



Examining Individual and Group Kahoot! Participation as Predictors of Student Engagement in Game-Based Learning: Evidence from Higher Education Business Students in the UK

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ABSTRACT

This study investigates the predictive effects of individual and group Kahoot! participation constructs on student engagement in game-based learning within higher education. A quantitative cross-sectional research design was employed using a structured questionnaire administered to 111 business students enrolled in a Pearson BTEC Higher National Diploma programme in the United Kingdom. Data were analysed using simple, multiple and hierarchical regression techniques in SPSS to examine both individual and combined effects of participation constructs on student engagement. The findings reveal that individual participation constructs, particularly participation intensity and decision autonomy, significantly predict student engagement, whereas competitive engagement does not remain significant when analysed alongside other variables. For group participation, collaborative participation and shared decision making demonstrate significant positive effects, while group interaction does not show an independent effect in the combined model. The results further indicate that group participation constructs explain a greater proportion of variance in student engagement compared to individual participation constructs. Hierarchical regression analysis confirms that the inclusion of group-based variables significantly enhances the predictive power of the model. The study concludes that although both participation modes contribute to engagement, structured collaborative processes, especially shared decision making, have a stronger association with higher levels of engagement in Kahoot based learning environments. The study contributes to existing literature by providing a comparative analysis of participation modes and offers practical implications for the design of interactive learning strategies in higher education.

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1. Introduction

Game-based learning has increasingly become an important pedagogical approach in higher education because it promotes active participation, interaction and motivation among students. Digital learning tools such as Kahoot! are widely used in business education to support classroom engagement and enhance learning experience. Kahoot! enables lecturers to design interactive quizzes that students can complete either individually or collaboratively in groups, thereby creating an engaging learning environment that supports active participation (Wang & Tahir, 2020). Student engagement is widely recognised as a critical factor in achieving effective learning outcomes in higher education. In the context of teaching and learning, engagement refers to the level of students' behavioural, emotional and cognitive involvement in academic activities (Fredricks, Blumenfeld, & Paris, 2004). When students are actively engaged, they are more likely to participate in discussions, collaborate with peers and retain knowledge gained during instructional activities (Kuh, 2009). Consequently, game-based learning platforms such as Kahoot! have attracted increasing attention among educators seeking innovative approaches to enhance student engagement (Plump & LaRosa, 2017). Despite its growing adoption, the mode of participation in Kahoot!-based activities varies depending on instructional design. Some lecturers adopt individual participation, where students respond independently using personal devices, while others implement group-based participation, where students collaborate to answer quiz questions. Individual participation is associated with independent thinking and accountability, whereas group participation supports peer interaction, collaborative problem solving and shared decision making (Wang, Zhu, & Sætre, 2016). These participation modes may act as predictors of student engagement, yet their predictive roles may differ across classroom contexts.

In business education programmes, interactive teaching strategies are particularly important as students are expected to develop teamwork, communication and analytical skills relevant to professional practice. The integration of game-based learning tools such as Kahoot! can support both independent and collaborative learning experiences, with studies indicating positive social learning outcomes (Cameron & Bizo, 2019). Despite the increasing use of Kahoot! in higher education, there is limited empirical evidence that directly compares individual and group participation as predictors of student engagement in game-based learning, particularly within business education contexts, with relatively little research focusing specifically on the predictive role of group-based participation. This study addresses this gap by differentiating between individual and group participation modes and examining their roles as predictors of student engagement within a business education context. Therefore, this study examines individual and group Kahoot! participation as predictors of student engagement in game-based learning among higher education business students in the United Kingdom. By providing a comparative analysis of these participation modes, the study aims to generate empirical evidence on their predictive influence on student engagement. The findings will offer valuable insights for educators seeking to design more effective and engaging game-based learning strategies in higher education.

2. Literature Review and Theoretical Framework

2.1. Game-Based Learning in Higher Education

Game-based learning has become an increasingly important instructional strategy in higher education as educators seek innovative methods to improve student motivation and participation. Traditional lecture-based teaching approaches often limit student interaction and active involvement in classroom activities. In contrast, game-based learning integrates elements of play, competition and instant feedback into the learning process, thereby creating a more interactive learning environment. Scholars have argued that the integration of game elements into educational settings can transform passive learning experiences into active learning opportunities that encourage students to engage more deeply with instructional content (Hamari, Koivisto, & Sarsa, 2014). The growing adoption of digital technologies in education has further facilitated the implementation of game-based learning in university classrooms. Digital quiz platforms, simulation games and interactive learning applications enable instructors to design activities that promote participation and collaboration among students. Research suggests that digital game-based learning environments can enhance students' motivation and concentration by introducing competitive elements, rewards and instant feedback mechanisms into classroom activities (Sailer & Homner, 2020). These features contribute to a learning environment that stimulates students' curiosity and encourages continuous participation.

One of the most widely adopted digital platforms used in game-based learning environments is Kahoot! Kahoot enables educators to create interactive quizzes that students can answer using smartphones, tablets or computers during classroom sessions. The platform incorporates game elements such as scoring systems, countdown timers and leaderboards, which help to create a competitive and engaging learning atmosphere. Studies suggest that Kahoot!-based learning activities can improve students' participation and attention during lessons, as the interactive format encourages sustained focus (Aljaloud et al., 2015). In business education programmes, the use of digital game-based learning tools has become particularly relevant because students are expected to develop analytical thinking, teamwork and decision-making skills that reflect real-world business practices. Interactive learning technologies such as Kahoot! therefore provide opportunities for students to apply knowledge in engaging classroom environments while also developing collaborative and competitive learning behaviours.

2.2. Individual Kahoot Participation in Game-Based Learning

Individual participation in Kahoot!-based activities allows students to respond to quiz questions independently using their personal devices. This mode of participation emphasises individual responsibility and encourages students to rely on their own understanding when selecting answers. As a result, individual Kahoot participation can stimulate independent learning behaviour, as students actively process information and evaluate possible responses before submitting their answers. The key components used to conceptualise individual Kahoot participation include participation intensity, competitive engagement and decision autonomy.

2.2.1. Individual Participation Intensity

Participation intensity refers to the level of effort and concentration students demonstrate when engaging in learning activities. In digital game-based learning environments, participation intensity may be reflected through behaviours such as answering questions consistently, maintaining attention during the activity and attempting to improve performance throughout the session. Research indicates that quiz-based digital platforms encourage students to maintain focus because the fast-paced nature of the activity requires continuous attention and rapid responses (Baszuk & Heath, 2020). Students who participate individually in Kahoot! quizzes often demonstrate higher levels of concentration because they are solely responsible for answering each question. The interactive nature of Kahoot! quizzes may also contribute to sustained participation intensity among learners. When students receive instant feedback on their responses, they are more likely to remain attentive and attempt subsequent questions. Instant feedback mechanisms have been found to enhance engagement in digital learning environments because they allow students to immediately evaluate their understanding and adjust their learning strategies accordingly (Yu & Cai, 2022).

2.2.2. Competitive Engagement

Competition is a fundamental component of many digital learning games, including Kahoot! Leaderboards and scoring systems create a competitive environment in which students attempt to outperform their peers. Competitive engagement can serve as a strong motivational factor, encouraging students to invest greater effort in learning activities (Nadeem, Oroszlanyova, & Farag, 2023; Sailer & Homner, 2020). Studies suggest that moderate levels of competition can increase students' motivation and participation during learning activities. Competitive learning environments may stimulate behavioural engagement because students become more attentive and motivated when attempting to improve their performance relative to others. However, competition must be carefully managed to ensure that it remains supportive rather than discouraging for students with lower performance levels.

2.2.3. Decision Autonomy

Decision autonomy refers to the degree to which students can make independent decisions during learning activities. When students participate individually in Kahoot! quizzes, they rely on their own understanding and judgement when selecting answers. This autonomy can promote deeper cognitive engagement because students actively analyse questions and evaluate possible responses before submitting their answers. Educational psychology research suggests that autonomy plays a crucial role in promoting intrinsic motivation and engagement in learning environments. When students feel that they have control over their learning decisions, they are more likely to invest effort in understanding academic content (Patall, Cooper, & Robinson, 2008). Individual Kahoot participation therefore provides an opportunity for students to exercise autonomy and develop independent problem-solving skills.

2.3. Group Kahoot Participation in Game-Based Learning

Group participation represents an alternative mode of engagement within Kahoot!-based learning activities. In group sessions, students collaborate with peers to discuss questions and select answers collectively. This collaborative approach promotes communication, teamwork and shared responsibility. Group Kahoot participation can be conceptualised through three main components: Collaborative participation, group interaction and shared decision making.

