical Education courses, which share certain specificities, such as the use of movement in a range of different ways (physical, acoustic, and educational). Furthermore, music, like physical education, brings with it a series of bodily sensations, which is one reason why these two disciplines could benefit from a joint approach (Learreta & Sierra, 2003).

In the field of music education, studies have been published on the use of other apps (Ramos & Botella, 2017) and even on Kahoot!. According to Cantos (2017), for example, Kahoot! is widely used by music teachers, although the results have not yet been extensively evaluated (Carrión, 2019).

Studies of the use of Kahoot! in the field of physical education (PE), meanwhile, have shown that the platform can be used not only to develop theoretical content, but also to enhance motor skills (Ortí, 2018). However, as Pérez and Hortigüela (2020) and Victoria (2020) show, the key lies in inter-subject to achieve a more active life style. Other possible functions in PE include answering questions *in situ* in the gym, surprise questionnaires and quizzes (Victoria, 2020). Ortí (2018) conducted an interesting study in secondary education in which small groups of students learnt aspects of corporal status, such as anaerobic resistance, by answering Kahoot! questions that involved completing motor challenges around the school and theoretical challenges on the curricular content. However, further studies in the use of Kahoot! in both PE and music are needed (Kim & Gurvitch, 2018; Ortí, 2018; Pintor, 2017).

In general, there is consensus in the scientific literature that Kahoot! contributes to the development of aspects related to the perceived usefulness of class materials (for both teachers and students), students' enjoyment, and development of learning. Therefore, the platform leads to greater involvement with the material and the interaction with classmates (Wang & Tahir, 2020).

In light of the situation revealed by our literature review, we performed this study after obtaining an Education Innovation Project grant from a Spanish public university for the implementation of Kahoot! in undergraduate Music and PE classes, given the need for empirical studies on the educational use of this tool in more practical subjects of this kind. The aim of this study is to determine the opinion on the educational benefits of the Kahoot! platform of Education undergraduates enrolled in Music and PE classes.

Learning context

This study was conducted after the researchers had obtained an Education Innovation Project grant to study the use of Kahoot! in university subjects during the 2019/2020 academic year at a Spanish public university. In June 2019, the specific subjects, Music and PE, were chosen to be included in the study. At the same time, the teachers held various working meetings to discuss issues related to the Kahoot! questionnaires, such as a) the number of questions and b) the response time for each questionnaire, c) based on the contents of the teaching programs. The group also agreed on the best way to implement this teaching technology: a) whether completing the Kahoot! questionnaire would be compulsory or optional, b) whether the score would be taken into account in computing students' final grade for the subject and, if so, c) the percentage of the final grade it would represent; and d) the topics to be included in the Kahoot! questionnaire.

Once the second semester of the 2019-2020 academic year had begun, the methodology to be used and the schedule for completing the different Kahoot! questionnaires were explained to students enrolled in each of the subjects selected for the project. Students were also taught how to use the digital tool and completed an initial test with questions on general concepts that would be addressed in each subject. The time to be set aside to correct the questions was also established. In short, each Kahoot! questionnaire was intended to achieve active learning as follows:

- All questions would be constructed based on students' previous knowledge.
- Feedback would be provided about the correctness of the answers, with special attention paid to aspects not well understood by students.
- Each questionnaire would consist of at least 10 questions.
- Questions students had not understood would be presented again in a different form in the next Kahoot!
- Each questionnaire should feature at least five True/False questions and five other multiple-choice questions, in order to provide a variety of formats to improve the learning process.
- At least one of the questions had to refer to a photograph or illustration.
- At least one of the questions had to refer to a video (the response time would start immediately after watching the video).
- Each teacher had to adjust the response time according to the content presented.
- The goal was to encourage student involvement in the teaching-learning process. The use of real image and video prompts allows students to improve their skills as future educators when it comes to working with audio and visual materials.

