Investigating the Perceptions of Primary School Students on Gamification-based Learning in Mathematics: A Descriptive Survey Study

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ABSTRACT

The main focus of this study is to investigate student perceptions about integrating gamification-based learning into the primary level of mathematics, specifically discussing teaching related to the example Kahoot framework. A descriptive survey design was used, targeting 27 5th-grade students from Boys High School Gorikote, who had previous engagement with or learning through gamification. The research sample was selected using a purposive sampling method. The data was gathered using a standardized questionnaire derived from prior research and verified by professionals. The data was assessed using descriptive statistics such as frequency, mean, and standard deviation. The analysis of data showed that over 90% of the students had a strong consensus on the efficacy and applicability of Kahoot in enhancing mathematics skills and conceptual understanding and providing a good learning experience. Learning with Kahoot was enjoyable, effective, and favourable to collaboration and teacher-student interaction. This study highlighted Kahoot's transformative potential at the primary level of mathematics education, with a key role being played in its fostering of motivation, engagement, and academic performance. Considering the students' positive perceptions of Kahoot and its effectiveness in facilitating mathematical skills and conceptual understanding, it is recommended that Kahoot or a similar gamification-based learning tool be integrated into primary mathematics education in district Astore Gilgit Baltistan (where internet access and IT labs are available).

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1.   Introduction

Gamification is one of the most effective approaches to helping students upgrade their educational process and achieve high results. According to Guerrero Puerta (2024), the incorporation of gaming aspects into educational settings, known as gamification, has shown tremendous potential in terms of enhancing academic success, which refers to the achievement of learning goals and encouraging students. Although gamification is becoming more popular, there is not enough consent among researchers about whether or not gamification is helpful in enhancing academic performance (Chen & Chiu, 2016; Rachels & Rockinson-Szapkiw, 2018). Assessment in the area of mathematics instruction and particularly in terms of student development is essential since we need to make judgments on education. Based on research conducted by Şad and Özer (2019), gamification, which is made possible by platforms such as Kahoot, provides an interactive method of formative assessment that aligns with the technologically aware character of students and enhances their learning experience. Wichadee and Pattanapichet (2018) Kahoot is a helpful tool for boosting students' cognitive capacity because of it is ease of use and its capability to provide diverse learning experiences.

According to Bolat and Taş (2023), an investigation of the efficacy of gamified assessment tools in formal education was initiated and they shed light on how these tools affect academic achievement. Although some research had indicated potentially methodological variances in findings, Vankúš (2021) found that game-based learning tended to raise students' emotional reactions to geometry. Zhang and Huang (2024) demonstrated that gamification used successfully in educational settings enabled to increase students' engagement and language competency by means of adaptive gamified assessment in a blended setting. Finally, according to Taşkara and Ekmekçi (2024) the use of gamification in higher education is positively received by EFL teachers and the positive views of these teachers towards English as a Foreign Language (EFL). In addition, they write that gamification outpaces the restrictions in curriculum and time. This study discusses students' perception of gamification based formative assessment in the context of primary mathematics education in District Astore. This research aims to explore and examine based on the current application and efficiency of gamification by examining its application in particular, Kahoot platform on which it is mostly implemented. The results presented in this paper provide tremendous potential for academic achievement and practical implementation, and new contributions to education as a field.

An important research gap relating to how the primary school students behave when receiving a gamified learning in mathematics is highlighted in the existing literature and specifically in the Astore District. Recent studies on gamification, such as those by Hamari, Koivisto, and Sarsa (2014) and (Castillo-Parra, Hidalgo-Cajo, Vásconez-Barrera, & Oleas-López, 2022) have shown the effectiveness of gamification in improving student engagement and learning outcomes, especially in urban or developed educational environments. However, the research by Alsswey and Malak (2024) has yet to be extensively applied in rural settings, where educational challenges and socio-cultural dynamics may affect the effectiveness of gamified learning approaches. In addition, the work of Grijalvo, Segura, and Núñez (2022) highlights the compelling need for developed gamification frameworks that fit these specific environments. Thus, it's important to have a fact based study on how primary school students perceive gamification based tools in order to accurately evaluate the Kahoot tool efficacy as an instructive tool in mathematics. The increasing popularity of the Kahoot tool in the teaching-learning process necessitates a thorough assessment of its impact on students' learning outcomes. The study also investigates whether students feel comfortable and engaged with the educational tool. Hence, the study was carried out to investigate students' perceptions regarding the use of gamification-based tools in the mathematics teaching-learning process.