2.3.1. Collaborative Participation

Collaborative participation refers to the extent to which students actively engage in group discussions and jointly contribute to solving tasks during learning activities. In the context of Kahoot!-based learning, students work together to interpret questions, share ideas and arrive at collective answers. This process encourages knowledge sharing and peer learning, as students explain concepts to one another and build on shared understanding. Research suggests that collaborative learning environments enhance student engagement by promoting active involvement and deeper cognitive processing (Laal & Ghodsi, 2012). Through interaction and discussion, students are more likely to develop a comprehensive understanding of subject content. In Kahoot! group activities, collaborative participation can therefore strengthen both social and cognitive engagement.

2.3.2. Group Interaction

Group interaction refers to the communication and exchange of ideas among students during collaborative learning activities. In group Kahoot sessions, interaction occurs when students discuss possible answers, challenge each other's viewpoints and justify their reasoning. Studies have shown that interaction plays a significant role in enhancing student engagement, particularly in digital learning environments (Hrastinski, 2019). Active interaction encourages students to remain involved in the learning process and contributes to a sense of belonging within the group. In Kahoot!-based activities, group interaction can therefore enhance emotional and behavioural engagement by fostering participation and peer involvement.

2.3.3. Shared Decision Making

Shared decision making involves the collective evaluation of alternatives and agreement on a final response during group activities. In Kahoot! group participation, students must negotiate and justify their choices before selecting an answer, which encourages critical thinking and collaborative problem-solving. Educational research indicates that shared decision-making processes promote deeper cognitive engagement, as students are required to analyse information and consider multiple perspectives before reaching conclusions (Johnson, Johnson, & Smith, 2014). This collaborative approach enhances students' ability to think critically and engage meaningfully with learning content.

2.4. Student Engagement in Game-Based Learning

Student engagement is widely recognised as a multidimensional concept that reflects the extent to which learners actively participate in educational activities. Engagement encompasses behavioural, emotional and cognitive dimensions that collectively influence students' learning experiences.

2.4.1. Behavioural Engagement

Behavioural engagement refers to observable actions such as participation in classroom activities, attentiveness during lessons and completion of assigned tasks. In digital game-based learning environments, behavioural engagement may be demonstrated when students actively respond to quiz questions and remain focused throughout the activity. Kahoot! quizzes encourage behavioural engagement because students must continuously participate to progress through the game. Research has shown that interactive learning technologies can increase behavioural engagement by transforming passive learning environments into participatory experiences. Students who participate in digital quiz activities often demonstrate higher levels of attentiveness because they are required to respond to questions within limited time intervals (Turan, 2018).

2.4.2. Emotional Engagement

Emotional engagement refers to students' feelings and attitudes towards learning activities. Positive emotions such as enjoyment, excitement and interest can enhance students' willingness to participate in academic tasks. Game-based learning environments frequently

generate positive emotional responses because the playful and competitive nature of digital quizzes creates enjoyable classroom experiences. Several studies have found that Kahoot!-based learning activities increase students' enjoyment of classroom instruction. The colourful interface, competitive elements and immediate feedback mechanisms contribute to a dynamic learning environment that stimulates students' interest in course content (Iwamoto et al., 2017). When students experience positive emotions during learning activities, they are more likely to remain motivated and engaged throughout the lesson.

2.4.3. Cognitive Engagement

Cognitive engagement refers to the level of mental effort students invest in understanding learning materials and solving problems. Students who are cognitively engaged actively analyse information, think critically about concepts and attempt to apply knowledge to new situations. Game-based learning platforms such as Kahoot may promote cognitive engagement because quiz questions often require students to evaluate alternatives and select the most appropriate answer. Research suggests that interactive quizzes encourage deeper cognitive processing because students must quickly interpret questions and recall relevant knowledge before responding. This process stimulates mental effort and encourages students to think critically about the subject matter (Clark, Tanner-Smith, & Killingsworth, 2016).

2.5. Self-Determination Theory

Self-Determination Theory (SDT), developed by Edward Deci and Richard Ryan, provides a robust theoretical framework for understanding student motivation and engagement in educational contexts. The theory posits that individuals are intrinsically motivated when three fundamental psychological needs are satisfied, namely autonomy, competence and relatedness (Deci & Ryan, 1985; Ryan & Deci, 2020). Autonomy refers to the degree to which learners perceive that they have control over their learning decisions. In the context of this study, individual Kahoot participation promotes autonomy because students independently respond to quiz questions and rely on their own judgement. Research indicates that autonomy-supportive learning environments enhance students' intrinsic motivation and cognitive engagement, as learners become more actively involved in the learning process (Patall, Cooper, & Robinson, 2008). Competence relates to an individual's perception of their ability to perform tasks successfully. Kahoot incorporates game elements such as leaderboards, points and instant feedback, which contribute to students' sense of competence.

These features encourage learners to improve their performance and remain engaged during learning activities. Studies on gamified learning environments have shown that feedback and performance indicators significantly enhance students' motivation and behavioural engagement (Sailer & Homner, 2020). Relatedness refers to the need to feel socially connected to others. Group Kahoot participation satisfies this need by encouraging collaboration, communication and shared decision making among students. When learners interact with peers during group activities, they develop a sense of belonging, which enhances their emotional and behavioural engagement. Collaborative learning research supports this view, demonstrating that social interaction plays a crucial role in sustaining student engagement in educational settings (Hrastinski, 2019). Therefore, Self-Determination Theory provides a strong theoretical foundation for this study by explaining how individual and group Kahoot participation can enhance student engagement through the satisfaction of autonomy, competence and relatedness needs.

2.5.1. Evidence Supporting the Theory

Empirical evidence strongly supports the application of Self-Determination Theory in digital and game-based learning environments. Research has consistently shown that when learning activities satisfy the psychological needs of autonomy, competence and relatedness, students demonstrate higher levels of engagement and motivation (Ryan & Deci, 2020). Studies have found that autonomy-supportive learning environments significantly increase students' intrinsic motivation and cognitive engagement. For example, (Patall, Cooper, & Robinson, 2008) demonstrated that students who are given opportunities to make independent decisions in learning activities show higher levels of effort and persistence. This finding supports the role of individual Kahoot participation in promoting engagement through autonomy. Furthermore, gamified learning environments that incorporate competitive elements and feedback mechanisms have been shown to enhance students' sense of competence. Sailer and Homner (2020) found that game elements such as points, badges and leaderboards positively influence student