Two Kahoot! questionnaires were assigned each month, one to present content and detect ideas, and another to review or evaluate the content. Unfortunately, the schedule was interrupted due to the state of alarm declared in March 2020 by the Spanish government. As far as possible, some subjects continued to be presented in Kahoot! via the virtual campus. In the first weeks, there was a pause due to the uncertainty of how the studies could be continued, but gradually it was possible to return to normality in the classes with the use of educational platforms. Within the COVID-19 scenario, this tool was especially helpful in this period of isolation, as students could answer the questions of each Kahoot! quiz from their homes, using mobile phones.

Method

Participants

The sample consisted of 324 students from two universities: the Complutense University of Madrid (UCM), 84.79%, and the University of León (ULE). Most participants were women (88.6%), of between 18 and 35 years of age (Mean = 20.7; SD = 2.4). The participants were enrolled in one of the following degree programs: Double Degree in Early Childhood Education and Pedagogy, Early Childhood Education, or Primary Education. First-year students made up the biggest group (38.73%), although the percentage of second-year (29.93%) and third-year students (31.34%) was also relevant.

All the students had used Kahoot! in one or more of their previous university classes. For example, three (0.93%) had used it in at least six subjects; nine (2.78%) in five; 33 (10.19%) in four; 68 (20.99%) in three; 113 (34.68%) in two, and 49 (15.12%) in one. The remaining students reported ranges of between seven and eight (one, 0.31%); six and seven (one, 0.31%); five and six (one, 0.31%); four and five (one, 0.31%); three and four (nine, 2.78%); two and three (seven, 2.16%); or gave qualitative answers ("in many", "in most", "in some", "throughout my degree course").

Specifically, in addition to the Music and PE subjects evaluated in this study, the students reported that they had most often used the platform in their courses on Educational Psychology (116, 35.8%) and Management of Educational Institutions (59, 18.21%); nearly all study participants indicated that they had mostly used Kahoot! in theoretical contents. Meanwhile, 141 (43.52%) students stated that they had used it other contexts, while 179 (55.25%) stated that they had used the platform for the first time at the university. Of those who had used it prior to university, 35 (10.8%) had used it in Secondary Education & GCSE studies; while 106 (32.72%) had used it in other compulsory and non-compulsory educational settings (language schools, vocational training, music studies, etc.).

The university students were invited to volunteer to participate in the study, and they were given detailed information about the research and the questionnaire. All respondents gave their consent for the study to be published. Respondent anonymity was guaranteed, and all involved gave their informed consent.

Instruments

Based on our literature review, we created a questionnaire intended to measure the opinions of Kahoot! users. Items were grouped into five dimensions: usefulness, fun, learning, interaction and involvement. As noted above, these dimensions emerged from a review of the most relevant scientific literature on the topic. The first version was evaluated by four experts from the fields of education and psychology, who suggested small changes to improve content validity and the wording of the questions. A final 23-item instrument was created, with each item answered a 1 - 6 Likert scale with responses ranging from strongly disagree to totally agree.

Statistical analysis

First, the structure was analysed using confirmatory factor analysis (CFA). The factor loadings of each associated item were estimated and the limits required to obtain statistical identification were included: the coefficient of the first item of each dimension was set at 1, the coefficients of the measurement errors of each item were set at 1, and the correlation between these measurement errors was set at 0. A second-order factor was also estimated with loading of each of the five dimensions, and the coefficient of 1 of these effects was set to 1 to keep the model over-identified. The