2. Theoretical Background

The term gamification involved is the use of game design in activities and contexts not related to games, like in education, to encourage students. In the areas of mathematics education for primary school students, applications such as Kahoot have become popular in learning aspects of gamification (Deterding, Dixon, Khaled, & Nacke, 2011). Kahoot also uses features like points, a leaderboard, and immediate feedback as required by the self-determination theory by Ryan and Deci (2000), which argued that extrinsically motivated learning is better if enjoyable (Hamari, Koivisto, & Sarsa, 2014). From a cognitive perspective of development, gamification can be described as constructive learning, which implies that learners construct understanding actively from activities done by the self (Piaget, 1976). Kahoot accomplishes this through its quizzes, which ensure learners are involved in 'doing' and 'thinking' through problems. Moreover, there is an instant response, which is one of the most effective ways of learning for young learners when it comes to mathematics. Once in a while, they get an opportunity to rectify mistakes on their own without bias due to effective feedback (Hattie & Timperley, 2007). It also fits into Vygotsky (1978) zone of proximal development (ZPD) because learners need support to enable them to achieve a higher level of mastery that they may not otherwise achieve on their own. This makes Kahoot helpful for a teacher to change its level of difficulty or its speed to fit the student's learning, hence essential in mathematics learning.

Also, Kahoot promotes social learning in line with Bandura (1997) viewpoint that points to observing, modeling and imitating from peers. Kahoot offers multiple players and team features that can be used in the classroom setting: It ensembles group learning for students as they can watch their peers' performances and use peer learning to achieve better results (Licorish, Owen, Daniel, & George, 2018). This kind of interaction fosters competition, but it

also reinforces lessons and affords students the opportunity to study and share knowledge with peers, improving their grasp of mathematical ideas. Moreover, formative assessment, through instant feedback and analytics, enables teachers to see students' strengths and weaknesses on real time. Black and Wiliam (1998) also believe that learning outcomes should be improved by providing evidence on learning practices. Thus, Kahoot's quizzes become a continuous assessment tool where, based on the data received, teachers can identify deficiencies in learners' mathematical knowledge. In a nutshell, gamification increases fun with the learning material, which is crucial to learners' sustained interest in disciplines that can be less engaging, such as mathematics. Learning is effective when the activity is highly engaging, hence the support from Czikszentmihalyi (1990) flow theory. The use of visual prompts, music, and feedback makes the Kahoot learning atmosphere fun, which helps to facilitate positive attitudes toward learning mathematics and minimizes math anxiety (Plump & LaRosa, 2017; Su & Cheng, 2015).

3.   Literature Review

The use of gamification has been shown to have a good impact on the motivation and engagement of students in elementary mathematics, hence improving their capacity to retain and understand material (Yan, 2023). In addition to this, it helps children understand how to form geometric structures and stimulates their creative thinking (Yan, 2024). However, a number of barriers still prevent instructors including the complexity of course planning and the distracting nature of students (Yan, 2023). As stated by Maryana, Halim, and Rahmi (2024), the use of gamification in mathematics instruction increased student involvement and increased learning academically. Furthermore, those students who took part in the gamified learning environment had more favorable views about mathematics than the group that served as the control (Maryana, Halim, & Rahmi, 2024).

Furthermore, according to Maryana, Halim, and Rahmi (2024), gamification has the potential to be an effective instructional technique in the field of mathematics teaching, hence improving both student engagement and the results of their learning. Research showed that most educators have positive views about gamification in higher education but their worries vary in how familiar they are with games (Marinensi & Romero Carbonell, 2021). It was well rounded gamers who cared about the potential negative effects. Also the time and support required to implement gamification in the instruction was highlighted by non-gamers, at the same time, as a problem related with this implementation (Marinensi & Romero Carbonell, 2021). As reviewed in the proposed investigation by Alsswey and Malak (2024), the application of Kahoot as a gamification tool has reduced a lot stress and anxiety expression among students, which, in turn, contributed to improving both their psychological healthy and academic performance. This is in line with a previous study by Hamari, Koivisto, and Sarsa (2014), where she demonstrated that gamified learning can reduce level of stress because gamified learning is more engaging. This finding of increased self-efficacy is consistent with Bandura (1997) theory of self-efficacy which is that mastery experiences result in increase in the confidence in skill itself. Although it has been shown that gamification positively affects engagement, self-efficacy and academic achievement (Alsswey & Malak, 2024; Hamari, Koivisto, & Sarsa, 2014), most of this research has been conducted in settings related to higher education or in more developed education contexts. The government of Gilgit-Baltistan (GB) initiated the integration of the GB Smart School System, which has boosted student participation and enrollment in schools throughout GB.