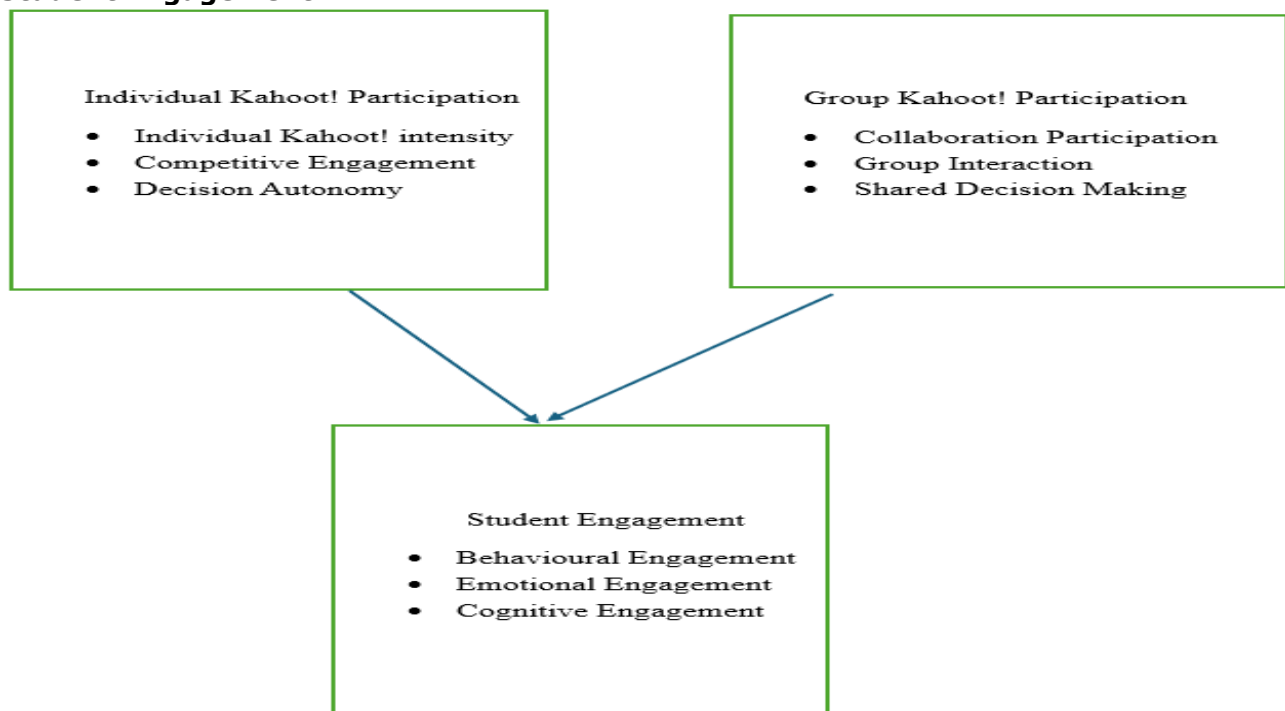
motivation and engagement. Similarly, research on Kahoot has shown that its interactive features increase students' attention and participation during classroom activities (Wang & Tahir, 2020). In addition, collaborative learning studies highlight the importance of relatedness in promoting engagement. Hrastinski (2019) found that social interaction and peer collaboration significantly enhance students' emotional and behavioural engagement in digital learning environments. Group-based activities encourage students to share ideas, discuss concepts and develop a sense of belonging, which contributes to sustained engagement. Empirical studies on Kahoot further support these findings. Research indicates that Kahoot-based learning activities increase students' enjoyment, motivation and classroom participation due to their interactive and collaborative nature (Licorish et al., 2018; Plump & LaRosa, 2017). These findings provide strong evidence that game-based learning tools such as Kahoot effectively satisfy the psychological needs identified in Self-Determination Theory, thereby enhancing student engagement.

2.6. Research Gap and Study Contribution

Although previous studies have demonstrated the effectiveness of Kahoot! in enhancing classroom engagement, most existing research has focused on its overall impact on learning outcomes or student motivation. Limited attention has been given to how different modes of participation within Kahoot! activities influence student engagement. There are few empirical studies that directly compare individual and group participation as predictors of student engagement within higher education settings. Furthermore, existing research rarely examines how these participation modes influence the behavioural, emotional and cognitive dimensions of engagement, particularly within business education contexts. Unlike previous studies that have primarily treated Kahoot! as a general engagement tool, this study adopts a more differentiated approach by examining individual and group participation as distinct predictors of student engagement. In addition, this study applies a multidimensional perspective of engagement within a business education context, thereby providing a more nuanced understanding of how participation modes shape student engagement in game-based learning environments. Therefore, this study addresses these gaps by examining individual and group Kahoot! participation as predictors of student engagement in game-based learning among higher education business students.

2.7. Conceptual Framework

Figure 1: Conceptual Framework of Kahoot! Participation Constructs as Predictors of Student Engagement



The conceptual framework illustrates the relationship between the independent variables and the dependent variable examined in this study. The independent variables are operationalised at the construct level, comprising six dimensions of Kahoot! participation.

Individual Kahoot! participation is represented by participation intensity, competitive engagement and decision autonomy, which reflect the autonomy and competence components of Self-Determination Theory. Group Kahoot! participation is represented by collaborative participation, group interaction and shared decision making, which align with the relatedness component of the theory. Each construct is hypothesised to have a direct predictive relationship with student engagement, as indicated by the directional arrows linking each participation construct to the dependent variable. Student engagement is conceptualised as a multidimensional construct consisting of behavioural, emotional and cognitive engagement. The framework therefore reflects both individual and group participation mechanisms as distinct but complementary predictors of student engagement in game-based learning environments. It also provides the basis for testing the hypotheses developed in this study.

2.8. Hypotheses Development

Self-Determination Theory provides a strong theoretical basis for explaining how participation in Kahoot!-based learning activities can influence student engagement. The theory emphasises the role of autonomy, competence and relatedness as key drivers of motivation and engagement. Individual Kahoot! participation is primarily associated with autonomy and competence. Participation intensity and competitive engagement reflect students' effort and desire to perform well, while decision autonomy captures independent decision-making during learning activities. These factors are expected to positively predict student engagement.

2.8.1. Individual Kahoot! Participation Hypotheses

H1: Participation intensity in individual Kahoot! activities positively predicts student engagement in game-based learning.

H2: Competitive engagement during individual Kahoot! participation positively predicts student engagement in game-based learning.

H3: Decision autonomy during individual Kahoot! participation positively predicts student engagement in game-based learning.

Group Kahoot! participation is closely associated with relatedness, as it involves collaboration, interaction and shared decision making among students. These social processes are expected to enhance engagement through increased communication, peer support and collective problem solving.

2.8.2. Group Kahoot! Participation Hypotheses

H4: Collaborative participation in group Kahoot! activities positively predicts student engagement in game-based learning.

H5: Group interaction during Kahoot! activities positively predicts student engagement in game-based learning.

H6: Shared decision making in group Kahoot! participation positively predicts student engagement in game-based learning.

Beyond individual effects, both participation modes may jointly contribute to student engagement. The combination of autonomy, competence and relatedness is expected to provide a more comprehensive explanation of engagement in game-based learning environments.

2.8.3. Joint Effects Hypotheses

H7: Individual and group Kahoot! participation jointly predicts student engagement in game-based learning.

H8: Individual Kahoot! participation constructs jointly predicts student engagement in game-based learning.

H9: Group Kahoot! participation constructs jointly predicts student engagement in game-based learning.

Given the collaborative nature of group-based learning and its alignment with the relatedness component of Self-Determination Theory, it is expected that group participation may exert a stronger prediction on engagement compared to individual participation.

2.8.4. Comparative Hypothesis

H10: Group Kahoot! participation constructs have a stronger predictive effect on student engagement than individual participation constructs.

3. Methodology

3.1. Research Design

This study adopted a quantitative cross-sectional research design with an explanatory orientation to examine the relationship and degree of prediction between individual and group Kahoot! participation constructs and student engagement in game-based learning. The explanatory design is appropriate because the study seeks to determine the extent to which different participation constructs predict student engagement. The study employs regression analysis as the primary statistical technique to test the predictive relationships between independent variables and dependent variables. Regression analysis enables the identification of the strength and direction of influence of individual and group participation constructs on student engagement. A cross-sectional approach was used, as data were collected from respondents at a single point in time using a structured questionnaire. This design is suitable for analysing relationships among variables within a specific population without manipulating the study environment.

3.2. Questionnaire Development, Measurement and Structure

The questionnaire used in this study was developed based on established literature on game-based learning, student engagement and motivational theory, particularly Self-Determination Theory. The instrument was designed to measure individual and group Kahoot! participation as predictors of student engagement in game-based learning environments. The development of the measurement items was guided by the three core psychological needs identified in Self-Determination Theory, namely autonomy, competence and relatedness. These theoretical dimensions informed the operationalisation of both participation constructs and student engagement. Autonomy is reflected in decision autonomy, where students independently select answers and rely on their own judgement. Competence is captured through participation intensity and competitive engagement, as students strive to perform well, improve scores and respond accurately. Relatedness is represented through collaborative participation, group interaction and shared decision making, where students engage socially and work collectively during group Kahoot! activities. These dimensions collectively explain how participation in Kahoot! activities can predict behavioural, emotional and cognitive engagement.

The questionnaire was structured into three main sections. Section A measured individual Kahoot! participation, Section B measured group Kahoot! participation and Section C measured student engagement. A five-point Likert scale was employed, ranging from strongly agree (5) to disagree (1), to capture respondents' perceptions of their experiences during Kahoot!-based learning activities. Section A focused on individual Kahoot! participation and comprised three constructs: participation intensity, competitive engagement and decision autonomy. Each construct was measured using five items, resulting in a total of fifteen items. Section B measured group Kahoot! participation and included three constructs: collaborative participation, group interaction and shared decision making. Each construct was also measured using five items, resulting in fifteen items. Section C measured student engagement using three dimensions: behavioural engagement, emotional engagement and cognitive engagement. Each dimension was measured using three items, giving a total of nine items. The measurement items were adapted from prior validated studies in the areas of game-based learning, student engagement and collaborative learning. Constructs related to participation intensity and engagement were informed by studies such as Hamari, Koivisto and Sarsa (2014) and Sailer and Homner (2020). Competitive engagement items were derived from research on gamified learning environments (Plump & LaRosa, 2017), while decision autonomy items were informed by studies on autonomy and intrinsic motivation (Patall, Cooper, & Robinson, 2008). Group-based constructs were adapted from collaborative learning literature (Johnson, Johnson, & Smith, 2014; Laal & Ghodsi, 2012), while student engagement was measured using the multidimensional framework proposed by Fredricks, Blumenfeld and Paris (2004), capturing behavioural, emotional and cognitive dimensions. All items were contextualised to reflect Kahoot!-based classroom activities while maintaining alignment with established theoretical and empirical foundations. This ensured that the instrument was both relevant to the study context and grounded in validated research constructs.