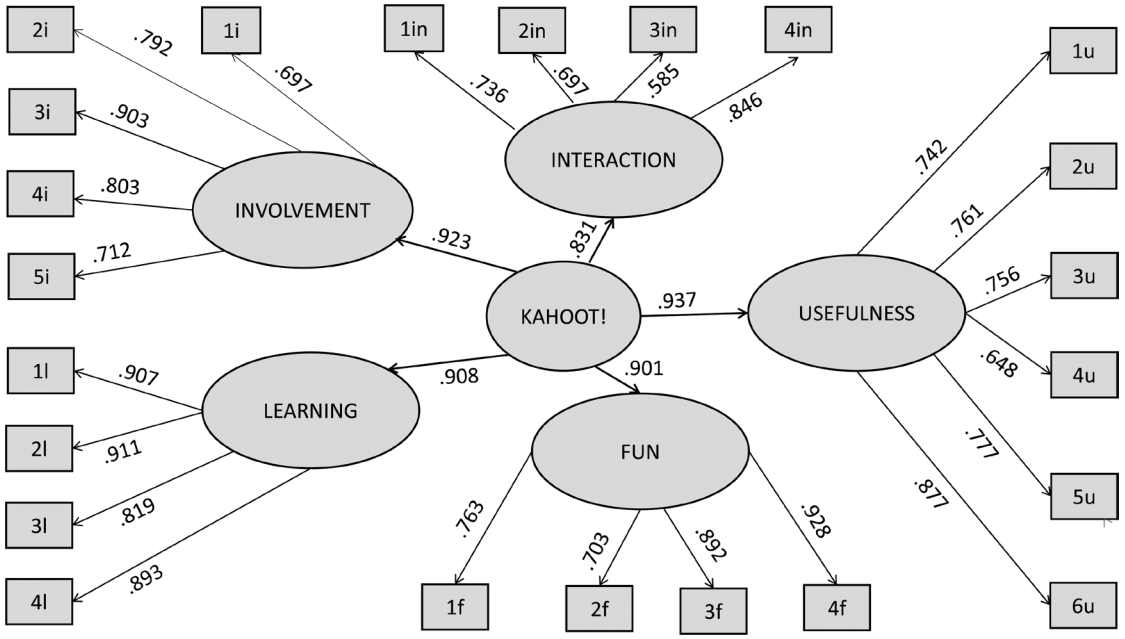

Figure 1. Confirmatory factor analysis model.

analysis model is shown in Figure 1. The CFA was performed using WLSM (Weighted Least Squares-Mean), since it is a robust method with respect to deviations from normality or small sample sizes, and it can be used to analyse both categorical and ordinal variables (Tarka, 2017). Different types of fit indices were used to measure the fitness of the model, following the usual recommendations, and the cut-off points suggested by Hu and Bentler (1999) were used: non-significant chi-square; CMIN/DF < 5; CFI > .90; TLI> .90; SRMR < .08.

Descriptive data (mean and standard deviation) were analysed for the total score, the subscales, and each of the 23 items. The normality of the scores was verified using the Shapiro-Francia test. Inter-group comparisons of factors, such as the university of origin, sex, prior use of Kahoot!, degree program, and class (Music or PE) were performed using T-tests to compare the means of two independent groups, or one-way analysis of variance. Effect sizes were also estimated when comparing groups (Cohen's *d*), assuming the usual evaluation criteria (Cohen, 1988): *d* less than 0.30 shows an insignificant effect, between 0.30 and 0.50 a small effect, between 0.50 and 0.80 a moderate effect, and over 0.80 a large effect. All analyses were performed using Stata 13.1 software for Windows and MPlus 6.11 for CFAs (Muthén & Muthén, 2010).

Results

The CFA showed an adequate goodness of fit, with values within the recommended range for most fit indices: CFI = .984; TLI = .981, chi-squared (225) = 1077.97; p <.001; CMIN / DF = 4.79; SRMR = .054. All loadings were statistically significant (p < 001). The factor loadings between the second-order factor and each of the latent factors were very high (between .83 and .94), indicating a strong correlation between each of the factors, meaning that it is reasonable to calculate a total Kahoot! opinion score. Figure 1 shows the model analysed with standardised factor coefficients, and Table 1 shows the non-standard loadings with their

Table 1. Results of the Confirmatory Factor Analysis of the scale on the teaching of expressiveness in music

