

DIGITAL TRANSFORMATION IN BIOPHYSICS EDUCATION: GAMIFICATION-BASED ASSESSMENT USING KAHOOT! AND WAYGROUND

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Abstract

This study examines the use of gamification-based digital assessment in undergraduate biophysics education, with particular attention to Kahoot! and Wayground (formerly Quizizz). The study was conducted among 60 first-year medical students studying biophysics at Tashkent State Medical University. A four-week pedagogical intervention compared a control group receiving traditional instruction and assessment ($n = 30$) with an experimental group using gamified assessment through Kahoot! and Wayground ($n = 30$). The procedure included a pre-test, instructional intervention, post-test, and student questionnaire. Descriptive results showed an increase in the mean score from 56 to 68 in the control group (+12 points), whereas the experimental group increased from 55 to 82 (+27 points). Student perceptions were also favorable: 90% considered the gamified lessons interesting, 85% reported that the platforms helped them understand the material, 88% reported increased activity, and 92% wanted the approach to be used in the future. In the bioacoustics unit, 87% of students reported easier understanding of the topic and 89% indicated that interactive tests helped reinforce their knowledge. The findings suggest that gamified assessment can support active participation and formative assessment in biophysics, particularly when questions connect physical concepts with clinical contexts such as ultrasound and the Doppler effect. Because the source study did not report standard deviations, confidence intervals, effect sizes, or inferential tests, the findings are interpreted as descriptive evidence rather than statistical proof of effectiveness.

Keywords: biophysics education; gamification; formative assessment; Kahoot!; Wayground; Quizizz; bioacoustics; medical education

Introduction

Biophysics occupies an important position in medical education because it provides the physical basis for understanding processes and technologies encountered in clinical practice. Topics such as bioelectric potentials, circulation, sound, ultrasound, and the Doppler effect require students to connect abstract physical principles with biological and clinical phenomena. This combination can make assessment demanding,

particularly when conventional tests emphasize recall rather than rapid application of concepts.

Digital transformation in higher education has expanded the range of assessment formats available to teachers. Among these approaches, gamification introduces selected game elements—such as points, immediate feedback, competition, rankings, and short challenges—into non-game learning activities. Kapp (2012) describes gamification as an approach that uses game-based methods and strategies to support learning, retention, and application. In formative assessment, these elements can make feedback more immediate and can create repeated opportunities for students to check their understanding.

Interactive platforms such as Kahoot! and Quizizz, now known as Wayground, are particularly suitable for short formative assessments. Kahoot! is commonly used for live, teacher-led quizzes in which students respond in real time. Wayground provides live activities as well as assigned practice and assessment tasks, allowing greater flexibility for individual work. Current platform documentation confirms that Wayground is the new name of the platform formerly known as Quizizz (Wayground, 2025).

Previous educational research has reported positive learner engagement with Kahoot!. Mdallose, Ramaila, and Ramnarain (2022) found that Kahoot! could support academic performance, motivation, and active engagement in science teacher education. Similarly, Mat Husin and Azmuddin (2022) reported that university learners perceived Kahoot! as enjoyable and useful for reinforcing learning. These findings provide a relevant background for examining gamified assessment in biophysics, where rapid feedback may be particularly useful for checking conceptual understanding.

The present study therefore aimed to improve the assessment of biophysics knowledge through gamification, focusing on Kahoot! and Wayground and applying them to the bioacoustics unit. The specific objectives were to (a) compare changes in student performance under traditional and gamified assessment conditions, (b) examine students' perceptions of gamified assessment, and (c) identify practical ways to use interactive questions to connect biophysical concepts with clinical applications.

Methods

The study used a comparative pedagogical design with descriptive pre-test and post-test measurements. The participants were 60 first-year students studying biophysics in the medical education program at Tashkent State Medical University. They were divided into a control group ($n = 30$) and an experimental group ($n = 30$).

The control group received conventional instruction and assessment, while the experimental group participated in gamified assessment using Kahoot! and Wayground. The intervention lasted four weeks.

The intervention incorporated short digital quizzes into biophysics lessons. Questions addressed diffusion and osmosis, bioelectric potentials, circulation biophysics, and, most extensively, bioacoustics. In bioacoustics, the activities focused on sound parameters, hearing physiology, ultrasound imaging, and the Doppler effect. Kahoot! was used primarily for live classroom competition and immediate feedback. Wayground was used for both live activities and more individualized practice or homework. The question design combined factual items with short clinical-context problems so that students were required to identify or apply a physical principle.

The procedure consisted of four stages: an initial diagnostic test (pre-test), the instructional period, a final test (post-test), and a questionnaire on student perceptions. Academic performance was summarized using mean test scores before and after the intervention. The questionnaire examined whether students found gamified lessons interesting, whether the platforms supported understanding, whether they increased activity, whether students wanted the approach to continue, and which platform they preferred.