3.3. Population, Sampling Technique and Sample Size

Results Consortium Limited is a higher education college in the United Kingdom with three campuses located in Northampton, Dagenham (London campus) and Crewe (Manchester). The

institution is accredited to deliver the Pearson BTEC HND Business Programme. This study was conducted within the Business Department at the Northampton campus, where the researchers are based. At the time of the study, five cohorts were enrolled in the HND Business programme, namely C32, C33, C23N1, C23N2 and C24. However, four cohorts (C32, C33, C23N1 and C24) were selected to participate in the study, as these groups had been exposed to Kahoot!-based learning activities during classroom sessions. A total of 111 students across these cohorts participated in the study. Each Kahoot quiz was timed at 45 seconds per question, while true or false questions were limited to 20 seconds. This duration was considered sufficient to allow group members to think and interact before selecting a response.

A purposive sampling technique was adopted for this study. This approach was considered appropriate because the study specifically required participants who had prior experience with both individual and group Kahoot! participation. Purposive sampling enabled the researchers to intentionally select participants who were relevant to the research objectives and capable of providing meaningful responses based on their exposure to game-based learning activities. This sampling approach is consistent with previous educational research where participants are selected based on specific characteristics or experiences relevant to the study (Etikan, 2016). By focusing on students who had actively participated in Kahoot!-based learning, the study ensured that the data collected was both relevant and reflective of the constructs being examined. In addition, this approach helped to enhance the validity of the findings, as only participants with direct experience of the phenomenon under investigation were included.

3.4. Ethical Considerations

Ethical considerations were carefully observed throughout the study. Prior to data collection, students were informed about the purpose, nature and voluntary nature of the research during classroom sessions. The study was explained clearly to ensure that participants understood what their involvement would entail. Students were informed about the purpose of the study during classroom sessions, and participation was voluntary. Completion of the questionnaire was taken as an indication of informed consent. Confidentiality and anonymity were strictly maintained, and no personally identifiable information was collected from participants. Students were assured that their responses would be used solely for academic purposes and that their participation would not affect their academic standing. Furthermore, ethical approval for the study was obtained from the Director of Research at Results Consortium Limited. The approval letter is included in the appendix of this study. Consent documentation from each participating cohort is also provided in the appendix. The study adhered to standard ethical guidelines for educational research to ensure that the rights, dignity and well-being of participants were protected.

3.5. Data Analysis Techniques

Data collected from the questionnaire were analysed using IBM SPSS version 31.0.2.0. Inferential statistical techniques were employed to examine the relationships between the study variables. Regression analysis was adopted as the primary analytical technique because the study seeks to examine the predictive influence of individual and group Kahoot participation constructs on student engagement. Regression analysis is appropriate in this context as it enables the estimation of the strength and direction of relationships between independent variables and the dependent variable, thereby providing empirical evidence for hypothesis testing. Simple linear regression analysis was used to test the individual effect of each participation construct on student engagement (H1-H6). Multiple regression analysis was further employed to examine the joint influence of constructs (H7-H10) and to compare the relative strength of predictors using standardised beta coefficients. Before conducting regression analysis, key assumptions were considered to ensure the validity of the results. The assumption of linearity was satisfied as the relationships between variables were examined using scatterplots, which indicated a linear pattern. Normality of residuals was assessed and found to be acceptable based on the distribution of the data. Multicollinearity was assessed using tolerance and Variance Inflation Factor values. Although the constructs were theoretically distinct, some overlap among predictors was observed and is considered in the interpretation of the results and limitations of the study.

3.6. Reliability Analysis

Reliability analysis was conducted to assess the internal consistency of measurement constructs used in this study. Cronbach's alpha was employed as the measure of reliability. The analysis was performed at the construct level, where each construct was assessed separately

using its corresponding questionnaire items. This approach ensures that the internal consistency of items within each construct is accurately evaluated.

Table 1: Reliability Analysis of Measurement Constructs

Construct	Number of items	Cronbach's alpha
Individual participation intensity	5	.963
Individual competitive engagement	5	.971
Individual decision autonomy	5	.962
Collaborative participation	5	.961
Group interaction	5	.961
Shared decision making	5	.965
Student engagement	9	.961

Note: Cronbach's alpha values above 0.70 indicate acceptable internal consistency.

Reliability analysis was conducted to assess the internal consistency of the measurement constructs using Cronbach's alpha. The analysis was performed separately for each construct based on its corresponding items. As presented in Table 1, all constructs recorded Cronbach's alpha values above the recommended threshold of 0.70, indicating satisfactory to excellent internal consistency. This suggests that the measurement scales used in this study are reliable for further analysis. This finding is consistent with the recommended threshold for reliability in social science research ((Nunnally & Bernstein, 1994), as cited in Tavakol and Dennick (2011))

4. Results and Discussion

4.1. Hypotheses Testing

4.1.1. Hypothesis 1

Participation intensity in individual Kahoot! activities positively predicts student engagement in game-based learning

Table 2: Effect of Participation Intensity on Student Engagement

Variable	R	R ²	β	t	p
Participation intensity	.803	.644	.803	14.044	< .001

Table 2 indicates that participation intensity has a strong and significant positive effect on student engagement ($\beta = .803$, $t = 14.044$, $p < .001$). The model explains 64.4% of the variance in student engagement ($R^2 = .644$), suggesting that participation intensity is a substantial predictor of engagement in game-based learning. Beyond the statistical significance, this finding highlights the importance of active involvement in Kahoot-based activities. Students who consistently respond to questions, maintain focus and actively engage with the quiz process are more likely to experience higher levels of behavioural, emotional and cognitive engagement. The interactive and time-sensitive nature of Kahoot requires sustained attention, which helps to keep students mentally involved throughout the activity. This finding is consistent with previous studies on game-based learning and student engagement. For instance, Hamari, Koivisto and Sarsa (2014) reported that active participation in gamified learning environments significantly enhances student motivation and engagement. Similarly, Plump and LaRosa (2017) found that students who actively participate in Kahoot activities demonstrate higher levels of classroom engagement due to the interactive and competitive nature of the platform. These findings reinforce the role of participation intensity as a key driver of engagement in game-based learning.

From a theoretical perspective, this result supports Self-Determination Theory, particularly the competence dimension. When students actively participate and receive immediate feedback on their performance, they develop a sense of effectiveness and achievement. This perceived competence enhances intrinsic motivation, which in turn promotes deeper engagement in the learning process. However, although participation intensity shows a strong effect in the simple regression model, its influence may reduce when other participation constructs are introduced in a multiple regression model. This suggests that participation intensity may share explanatory variance with related constructs such as competitive engagement and group interaction. In this case, the effect of participation intensity is not isolated, but rather works alongside other participation factors to influence student engagement. Overall, the findings provide strong support for H1 and demonstrate that active participation plays a critical role in enhancing student engagement in game-based learning environments.

4.1.2. Hypothesis 2

Competitive engagement during individual Kahoot! participation positively predicts student engagement in game-based learning.

Table 3: Effect of Competitive Engagement on Student Engagement

Variable	R	R ²	β	t	p
Competitive engagement	.682	.465	.682	9.731	< .001

Table 3 reveals that competitive engagement significantly predicts student engagement ($\beta = 0.682$, $t = 9.731$, $p < 0.001$). The model accounts for 46.5% of the variation in student engagement ($R^2 = 0.465$), indicating that competitive engagement serves as a meaningful predictor of engagement within game-based learning contexts. This finding suggests that competitive elements embedded within Kahoot, including leaderboards, point systems and time constraints, contribute to increased student motivation and participation. When students are exposed to competitive conditions, they are more likely to exert effort, sustain attention and aim to improve their performance. These behaviours collectively enhance their level of engagement during learning activities. This outcome is consistent with prior research on gamified learning. For instance, Plump and LaRosa (2017) reported that competitive features in Kahoot enhance student participation and engagement in the classroom. Likewise, Hamari, Koivisto and Sarsa (2014) emphasised that competition acts as a strong motivational driver in gamified environments by encouraging deeper involvement in tasks.