Variables	Non-standard loadings (SE)	Confidence Interval (95%)
Usefulness		
Useful for content	1.00	–
Evaluation resource	1.03 (0.043)	(0.92 1.14)
Helps me focus	1.02 (0.046)	(0.90 1.14)
Useful for my future	0.87 (0.053)	(0.74 1.01)
Optimizes my studies	1.05 (0.041)	(0.94 1.15)
Satisfactory experience	1.18 (0.046)	(1.06 1.30)
Fun		
Fun activity	1.00	–
I enjoyed it	0.96 (0.026)	(0.90 1.03)
I feel like going to lectures when I play	0.76 (0.036)	(0.67 0.85)
I enjoy studying if I can play afterwards	0.82 (0.036)	(0.73 0.91)
Learning		
Helps me remember	1.00	–
Improves my understanding of skills	1.01 (0.019)	(0.96 1.05)
Helps me correct my mistakes	0.90 (0.023)	(0.85 0.96)
Makes learning easier	0.99 (0.021)	(0.93 1.04)
Involvement		
I pay more attention	1.00	–
I want it to be included in my assessment	1.14 (0.052)	(1.00 1.27)
Committed to feed-back	1.30 (0.056)	(1.15 1.44)
Doing well increases confidence	1.15 (0.055)	(1.01 1.30)
Motivation to attend lectures	1.02 (0.050)	(0.89 1.15)
Interaction		
Competitive game	1.00	–
Positive competition	0.95 (0.053)	(0.81 1.08)
We discuss scores	0.79 (0.075)	(0.60 0.99)
Promotes collaborative learning	1.15 (0.070)	(0.97 1.33)

Note: SE: standard error; all loadings were statistically significant with $p < .001$.

Table 2. Descriptive data and comparison between Music and Physical Education subjects

	Music	Physical Education	*Total means (SD)*	*t (p)*	*d*
	Mean (SD)	Mean (SD)			
Usefulness	28.18 (5.56)	26.75 (5.91)	27.43 (5.90)	2.13(.034)	0.25
Useful for content	4.83 (1.00)	4.71 (1.24)	4.76 (1.12)	0,88(.381)	0.10
Assessment resource	4.54 (1.31)	4.29(1.34)	4.42 (1.38)	1.62(.107)	0.19
Helps me focus	4.81 (1.23)	4.42 (1.27)	4.61 (1.29)	2.66(.008)	0.31
Useful for my future	4.68 (1.31)	4.76 (1.33)	4.68 (1.33)	–0.52(.602)	–0.06
Optimizes my studies	4.30 (1.34)	3.82 (1.37)	4.07 (1.38)	3.09(.002)	0.36
Satisfactory experience	5.01 (1.07)	4.76 (1.19)	4.87 (1.16)	1.88(.061)	0.22
Fun	19.69 (3.59)	18.87 (4.22)	19.27 (3.97)	1.81(.071)	0.21
Amusing activity	5.36 (0.97)	5.18 (1.09)	5.26 (1.05)	1.56(.121)	0.18
I enjoyed it	4.93 (1.06)	4.76 (1.29)	4.84 (1.17)	1.23(.220)	–0.14
I look forward to going to class when I play	4.78 (1.26)	4.55 (1.51)	4.67 (1.33)	1.52(.131)	0.18
I enjoy studying if I can play afterwards	4.56 (1.21)	4,38 (1.29)	4.46 (1.26)	1.24(.216)	0.15
Learning	19.09 (3.79)	17.84 (4.29)	18.48 (4.15)	2.67(.008)	0.31
Helps me remember	4.79 (1.09)	4.67 (1.15)	4.72 (1.14)	0.89(.373)	0.10
Improves my understanding of skills	4.66 (1.09)	4.24 (1.20)	4.47 (1.18)	3.16(.002)	0.37
Helps me correct my mistakes	4.84 (1.02)	4.57 (1.28)	4.71 (1.15)	2.04(.043)	0.24
Makes learning easier	4.80 (1.06)	4.35 (1.26)	4.60 (1.18)	3.34(.001)	0.39
Involvement	18.68 (3.83)	16.40 (4.27)	17.67 (4.26)	4.83(<.001)	0.57
I pay more attention	4.49 (1.39)	3.88 (1.55)	4.23 (1.49)	3.60(<.001)	0.42
I want it to be included in my assessment	4.67 (1.25)	3.89 (1.57)	4.35 (1.45)	4.79(<.001)	0.56
Committed to feed-back	4.68 (1.02)	4.31 (1.25)	4.51 (1.15)	2.86(.005)	0.34
Doing well increases confidence	4.89 (1.05)	4.59 (1.20)	4.73 (1.16)	2.29(.023)	0.27
Motivation to attend lectures	4.46 (1.19)	3.61 (1.37)	4.11 (1.33)	5.71(<.001)	0.67
Interaction	17,93 (3.97)	15.73 (4.34)	17.01 (4.26)	4.55(<.001)	0.53
Competitive game	4.15 (1.41)	3.45 (1.41)	3.84 (1.46)	4.29(<.001)	0.50
Positive competition	4.30 (1.43)	3.72 (1.51)	4.06 (1.48)	3.35(<.001)	0.39
We discuss scores	4.67 (1.42)	4.12 (1.60)	4.44 (1.51)	3.15(.002)	0.37
Promotes collaborative learning	4.81 (1.15)	4.45 (1.39)	4.64 (1.28)	2.52(.012)	0.30