These include the enhancement of the usage of blended learning, the setting up of smart classes, the provision of various technologies, laptops, and Chromebooks and the 400 hundred Information IT labs with digital technological facilities. However, districts like Astore have lower rather than higher student outcome gains (Abbasi, 2023, August 3)., whereas districts like Gilgit and Hunza have higher gains. A similar scenario is clearly seen at the elementary level where the BE Board of Elementary Results of Grade 5 in District Astore were below the required proficiency in basic learning (Abbasi, 2023, August 3). This study is indeed a follow-up to an experimental study that was undertaken in Boys High School, Astore. The previous research proved that there was an enhancement of the learning outcomes when Kahoot was used; therefore, there is a need to establish the students' perception regarding this type of learning gamification. Knowledge of students' perception and experiences with regard to Kahoot will give a comprehensible understanding that will help to evaluate the effectiveness

of such digital tools as well as contribute to the identification of other aspects that need enhancement in technology-taught reforms in District Astore.

3.1. Objectives
• To investigate students' perceptions of gamification-based learning in mathematics teaching at the primary level in District Astore.

3.2. Research Question
• What is the perception of primary school students about the use of gamification-based learning in mathematics teaching in District Astore?

4. Methodology

This research adopts a descriptive survey research design to assess students' perception toward gamification-based learning practices in primary-level mathematics. The descriptive design is useful in the application of several data collection instruments, such as questionnaires, interviews, and observations. Using such simple language in the questionnaire to choose from may also be very effective for students in primary schools. Here, flexibility prevents the data collected from being too complex for children and adolescents to understand, hence making their responses more credible (Gall, Borg, & Gall, 1996). The study was targeted at a population of fifth-grade students at Boys High School Gorikote Astore who had prior experience with using Kahoot for gamification-based learning in Mathematics. The number of participants was 27 learners purposively selected to participate in the study to make sure all learners were exposed to Kahoot-based activities. This method enables the study to get detailed and rich context information from students who have first-hand experience with the intervention (Patton Quinn, 2002). However, the sample size is limited, which is insignificant in generating a generalized overall view, and it is appropriate for capturing the perception and reflection of the selected cohort of students subjected to the gamification intervention. When conducting educational research with students at the primary level, purposive and specific focus in their selection leads to a higher level of understanding and, hence, better data, especially considering that all of them have been through similar situations (Creswell & Creswell, 2017). Since the study only takes subjects from students who have interacted with the Kahoot-based approach before, the study's data is reliable and valid and informs the extent to which the approach to learning has been effective.

4.1. Data Collection

Data was collected from those students who had experienced and been taught gamification-based technique. A structured questionnaire comprising a five-point Likert scale was used to collect that data from the entire group of 27 students. The questionnaire sought to explore various dimensions of students' perceptions concerning the efficacy and applicability of gamification-based assessment practices within their mathematics education. Particularly tailored for 5th-grade mathematics instructions, the questionnaire adopted was sourced from Nuri, Qadir, Mohammed, and Azaldin (2022), encompassing twenty-four items graded on a five-point Likert Scale ranging from "strongly disagree" (1) to "strongly agree" (5). Drawing inspiration from recent studies by Alawadhi and Abu-Ayyash (2021); Kaur and Naderajan (2019); Wichadee and Pattanapichet (2018); Youhasan and Raheem (2019) Alwadhi & on Kahoot's utility as a formative assessment tool in English language learning among postgraduate students, the questionnaire was adapted. Notably, Nuri et al. (2022) conducted their study wherein a similar questionnaire was employed. However, for the present research investigating student perceptions of gamification-based formative assessment in primary-level mathematics education within District Astore, the questionnaire was translated from English to Urdu to ensure better comprehension among participants. The Likert scale utilized ranged from "strongly disagree" (1) to "strongly agree" (5), facilitating detailed responses from the participants.