From a theoretical standpoint, this finding supports Self-Determination Theory, particularly the competence component. Competitive engagement enables students to evaluate their performance in relation to others, which can strengthen their sense of accomplishment when they perform well. This sense of competence fosters intrinsic motivation and, consequently, promotes higher engagement. However, although competitive engagement is significant in the simple regression analysis, its effect may reduce when additional participation constructs are included in a multiple regression model. This indicates that competitive engagement shares variance with other related constructs, such as participation intensity and group interaction. As a result, its influence is not entirely distinct but operates alongside other participation factors in shaping student engagement. Overall, the findings support H2 and confirm that competitive elements within Kahoot-based learning environments play an important role in enhancing student engagement.

4.1.3. Hypothesis 3

Decision autonomy during individual Kahoot! participation positively predicts student engagement in game-based learning.

Table 4: Effect of Decision Autonomy on Student Engagement

Variable	R	R ²	β	t	p
Decision autonomy	.832	.692	.832	15.651	< .001

The findings in Table 4 indicate that decision autonomy significantly predicts student engagement ($\beta = .832$, $t = 15.651$, $p < .001$). The model accounts for 69.2% of the variance in student engagement ($R^2 = .692$), demonstrating that decision autonomy is a highly influential predictor of engagement in game-based learning contexts. This result suggests that allowing students to make independent choices during Kahoot activities enhances their level of involvement in the learning process. When students are required to interpret questions, assess possible options and make decisions on their own, they engage in deeper cognitive processing. This level of active thinking increases their ability to connect with the learning material and maintain focus throughout the activity. The finding is consistent with existing research on autonomy and engagement. Patall, Cooper and Robinson (2008) found that opportunities for independent decision making significantly improve students' motivation and engagement. Similarly, Ryan and Deci (2020) emphasised that autonomy is a central factor in fostering intrinsic motivation, which is essential for sustained engagement in learning tasks.

From a theoretical perspective, this outcome aligns with the autonomy dimension of Self-Determination Theory. When students feel a sense of control over their learning actions, they are more intrinsically motivated to participate. This motivation translates into greater behavioural participation and deeper cognitive involvement in learning activities. However, despite its strong

effect in the simple regression model, the influence of decision autonomy may decline when additional participation variables are included in a multiple regression analysis. This indicates that decision autonomy shares variance with related constructs such as participation intensity and competitive engagement. Consequently, its effect is not entirely distinct but operates alongside other participation factors in influencing student engagement. Conclusively, the findings support H3 and highlight decision autonomy as a key determinant of student engagement in game-based learning environments.

4.1.4. Hypothesis 4

Collaborative participation in group Kahoot! activities positively predicts student engagement in game-based learning.

Table 5: Effect of Collaborative Participation on Student Engagement

Variable	R	R ²	β	t	p
Collaborative participation	.900	.809	.900	21.501	< .001

Table 5 shows that collaborative participation has a significant positive effect on student engagement ($\beta = .900$, $t = 21.501$, $p < .001$). The model accounts for 80.9% of the variance in student engagement ($R^2 = 0.809$), indicating that collaborative participation is a highly influential predictor within game-based learning settings. This outcome suggests that students who are actively involved in group-based activities, including exchanging ideas and working together to solve problems, tend to demonstrate higher levels of engagement. The collaborative structure of Kahoot activities encourages students to interact continuously, consider different perspectives and contribute to shared outcomes. As a result, students become more immersed in the learning process, enhancing both their cognitive involvement and emotional connection to the task. The finding aligns with established research on collaborative learning, which emphasises the role of peer interaction in fostering engagement. Laal and Ghodsi (2012) highlighted that collaborative environments promote active participation and facilitate deeper learning through knowledge sharing. In a similar vein, Johnson, Johnson and Smith (2014) argued that cooperative learning enhances student involvement by encouraging mutual responsibility and structured interaction among learners.

From a theoretical standpoint, this result reflects the relatedness component of Self-Determination Theory. Engagement is strengthened when students feel socially connected and supported within a group. Collaborative participation creates opportunities for such connections, thereby increasing motivation and encouraging sustained involvement in learning activities. Nevertheless, despite the strong effect observed in the simple regression model, the influence of collaborative participation may weaken when additional group-related variables are introduced in a multiple regression analysis. This indicates that collaborative participation overlaps with constructs such as group interaction and shared decision making, suggesting that these elements collectively contribute to student engagement rather than functioning independently.

4.1.5. Hypothesis 5

Group interaction during Kahoot! activities positively predicts student engagement in game-based learning.

Table 6: Effect of Group Interaction on Student Engagement

Variable	R	R ²	β	t	p
Group interaction	.897	.805	.897	21.242	< .001

Table 6 demonstrates that group interaction significantly predicts student engagement ($\beta = .897$, $t = 21.242$, $p < .001$). The model explains 80.5% of the variance in student engagement ($R^2 = .805$), indicating that interaction among students is a highly influential factor in shaping engagement within game-based learning environments. This finding suggests that when students actively communicate, exchange ideas and respond to one another during Kahoot activities, their level of engagement increases substantially. Interaction creates a dynamic learning environment in which students are not passive recipients of information but active participants in the learning process. Through discussion and peer exchange, students remain attentive and are more likely to process information deeply, thereby enhancing both behavioural and cognitive engagement. The result is supported by research on interactive and social learning environments. Hrastinski

(2019) emphasised that interaction is a central element of engagement in digital learning contexts, as it promotes active participation and sustained involvement. In addition, Henrie, Halverson and Graham (2015); Kuh (2009) and Nadeem, Oroszlanyova and Farag (2023) found that student interaction in technology-enhanced learning environments significantly improves motivation and engagement by encouraging participation and collaboration.

From a theoretical perspective, this finding aligns with the relatedness component of Self-Determination Theory. Interaction among peers strengthens social bonds and fosters a sense of belonging, which enhances students' willingness to engage in learning activities. When students feel connected within a learning environment, they are more motivated to participate and contribute meaningfully. However, despite the strong predictive effect observed in the simple regression model, the influence of group interaction may decrease when analysed alongside other collaborative constructs in a multiple regression model. This suggests that group interaction shares variance with constructs such as collaborative participation and shared decision making, indicating that these factors collectively contribute to student engagement rather than acting independently. H5 is accepted.

4.1.6. Hypothesis 6

Shared decision making in group Kahoot! participation positively predicts student engagement in game-based learning

Table 7: Effect of Shared Decision Making on Student Engagement

Variable	R	R ²	β	t	p
Shared decision making	.941	.886	.941	29.068	< .001

Table 7 indicates that shared decision making significantly predicts student engagement ($\beta = .941$, $t = 29.068$, $p < .001$). The model accounts for 88.6% of the variance in student engagement ($R^2 = .886$), suggesting that shared decision making is an exceptionally strong predictor of engagement in game-based learning environments. This finding indicates that when students are involved in collective decision-making processes during Kahoot activities, their level of engagement increases substantially. The requirement to evaluate alternatives, negotiate viewpoints and agree on a final response encourages active participation and deeper cognitive processing. Students are not only involved in answering questions but also in reasoning through options collaboratively, which strengthens their understanding and engagement with the learning material. The result is supported by research on cooperative learning and group cognition. Johnson, Johnson and Smith (2014) emphasised that shared decision-making processes enhance critical thinking and engagement by requiring learners to justify their choices and consider multiple perspectives. In addition, Iwamoto et al. (2017) found that interactive and participatory learning environments increase student engagement by promoting active involvement in decision-related tasks.

From a theoretical perspective, this finding reflects both the competence and relatedness components of Self-Determination Theory. Students experience competence when they contribute meaningfully to group decisions and observe the outcomes of their contributions. At the same time, the collaborative nature of shared decision making strengthens social connections, which enhances motivation and encourages sustained engagement. However, despite the exceptionally strong effect observed in the simple regression model, the influence of shared decision making may be reduced when analysed alongside other group-based constructs in a multiple regression model. This suggests that shared decision-making overlaps with constructs such as collaborative participation and group interaction, indicating that these elements operate together as part of a broader collaborative mechanism influencing student engagement.