Note: SD: standard deviation; t: Student's t with degree of freedom=N-2; g: Hedges g effect size; Comparisons with statistically significant differences (p <.05) are shown in bold; * t and g are expressed as absolute values. Comparisons are bilateral and the direction of the differences is interpreted based on the descriptive data. N=324.

95% confidence interval. The scale showed a high degree of internal consistency: Cronbach's alpha = .951.

Our results show that, generally speaking, respondents regard Kahoot! as a useful, amusing tool that helps them to learn, become involved in the subject, and interact with others. Distribution normality tests showed that normal distribution could be assumed for both the subscales and the total score.

The comparison of variables between groups shows that there are statistically significant differences between groups according to the specific class (Musical Education or PE) in which the tool was used (see Table 2). These differences were found in all subscales except for *Fun*, although the effect sizes were low and moderate. Music students expressed more favourable opinions about Kahoot! than PE students in four of the five dimensions. The most relevant differences were found in the dimensions of *Involvement* (*d*= 0.57) and *Interaction* (*d*= 0.53). These results are summarised in Table 2.

The comparison of the results by gender, university of origin and prior use of Kahoot! showed no statistically significant differences. Specifically, there are no statistically significant differences according to university of origin in *Usefulness* (*p* =.52), *Fun* (*p* =.92), *Learning* (*p* =.64), *Involvement* (*p* =.44) and *Interaction* (*p* =.50); and no differences are observed as a function of the prior use of Kahoot! in students' view of the platform in terms of *Usefulness*, (*p* =.16); *Fun*, (*p* =.44); *Learning*, (*p* =.17); *Involvement*, (*p* =.81); and *Interaction*, (*p* =.92). Nor were there any statistically significant difference with regard to gender, with non-significant results in the effect size of this variable between both groups, which can be observed in the scores obtained in the dimensions: *Usefulness*, (*p* =.63); *Fun*, (*p* =.22); *Learning*, (*p* =.79); *Involvement*, (*p* =.87); and *Interaction* (*p* =.20).

The omnibus analysis found a statistically significant difference with regard to the year of study (F [2.281] = 3.25; *p*= .040), although in the paired post-hoc comparisons (Bonferroni) no differences were found. In any event, there was a trend towards higher scores among second- and third-year students (total mean of 3rd year =109.4; SD = 20.3) than first-year students (mean of 1st year = 103.3; SD = 22.7; p = .060).