Because the source study reports group mean scores and percentages but does not provide standard deviations, sample-level distributions, confidence intervals, or inferential statistical tests, the present article uses descriptive comparison only. Changes in mean scores were calculated as post-test minus pre-test. Questionnaire responses were summarized as percentages. No p-values or effect sizes were calculated or inferred from the available information.

Results

The academic performance results showed improvement in both groups, with a larger absolute increase in the experimental group. The control group increased from a mean pre-test score of 56 to a post-test score of 68, representing a 12-point gain. The experimental group increased from 55 to 82, representing a 27-point gain.

Table 1
Pre-test and post-test mean scores

Group	Pre-test	Post-test	Gain
Control group (n = 30)	56	68	+12
Experimental group (n = 30)	55	82	+27

The questionnaire results were also favorable. Ninety percent of students considered the gamified lessons interesting, 85% reported that Kahoot! and Wayground helped them understand the material, 88% reported increased activity, and 92% wanted the approach to be used in future lessons. Platform preference was relatively balanced, with 45% preferring Kahoot! and 55% preferring Wayground.

Table 2
Student perceptions of gamified assessment

Question / indicator	Yes (%)	No (%)
Gamified lessons were interesting	90	10
Platforms supported understanding	85	15
Activities increased engagement	88	12
Students wanted future use	92	8

In the bioacoustics component, 87% of students reported that the topic became easier to understand, while 89% reported that the interactive tests reinforced their knowledge. The activities included questions on sound-wave parameters, hearing physiology, ultrasound diagnostics, and the Doppler effect. Thus, the digital assessment was not limited to factual recall; it also provided a structure for linking physical concepts to clinical examples.

Discussion

The descriptive results indicate a stronger increase in mean test performance in the gamified group than in the control group. The difference in gain was 15 points (+27 versus +12). This pattern is consistent with the intended function of formative gamification: students receive immediate feedback, encounter questions repeatedly, and are encouraged to remain active during the assessment process. However, the available data do not permit a formal statistical conclusion about the size or significance of the intervention effect.

The student questionnaire provides complementary evidence. High proportions of students reported that the activities were interesting, supported understanding, and increased activity. These findings are broadly consistent with previous research on Kahoot! in higher education. Mdلالose et al. (2022) reported positive effects of Kahoot! on engagement and motivation in science teacher education, while Mat Husin and Azmuddin (2022) found that university learners considered Kahoot! enjoyable and useful for reinforcing academic learning. The present study extends this line of work to biophysics within medical education and, specifically, to bioacoustics.

The pedagogical value of the approach may be particularly relevant to bioacoustics because many concepts become more accessible when represented

through short, focused questions. For example, asking students to distinguish frequency from amplitude can reinforce the physical meaning of sound parameters, while questions about ultrasound or Doppler flow measurement can connect the same principles with clinical practice. Such tasks are compatible with the interdisciplinary character of medical biophysics and can be integrated into formative assessment without replacing conventional teaching.

The two platforms also serve somewhat different instructional purposes. Kahoot! is well suited to synchronous classroom competition, where all students respond at approximately the same time and the teacher can immediately discuss misconceptions. Wayground offers greater flexibility for independent practice and assigned work. The current platform documentation identifies Wayground as the renamed Quizizz platform and describes support for live sessions, assigned activities, differentiated instruction, and performance reporting (Wayground, 2025). The choice between the platforms can therefore be aligned with the pedagogical objective rather than treated as a question of one platform universally replacing the other.

Several limitations should be noted. The study involved 60 students from one medical university and covered a four-week period. The source document does not report randomization, standard deviations, reliability coefficients for the tests, confidence intervals, effect sizes, or inferential statistical tests. The questionnaire results are self-reported and may therefore reflect students' perceptions rather than independently measured learning outcomes. Future research should use larger and more diverse samples, standardized assessment instruments, longer follow-up periods, and appropriate inferential statistics.

Conclusion

The study indicates that gamification-based assessment using Kahoot! and Wayground can be incorporated into biophysics education as a practical formative assessment strategy. In the four-week comparison, the experimental group showed a larger descriptive increase in mean test scores than the control group, and most students reported positive perceptions of the approach. The bioacoustics activities demonstrated how short interactive questions can connect physical principles with clinical contexts such as ultrasound and the Doppler effect.

The findings support the use of gamified assessment as a complement to, rather than a replacement for, established teaching and assessment methods. For medical biophysics, the most useful implementation appears to be a structured combination of conceptual questions, immediate feedback, clinical scenarios, and opportunities for both live and individual practice. Further controlled research with complete statistical

reporting is needed to determine the magnitude and generalizability of the observed learning gains.

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