4.2. Validity and Reliability

A survey instrument to measure the level of acceptance of gamification-based learning on students' perception has to be validated in terms of content validity to eliminate any possible ambiguity by seeking input from five experts, including two PhD scholars and three subject specialists in English. Their input adjusted the items to align with the goal and objectives of the study in order to enhance the reliability of the tool that would be used to

gather data. All the selected items formed a consensus with most of the experts, and the Content Validity Index (CVI= 1) suggested that the items were adequate; only two items were removed as per their suggestions. This researcher adapted questionnaire, used in the present study with a sample of teachers delivering English courses which were including Kahoot, designed to gauge motivation levels of students, was translated from English to Urdu and slightly modified for the purpose of measuring the effects of gamification in Mathematics at the primary level in Gilgit Baltistan, Pakistan. Furthermore, prior studies employed a reliability test where Cronbach's Alpha (α = 0.67 > 0.60), which supports the suggestion by Cohen, Manion, and Morrison (2017). Cronbach's Alpha was used, and the obtained value was greater than 0.7, indicating satisfactory reliability in this study. The data that were collected through the questionnaire contained a five-point Likert scale From Nuri et al. (2022) and other related studies such as Alawadhi and Abu-Ayyash (2021) and (Mahbub, 2020) composed of 24 items. It was designed for English courses, but the same was applied when introduced to math, and it was endorsed by experts with minor modifications made to suit the course. Based on the reliability findings, the adapted questionnaire contained 22 items, which is valid for assessing students' attitudes toward gamification-based learning in the context of primary education.

5.   Results
Table 1: Students perception about Gamification based learning in Mathematics

S.#	Statements	SD F %	D F %	N F %	A F %	SA F %	Mean	SD
1	Learning mathematics with Kahoot is enjoyable. کاہوٹ گیم کے ساتھ ریاضی سیکھنا مزہ ہے۔	0 0%	1 3.7%	0 0%	13 48.1%	13 48.1%	4.40	0.69
2	I can improve my mathematical skills through Kahoot میں کابوٹ گیم کے ذریعے اپنی ریاضی کی مہارتوں کو بہتر کرسکتا ہوں	0 0%	1 3.7%	0 0%	13 48.1%	13 48.1%	4.40	0.69
3	Kahoot game helps me learn mathematical concepts in a better way. کاہوٹ گیم مجھے ریاضی کے تصورات کو بہتر طریقے سے سیکھنے میں مدد کرتی ہے	0 0%	1 3.7%	0 0%	12 44.4%	14 51.9%	4.44	.697
4	I understand mathematics better through the Kahoot game. میں کاہوٹ گیم کے ذریعے ریاضی کو بہترسے سمجھتا ہوں	0 0%	01 3.7%	0 0%	08 29.6%	18 66.7%	4.592	.693
5	I think that Kahoot game is helpful in enhancing my mathematical abilities. میں سمجھتا ہوں کہ کاہوٹ گیم میری ریاضی کی صلاحیتوں کو بہتر بنانے میں مددگار ہے۔	0 0%	01 3.7%	0 0%	14 51.9%	12 44.4%	4.370	.687

The data in Table 1 shows how the students feel about using gamification-based instructions in math classes. The study had 22 questions that were meant to find out how students felt about gamification-based testing and how it changed math education. Students all agreed with the first question, which was called "Learning math with Kahoot is fun," کاہوٹ گیم کے ساتھ ریاضی سیکھنا مزہ ہے۔ with 96.3% saying they strongly agreed or agreed. The fact that the mean score was 4.40 and the standard deviation was only 0.69 shows that most of the students agreed that using Kahoot to study math was fun. The second question, "I can improve my math skills through Kahoot," میں کابوٹ گیم کے ذریعے اپنی ریاضی کی مہارتوں کو بہتر کرسکتا ہوں received the same level of agreement from the students: 96.3% said they strongly agreed or agreed. The mean score of 4.40 and the standard deviation of 0.69 show that most of the students agreed that Kahoot helped them improve their math skills. Also, all of the students who answered agreed with the third item, "The Kahoot game helps me learn math concepts better," کاہوٹ گیم مجھے ریاضی کے تصورات کو بہتر طریقے سے سیکھنے میں مدد کرتی ہے

with 96.3% saying they strongly agreed or agreed. With a mean score of 4.44 and a standard deviation of 0.697, students strongly agreed about how well Kahoot helps them understand math ideas. Many students agreed with the fourth item, میں کاہوٹ گیم کے ذریعے ریاضی کو بہترسے سمجھتا ہوں "I understand math better through the Kahoot game." In fact, 96.3% of those students said they strongly agreed or agreed. The mean score was 4.592, and the standard deviation was 0.693, which shows that most of the students agreed that Kahoot helped them understand math better. The fifth question described that "the Kahoot game helps me improve my math skills"