4.1.7. Hypothesis 7

Individual and group Kahoot! participation jointly predict student engagement in game-based learning.

Table 8: Model Summary for the Joint Effect of Individual and Group Kahoot Participation on Student Engagement

R	R ²	Adjusted R ²	F	p
.946	.895	.893	459.706	< .001

Table 9: Regression Coefficients for Individual and Group Kahoot Participation

Variable	β	t	p
Individual Kahoot! participation	.122	2.300	.023
Group Kahoot! participation	.844	15.811	< .001

Tables 8 and 9 show that individual and group Kahoot participation jointly and significantly predict student engagement ($R^2 = .895$, $F = 459.706$, $p < .001$). The model explains 89.5% of the variance in student engagement, suggesting that the combined effect of participation modes provides a very strong explanation of engagement in game-based learning environments. Examining the individual contributions of each predictor, group Kahoot participation demonstrates a strong and significant effect on student engagement ($\beta = .844$, $t = 15.811$, $p < .001$), whereas individual participation shows a much smaller, although still significant, effect ($\beta = .122$, $t = 2.300$, $p = .023$). This indicates that while both forms of participation contribute to engagement, group-based participation has a substantially greater influence. This finding suggests that collaborative learning dynamics play a dominant role in shaping student engagement during Kahoot activities. The opportunity to interact with peers, exchange ideas and make collective decisions appears to enhance students' involvement more strongly than individual participation alone. Group settings provide both cognitive stimulation and social support, which together strengthen engagement.

The result is consistent with research on social and collaborative learning, which emphasises the importance of interaction and shared learning experiences in promoting engagement. Studies have shown that students are more likely to remain engaged when learning activities involve peer interaction and collective problem solving, as these processes encourage active participation and deeper understanding. From a theoretical standpoint, the greater impact of group participation can be understood through the lens of Self-Determination Theory. Group-based activities enhance students' sense of relatedness by encouraging interaction and strengthening social bonds, while also promoting competence through collective problem-solving processes. Although individual participation contributes to autonomy by allowing students to make independent decisions, the findings indicate that the combined effects of social connection and shared competence play a more influential role in driving student engagement within this context. The reduced effect of individual participation indicates that its influence overlaps with group participation, suggesting shared variance between the predictors. In this case, group participation captures a larger portion of the variance in student engagement, thereby reducing the relative contribution of individual participation when both are considered together. Overall, the findings support H7 and demonstrate that both individual and group Kahoot participation jointly predict student engagement, with group participation emerging as the more influential predictor.

4.1.8. Hypothesis 8

Individual Kahoot! participation constructs jointly predict student engagement in game-based learning.

Table 10: Model Summary for the Joint Effect of Individual Kahoot Participation Constructs on Student Engagement

R	R^2	Adjusted R^2	F	p
.840	.706	.697	85.533	< 0.001

Table 11: Regression Coefficients for Individual Kahoot Participation Constructs

Variable	β	t	p
Participation intensity	.394	2.151	.034
Competitive engagement	-.134	-1.097	.275
Decision autonomy	.578	4.379	< .001

The results presented in Tables 10 and 11 indicate that the individual Kahoot participation constructs jointly and significantly predict student engagement ($R^2 = .706$, $F = 85.533$, $p < .001$). The model explains 70.6% of the variance in student engagement, demonstrating that the combined effect of individual participation constructs provides a substantial explanation of engagement in game-based learning environments. Examining the individual predictors, decision autonomy shows a strong and significant positive effect on student engagement ($\beta = .578$, $t =$

4.379, $p < .001$), while participation intensity also demonstrates a significant but weaker positive effect ($\beta = .394$, $t = 2.151$, $p = .034$). In contrast, competitive engagement does not significantly predict student engagement ($\beta = -0.134$, $t = -1.097$, $p = .275$), indicating that its influence is not statistically meaningful when considered alongside the other constructs. This finding suggests that within individual participation, the ability of students to make independent decisions plays a more critical role in driving engagement than competitive elements. While competition may initially motivate students, its effect appears to diminish when other factors such as autonomy and sustained participation are taken into account. This indicates that engagement in game-based learning is more strongly influenced by internal cognitive processes than by external competitive pressures.

The result is consistent with research on motivation and learning, which emphasises the importance of autonomy in sustaining engagement. Studies have shown that when students are given control over their learning decisions, they are more likely to demonstrate intrinsic motivation and deeper involvement in learning activities. In contrast, competitive elements may have a limited or context-dependent effect, particularly when they do not align with students' intrinsic motivations. From a theoretical perspective, this finding reinforces the central role of autonomy within Self-Determination Theory. Decision autonomy enhances intrinsic motivation by allowing students to take ownership of their learning, which leads to stronger engagement. Participation intensity also contributes to engagement by reflecting effort and persistence. However, the non-significant effect of competitive engagement suggests that competence driven purely by comparison with others may not be sufficient to sustain engagement when autonomy is present. Furthermore, the change in significance of competitive engagement compared to the simple regression model highlights the issue of shared variance among predictors. Although competitive engagement appeared significant when analysed independently, its effect becomes non-significant when other related constructs are included. This indicates that its influence overlaps with participation intensity and decision autonomy, and that these constructs collectively explain student engagement more effectively. Overall, the findings partially support H8, as not all individual participation constructs significantly predict student engagement. The results emphasise that decision autonomy is the most influential factor within individual participation, followed by participation intensity, while competitive engagement does not have a significant independent effect.

4.1.9. Hypothesis 9

Group Kahoot! participation constructs jointly predict student engagement in game-based learning.

Table 12: Model Summary for the Joint Effect of Group Kahoot Participation Constructs on Student Engagement

R	R ²	Adjusted R ²	F	P
.953	.908	.906	353.536	< .001

Table 13: Regression Coefficients for Group Kahoot Participation Constructs

Variable Entered	β	t	P
Collaborative participation	.207	2.166	.033
Group interaction	.137	1.421	.158
Shared decision making	.637	9.606	<.001

Tables 12 and 13 show that the group-based Kahoot participation constructs collectively and significantly predict student engagement ($R^2 = 0.908$, $F = 353.536$, $p < 0.001$). The model accounts for 90.8% of the variation in student engagement, indicating that group participation provides a substantial explanation of engagement within game-based learning contexts. A closer examination of the individual predictors indicates that shared decision making exerts a strong and significant positive influence on student engagement ($\beta = .637$, $t = 9.606$, $p < .001$). Collaborative participation also contributes significantly, although with a smaller effect size ($\beta = .207$, $t = 2.166$, $p = .033$). In contrast, group interaction does not demonstrate a statistically significant effect ($\beta = .137$, $t = 1.421$, $p = .158$), suggesting that its independent contribution is limited when considered alongside other group-related factors. These results indicate that the most impactful aspect of group participation lies in the process of making decisions collectively. When students are engaged in evaluating options, defending their viewpoints and reaching consensus, they are more deeply involved in the learning activity. Such structured collaboration

encourages critical thinking and sustained attention, which enhances overall engagement. Although collaborative participation supports engagement through shared involvement, its influence is less dominant compared to decision-oriented processes. Meanwhile, interaction on its own, without a clear decision-making structure, appears insufficient to drive meaningful engagement.

This outcome aligns with evidence from cooperative learning literature, which highlights the importance of structured collaboration in promoting engagement. Research suggests that activities involving collective reasoning and joint decision-making foster deeper cognitive involvement than those based solely on informal interaction. From a theoretical perspective, the findings can be interpreted through Self-Determination Theory. Shared decision-making addresses both competence and relatedness, as students actively contribute to outcomes while maintaining social connections. Collaborative participation primarily enhances relatedness, whereas group interaction reflects social engagement without necessarily promoting deeper cognitive involvement. The results therefore suggest that engagement is maximised when both cognitive effort and social connection are integrated within the learning process. In addition, the differences in statistical significance among the predictors point to the presence of shared variance. Although group interaction appeared significant in earlier simple regression analysis, it loses significance in the multiple regression model, indicating that its effect overlaps with other group constructs. In this case, shared decision-making accounts for a larger share of the variance in student engagement, thereby diminishing the independent effect of group interaction. Overall, the findings provide partial support for H9. While group participation constructs jointly predict student engagement, only shared decision making and collaborative participation demonstrate significant individual effects, with shared decision making emerging as the most influential factor.

4.1.10. Hypothesis 10

Group Kahoot! participation constructs have a stronger predictive effect on student engagement than individual participation constructs.