An analysis of the individual items shows that although all the students tend to consider Kahoot! a useful tool, those who made use of the tool in music-related subjects were more likely to say that it helps them to remain focussed (*d* =0.31) and that it optimizes their studies (*d* =0.36) than those who used the platform in subjects related to PE. In terms of learning, significant differences in favour of music subjects were found in the extent to which Kahoot! improves the student's understanding of skills (*d* =0.37), helps correct mistakes (*d* =0.24) and facilitates learning (*d* =0.39). In terms of the effect size, the highest scores were obtained in the *Involvement* dimension in items related to motivation to attend lectures (*d* =0.67), and the personal

importance attached to including the results of these activities in the assessment (d =0.56). These moderate scores show a similar trend to another item of the *Interaction* dimension - competitive game (d =0.50). All these scores are shown in Table 2.

Discussion

The dimensions of the questionnaire used in this study, which were created based on the literature review, are intended to measure the students' satisfaction with Kahoot!. Regarding *usefulness*, the implementation of this tool in Music and PE university classes has served to "review, consolidate and clarify the theoretical concepts" (Sánchez-Pavón, et al., 2017, p. 123). Thus, it is clear that Kahoot! is useful for performing continuous or educational assessment (De Soto-García, 2018; García-Válcárcel and Tejedor-Tejedor, 2017; Victoria, 2000). With regard to *fun*, students report that gamification methods like Kahoot! make learning more fun and interesting (Turán et al., 2016), which in turn improves other variables, such as attendance and punctuality (Fotaris et al., 2016). In terms of *learning*, the scientific literature shows that the use of Kahoot! inherently improves this dimension (De Sales et al., 2019), which in turn is also related to other factors, such as classroom dynamics and attitudes (Wang & Tahir, 2020). In line with our results, Giménez-Leal and de Castro-Vila (2019) show that this resource "has driven students to study more for longer periods at home before attending class" (2019, p. 15). *Involvement,* meanwhile, is largely determined by the satisfaction and motivation experienced by students when using gamification elements in the classroom (Fuster-Guilló et al., 2019). In terms of *interaction*, this study shows that Kahoot! improves communication with classmates and teachers, and that it promotes the development of communication and social skills.

Meanwhile, Music students registered higher scores than PE students for some of the 23 items. One example was the item measuring the extent to which Kahoot! was deemed "useful for content", clearly showing that Kahoot! is viewed by Music students as a good tool for learning conceptual content (Kim & Gurvitch, 2018), giving a "satisfactory experience". Higher scores were also found for the items reading "I enjoyed it" and "fun activity", both related to increased motivation. (Mingo-López & Vidal-Meliá, 2019; Mouws & Bleumers, 2015; Tewthanon, 2019). In the field of PE, the item with the highest score was "fun activity", which is consistent with the overall results and with the study by Fotaris et al. (2016). These findings suggest that the introduction of new technologies and new gamification tools into motor activities can increase student motivation. When it comes to Music students, two items are particularly revealing, "I feel like going to lectures when I play", related again to the advantages of gamification (Quintanal, 2016), and the item reflecting students' opinion that it "helps me remember", related to conceptual contents (Kim & Gurvitch, 2018).

Regarding the aspects least valued by students in both fields, it is interesting to note that the lowest scores were given to the dimensions of *interaction* and *usefulness*. The fact that these subjects are mainly practical and that interaction between students and hands-on activities are more common in these classes might explain why the competitive aspect of the tool is less highly valued as a competitive game and as a positive competition (Hanus & Fox, 2015). In addition, students do not believe the platform to be particularly useful as a means of optimizing their studies (Castro et al, 2018). Further research might be needed in this field to evaluate whether learning is more effective with Kahoot! than with other tools.

Regarding learning, statistically significant differences were found between the two academic subjects in the items "helps me correct mistakes", "facilitates learning" and "improves my understanding of skills". Here, the responses from Music students were more positive, as is the case with all the items in the *Involvement* dimension, since students' involvement in classroom activities determines, in turn, their improvement in learning. In this regard, it should be noted that Music is considered a language in itself that must be learned before being put into practice (Pitt, 2020), meaning that encouraging students to become more involved in this innovative and attractive activity will allow them to consolidate what they have learned.