Table 14: Hierarchical Regression Analysis Comparing the Predictive Effects of Individual and Group Kahoot Participation Constructs on Student Engagement

Variables Entered	R ²	ΔR ²	F Change	p
Individual participation constructs	.706	-	85.533	< .001
Individual & group participation constructs	.927	.221	105.288	< .001

Table 14 shows that the individual participation constructs significantly predict student engagement, explaining 70.6% of the variance in the dependent variable ($R^2 = .706$, $F = 85.533$, $p < .001$). However, when the group participation constructs are introduced into the model, the explanatory power increases substantially to 92.7% ($R^2 = .927$), representing an additional 22.1% increase in explained variance ($\Delta R^2 = .221$, $F \text{ change} = 105.288$, $p < .001$). This demonstrates that the inclusion of group participation constructs significantly improves the predictive strength of the model. This finding suggests that while individual participation plays an important role in influencing student engagement, group-based participation provides a much stronger contribution. The substantial increase in explanatory power indicates that engagement in game-based learning environments is more effectively driven by collaborative and interactive learning processes than by individual effort alone. Group participation introduces additional dimensions of learning, including peer interaction, shared responsibility and collective reasoning, which enhance students' involvement in the learning process. The result reinforces the importance of social and collaborative learning in educational settings. When students engage in group-based activities, they are exposed to diverse perspectives, encouraged to articulate their ideas and required to participate actively in collective tasks. These processes create a more stimulating and engaging learning environment, which leads to higher levels of behavioural, emotional and cognitive engagement.

From a theoretical perspective, the findings can be explained through Self-Determination Theory. Although individual participation supports autonomy by allowing learners to make independent decisions, group participation simultaneously satisfies the needs for relatedness and competence. The strong improvement in predictive power observed in the second model suggests

that the combined influence of social connection and shared problem-solving is more impactful in driving engagement than autonomy alone. This highlights the importance of integrating both social and cognitive elements in learning design. Furthermore, the increase in explanatory power from individual participation constructs to individual and group participation constructs provides empirical evidence that group participation constructs capture aspects of student engagement that are not fully explained by individual participation constructs. This indicates that group-based learning introduces unique contributions rather than merely duplicating the effects of individual participation. Overall, the findings provide strong support for H10, demonstrating that group Kahoot participation constructs have a stronger predictive effect on student engagement than individual participation constructs. This highlights the critical role of collaborative learning strategies in enhancing engagement within game-based learning environments.

5. Conclusion

This study examined the relationship between individual and group Kahoot participation constructs and student engagement within a game-based learning context. Using a quantitative cross-sectional design and regression analysis, the findings provide evidence that both individual and group participation constructs are associated with student engagement, although the strength of these associations varies across constructs. The results indicate that individual participation constructs such as participation intensity and decision autonomy are significantly related to student engagement, while competitive engagement appears to have a less consistent association when considered alongside other variables. This suggests that not all aspects of individual participation contribute equally to engagement, and that autonomy related factors may play a more prominent role within this context. With regard to group participation, the findings show that collaborative participation and shared decision making are positively associated with student engagement, while group interaction does not demonstrate a statistically significant independent relationship when examined alongside other group constructs. These results suggest that structured collaborative processes, particularly those involving joint decision making, may be more closely linked to engagement than general interaction alone. The comparative analysis further indicates that group participation constructs explain a greater proportion of the variance in student engagement than individual participation constructs. While this does not imply a causal relationship, it suggests that group-based learning activities may be more strongly associated with higher levels of engagement in Kahoot supported learning environments.

From a theoretical perspective, the findings are broadly consistent with Self-Determination Theory, as both individual and group participation appear to reflect elements of autonomy, competence and relatedness. However, the stronger association observed for group participation may indicate the importance of social and collaborative dimensions of learning in supporting student engagement. It is important to note that the cross-sectional nature of the study limits the ability to draw causal conclusions. The relationships identified should therefore be interpreted as associations rather than direct effects. In addition, the high explanatory power observed in some models may partly reflect overlap among predictors, which should be considered when interpreting the results. Overall, the study contributes to the understanding of how different forms of participation in game-based learning environments are related to student engagement. The findings suggest that both individual and group participation are relevant, although group-based activities may offer additional benefits in terms of engagement. Future research could build on these findings by employing longitudinal or experimental designs to further examine the nature and direction of these relationships.

5.1. Limitation of the Study

This study provides useful insights into the relationship between individual and group Kahoot participation constructs and student engagement. However, several limitations should be acknowledged when interpreting the findings.

First, the study employed a cross-sectional research design, where data were collected at a single point in time. While this approach is suitable for examining associations between variables, it limits the ability to establish causal relationships. As such, the findings should be interpreted as indicative of relationships rather than definitive evidence of cause-and-effect dynamics between participation constructs and student engagement.

Second, the study relied on self-reported data collected through a structured questionnaire. Although this approach allows for efficient data collection from a large number of

participants, it may be subject to response bias, including social desirability bias and subjective interpretation of questionnaire items. Students may have overestimated or underestimated their level of participation or engagement, which could influence the accuracy of the results.

Third, the study was conducted within a single institution, specifically among students enrolled in the Pearson BTEC HND Business programme at one campus. This limits the generalisability of the findings, as the results may reflect the specific learning environment, teaching practices and student characteristics of that institution. Caution should therefore be exercised when applying the findings to other educational contexts, institutions or disciplines.

Fourth, the very high R-squared values reported in the regression models suggest a strong explanatory power of the predictors. While this may indicate a well-fitting model, it could also reflect potential overlap among the independent variables. In particular, constructs such as collaborative participation, group interaction and shared decision making may capture closely related aspects of group learning. As a result, the high explanatory power should be interpreted cautiously, as it may partly be influenced by shared variance among predictors rather than entirely distinct contributions.

Related to this, the presence of high Variance Inflation Factor values observed during the analysis suggests potential multicollinearity among some of the independent variables. This indicates that certain constructs may not be entirely independent of one another, which can affect the stability and interpretation of regression coefficients. Although the variables were theoretically distinct, their empirical overlap should be considered when interpreting the results.

Fifth, the use of purposive sampling, while appropriate for selecting participants with prior experience of Kahoot-based learning, may introduce selection bias. The sample consisted only of students who had been exposed to both individual and group Kahoot activities, which may limit the representativeness of the findings. Students with different levels of exposure or from different learning environments may exhibit different patterns of engagement.

Sixth, the study focused specifically on Kahoot as a game-based learning tool. While Kahoot is widely used and relevant, the findings may not be directly transferable to other game-based learning platforms or digital learning tools that operate differently in terms of interaction, feedback and structure.

Finally, although the study examined key constructs derived from Self-Determination Theory, it did not account for other potential factors that may influence student engagement, such as prior academic ability, technological familiarity, teaching style or classroom environment. The exclusion of these variables means that the model may not fully capture all factors contributing to student engagement.

5.2. Recommendation

The recommendations presented in this study are derived directly from the empirical findings and are intended to guide the effective use of Kahoot-based learning to enhance student engagement.

First, given that participation intensity was found to be significantly associated with student engagement, educators may consider designing Kahoot! activities that encourage active and consistent student involvement. This can be achieved by incorporating frequent quiz sessions, ensuring all students can respond, and creating an environment that sustains attention throughout the activity. Emphasis should be placed on maintaining student participation rather than passive observation.

Second, the findings indicated that decision autonomy is one of the strongest individual predictors of student engagement. Therefore, educators may consider creating opportunities for students to make independent choices during learning activities. For example, allowing students sufficient time to think through questions, encouraging individual reasoning before answering, and avoiding excessive guidance may help to support autonomy and, in turn, enhance engagement.

Third, although competitive engagement showed a significant relationship in the simple regression analysis, it did not remain significant when other variables were considered simultaneously. This suggests that competition should be used with caution. Educators may incorporate competitive elements such as leaderboards and scoring, but these should not be overemphasised, as they may not independently sustain engagement for all learners.

Fourth, the findings highlight that collaborative participation is positively associated with student engagement. Educators are therefore encouraged to integrate group-based Kahoot activities into classroom practice. Structuring activities that require students to work together, discuss answers and contribute collectively may enhance engagement through shared learning experiences.

Fifth, the results demonstrate that shared decision making is the most influential group-based construct associated with student engagement. Based on this, educators should design Kahoot activities that require students to reach consensus before submitting responses. Encouraging group discussion, justification of answers and collective reasoning may promote deeper engagement and improve the quality of learning.

Sixth, although group interaction was found to be significant in isolation, it did not remain significant in the presence of other group constructs. This suggests that interaction alone may not be sufficient to enhance engagement unless it is structured and purposeful. Educators should therefore ensure that group interaction is guided by clear tasks, such as problem-solving or decision-making activities, rather than informal discussion.

Seventh, the comparative analysis indicates that group participation constructs explain a greater proportion of the variance in student engagement than individual participation constructs. In light of this, educators should consider placing greater emphasis on group-based Kahoot activities while still maintaining opportunities for individual participation. A balanced approach that integrates both modes may be more effective in supporting engagement.

Finally, given that the study was conducted using a cross-sectional design, future research is recommended to adopt longitudinal or experimental approaches to further explore these relationships. This would help to better understand how participation in Kahoot activities influences student engagement over time and under different instructional conditions.

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Appendix A

Questionnaire Used for Data Collection

Dear Student,

This survey is based on research on "Individual and Group Kahoot Participation as Determinants of Student Engagement in Game Based Learning: A Comparative Analysis among Higher Education Business Students in Results Consortium Limited, United Kingdom". Be rest assured that very response given in this survey remains confidential and it will be strictly used for research purposes.

Warm regards,

Dr Iqra Abbas,

Dr Toyosi Samuel

Riya Rachel Vinod

Shalna Shirin

1. Instruction

Please kindly indicate the one that is most applicable to you:

Strongly Agree (SA) - 5, Agree (A) - 4, Not Sure - 3, Strongly Disagree (SD) - 2, Disagree (DA) - 1

Section A: Independent Kahoot Participation					
Individual Participation Intensity	SA	A	NS	SDA	DA
1. I actively participated when playing Kahoot individually.					
2. I attempted to answer every question when playing individually.					
3. I remained focused throughout the individual Kahoot activity.					
4. I paid attention to every question when playing alone.					
5. I tried to improve my score when participating individually.					
Individual Competitive Engagement					
1. I felt motivated to outperform other students during individual Kahoot.					
2. The leaderboard encouraged me to perform better.					
3. I felt challenged when competing individually.					
4. I tried to answer faster than other students.					
5. Competing individually increased my effort in the quiz.					
Individual Decision Autonomy					
1. I made my own decisions when answering questions.					
2. I relied on my own understanding to select answers.					
3. I felt responsible for my answers during individual Kahoot.					
4. I preferred answering questions independently.					
5. I trusted my own judgement during the quiz.					
Section B: Group Kahoot Participation					
Collaborative Participation					
1. I actively contributed to my group's answers during Kahoot.					
2. I shared ideas with my group members.					
3. I participated in discussions before answering questions.					
4. I helped my group decide the correct answer.					
5. My participation helped the group perform better.					
Group Interaction					
1. My group members discussed questions before answering.					
2. We exchanged ideas during the Kahoot quiz.					
3. Communication within the group helped us answer correctly.					
4. Group discussion improved our understanding of the questions.					
5. I felt comfortable interacting with my group members.					
Shared Decision Making					
1. Our group decided answers together.					
2. Everyone's opinion was considered before selecting answers.					
3. Group discussions helped us select the best answer.					
4. The group worked together to solve questions.					
5. Team decisions improved our performance.					
Section C: Student Engagement in Game Based Learning					
Behavioural Engagement					
1. I actively participated during Kahoot activities.					
2. Kahoot encouraged me to stay involved in the lesson.					
3. I paid attention throughout the Kahoot session.					
Emotional Engagement					
1. I enjoyed participating in Kahoot quizzes.					
2. Kahoot made the class more interesting.					
3. I felt excited when participating in Kahoot.					
Cognitive Engagement					
1. Kahoot made me think carefully about the questions.					
2. Kahoot helped me concentrate on the lesson.					
3. Kahoot encouraged me to think critically about the topic.					

Appendix B Sample Participant Consent Form



Dr Iqra Abbas
Dr Toyosi Samuel
Shalna Shirin
Riya Rachel Vinod
Results Consortium Limited
United Kingdom

21st March 2026

Dear Class Representative and Assistant Class Representative (Cohort C24),

We hope you are well.

We are writing to seek your consent and support in facilitating a research study that will be conducted within your class. The study is titled *Individual and Group Kahoot Participation as Determinants of Student Engagement in Game Based Learning: A Comparative Analysis among Higher Education Business Students in Results Consortium Limited, United Kingdom*.

As the class representative and assistant class representative, you play an important role in supporting communication and coordination within your cohort. I kindly request your assistance in helping to inform your classmates about the study and in supporting the distribution of the research questionnaire. Your role will be strictly facilitative, and you are not expected to influence participation or responses in any way.

Please note that participation in this research is entirely voluntary for all students, including yourselves. No student will be under any obligation to take part, and anyone who chooses to participate will have the right to withdraw at any stage without any academic consequences. The study is purely for academic and research purposes.

All information collected during this research will be treated with strict confidentiality. No names or identifiable details will be recorded, and all responses will be anonymised. The data will be securely stored in line with the requirements of the United Kingdom General Data Protection Regulation, and access will be limited to the researcher only. The findings will be presented in aggregate form and will be used for academic publication.

If you are willing to support this research in your capacity as class representatives, kindly indicate your consent by signing below.

Thank you for your cooperation and support.

Yours sincerely,
Dr Iqra Abbas
Dr Toyosi Daniel Samuel
Shalna Shirin
Riya Rachel Vinod



I, Sikona Ravica, in my capacity as Class Representative, confirm that I have read and understood the purpose of this research and agree to support its facilitation within Cohort 24.

Signature: [Signature]
Date: 23.03.2026

I, Akshay Gada, in my capacity as Assistant Class Representative, confirm that I have read and understood the purpose of this research and agree to support its facilitation within Cohort 24.

Signature: 23.03.2026
Date: [Signature]

Appendix C Reliability Test Data

Reliability Statistics

Cronbach's
Alpha

N of Items

.969

7

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Student_Engagement	26.88	8.315	.922	.961
Participation_Intensity	26.87	8.383	.893	.963
Individual_Competitive_En gagement	26.90	8.543	.778	.971
Individual_Decision_Auton omy	26.89	8.379	.905	.962
Collaborative_Participation	26.91	8.167	.925	.961
Group_Interaction	26.92	8.151	.917	.961
Shared_Decision_Making	26.93	8.191	.872	.965

Appendix D

Regression analysis of decision autonomy on student engagement

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.832 ^a	.692	.689	.281

a. Predictors: (Constant), Individual_Decision_Autonomy

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	19.287	1	19.287	244.966	<.001 ^b
	Residual	8.582	109	.079		
	Total	27.869	110			

a. Dependent Variable: Student_Engagement

b. Predictors: (Constant), Individual_Decision_Autonomy

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.738	.242		3.047	.003
	Individual_Decision_Autonomy	.839	.054	.832	15.651	<.001

a. Dependent Variable: Student_Engagement

Appendix E

Ethical clearance issued by Results Consortium



April 5th, 2026

Dear Dr. Ahmad,

Ethical Approval for Research Study

This letter serves to confirm that the research study titled: "Examining Individual and Group Kahoot! Participation as Predictors of Student Engagement in Game-Based Learning: Evidence from Higher Education Business Students in the United Kingdom" conducted by Dr Toyosi Samuel, FHEA; Dr Iqra Abbas; Riya Rachel Vinod; and Shalna Shirin, has been formally reviewed, approved, and authorised by Results Consortium Limited, United Kingdom.

The research was undertaken within the HND Business Department of Results Consortium Limited, Northampton Campus, UK. All necessary ethical procedures and institutional requirements were thoroughly scrutinised prior to approval. This included a comprehensive review of the research design, data collection instruments, participant involvement, and data handling procedures.

The institution confirms that the study adhered to established ethical standards for educational research. Participation in the study was voluntary, and appropriate measures were taken to ensure informed consent, anonymity, and confidentiality of all participants. No personally identifiable information was collected, and all data were used strictly for academic and research purposes.

Following this rigorous review process, the study was deemed ethically compliant and suitable for implementation within the institution. Results Consortium Limited therefore fully supports and authorises the conduct and dissemination of this research.

Should you require any further information or clarification, please do not hesitate to contact the undersigned.

Yours faithfully,
Kevin Rajmun
Director,
Results Consortium Limited,
United Kingdom
Email: Kevin@resultsco.org.uk
ORCID: <https://orcid.org/0009-0002-6913-1319>