The participants also recorded a high score for the item "committed to feedback", showing the positive effect of feedback on learning, especially among peers (Pintor, 2017). Another interesting item was "doing well increases confidence", which was more evident among Music students, who are less confident in their subject due to the need to learn musical notations that they are often unfamiliar with when they start their course. Music students, therefore, were aware of the academic and personal benefit derived from using Kahoot! (Castro et al., 2018), which promotes cognitive skills such as understanding, logical reasoning, judgement and creativity (Kim & Gurvitch, 2018).

In addition, there were high scores for all the items in the *interaction* dimension, since any kind of group task encourages collaboration and cooperation among the students themselves (Pintor, 2017; Kim & Gurvitch, 2018).

Generally speaking, our results highlight three fundamental factors. First, with respect to the differences according to year of study, there is a trend towards higher scores in second- and third-year students. This could be due to two factors: a) a higher academic level and therefore higher vocational maturity as students get experience and make progress at the university (Ortí, 2018), and b) the more students become familiar with Kahoot!, the higher their opinion of the tool.

Second, similar results were obtained among students from the two universities. This, on the one hand, is due to the fact that the potential of the tool is determined by the use that teachers make of it; and on the

other hand, the way in which teachers use it in their methodology - as Ortí (2018) shows - opens up a whole range of possibilities for new, innovative Kahoot! activities.

Third, the similar responses received regarding previous experience with the tool, regardless of the extent of use, may be due to the fact that the procedure involves the use of devices that students consider to be a part of their daily lives (mobile phones and computers), which they associate with amusing, and therefore motivating, activities (Rahmahani et al, 2020).

Finally, our review of the literature suggests that Kahoot! could not only be useful in theoretical contents, but also in other fields which involve a greater focus on motor skills, movement and practical activities, because the platform allows teachers to create questions that require the answerer to engage in more practical activities such as those often associated with Music and PE.

Conclusions

The results of this study have allowed us to meet the objectives initially set. With respect to the first, the opinions of the university students studied show that this technological tool is viewed as highly useful and able to promote, fun, learning, involvement and interaction in practical subjects. Overall, the study participants considered Kahoot! to be useful for learning content, and they rated it as a satisfactory experience and a fun activity that enhances their enjoyment of tasks. Furthermore, Music and PE are good examples of content integration, since the subjects share the link between perception and action. In an innovative university context, growing importance is being given to cross-cutting, multidisciplinary, globalising approaches that use ICT as a dynamic element in the development of various skills (Ramos & Botella, 2017).

In addition, we observed significant differences in students' opinions of the platform as a function of the subject studied, in this case, Music or PE. This is an important finding that could point to a certain association between the subjects studied and students' opinions of them. As mentioned above, Music is a subject that requires familiarity with a particular technical language on which the development of procedural skills is based. This is, *a priori*, a greater handicap for newly enrolled students of Music than for those studying PE (even though this also requires a theoretical background). Our study has shown that Kahoot! made it easier for Music students to understand their course material, due in large part to its innovative, entertaining and interactive features, which facilitate the understanding of these contents. Therefore, the characteristics of the subject should be taken into account before recommending this educational tool.

This study has some limitations: on the one hand, men and women were not equally represented in the sample; and on the other, a more representative sample of students from several different universities across Spain would be needed to achieve more generalizable results.

In future studies, it would be interesting to analyse a) the differences between the opinion of Kahoot! users on gender issues, b) other practical disciplines, c) the implementation of active, interdisciplinary educational proposals that integrate theoretical and practical content.

In conclusion, academic subjects that require the development of practical skills tend to immerse students in a practical setting that, in some cases, makes it hard for them to understand and study theoretical content. Kahoot! allows teachers to present this conceptual content in a different way by integrating the concepts and procedures in an active, innovative, collaborative methodology that is more attractive to the students, and that consequently helps them learn more effectively. Therefore, the benefit of Kahoot! is determined by the extent to which the teacher uses it to present course content in an innovative way by combining active methodology and educational technology.

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