میں سمجھتا ہوں کہ کاہوٹ گیم میری ریاضی کی صلاحیتوں کو بہتر بنانے میں مددگار ہے۔

Again, students strongly agreed with this statement (96.3%), which means that they agreed or strongly agreed. The strong opinion among students about Kahoot's ability to improve their math skills is shown by the mean score of 4.370 and the standard deviation of 0.687. It is concluded that students overall have a positive perception of Kahoot as an enhancement to their learning experience in mathematics. High means across statements (ranging from 4.37 to 4.59) and consistent agreement percentages (96.3%) suggest that Kahoot is seen as a valuable educational tool for making mathematics more engaging, understandable, and skill-enhancing. The low standard deviation across responses also indicates consistency in these positive perceptions. The graphical representations are shown as under:

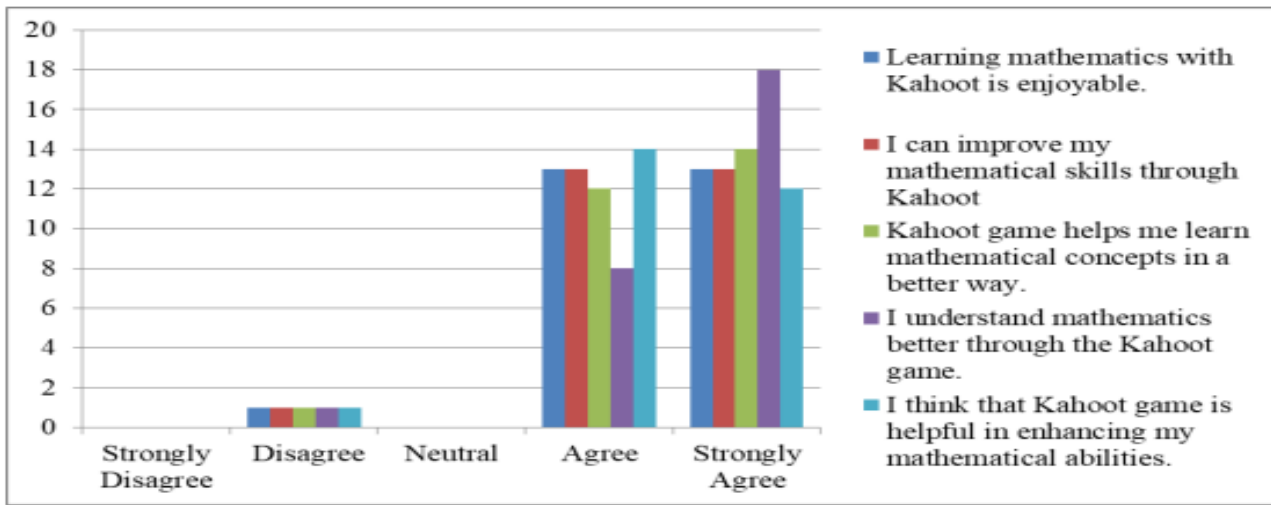**Figure 1: Students Perception about the Use of GBL in Mathematics Subject (Item 1 to 5)**

Table 2: Students perception about the use of GBL in Mathematics subject(item 6 to 11)

S.#	Statements	SD F %	D F %	N F %	A F %	SA F %	Mean	SD
6	Kahoot game provides me an opportunity to enhance my understanding of mathematics. کاہوٹ گیم مجھے ریاضی کی سمجھ کو بڑھانے کا موقع دیتی ہے۔	0 0%	01 3.7%	0 0%	12 44.4%	14 51.9%	4.444	.697
7	I think Kahoot game helps me to develop my Mathematical skills. میں سمجھتا ہوں کہ کاہوٹ گیم میری ریاضی کی مہارتوں کو بڑھانے میں میری مدد کرتی ہے۔	0 0%	01 3.7%	0 0%	07 25.9%	19 70.4%	4.629	.687
8	Kahoot game helps me learn more effectively. کاہوٹ گیم مجھے ریاضی کو زیادہ مؤثر طریقے سے سمجھنے میں مدد کرتی ہے	0 0%	01 3.7%	0 0%	16 59.3%	10 37.0%	4.296	.668
9	Kahoot game encourages me to share my ideas in Mathematics class. کاہوٹ گیم مجھے ریاضی کی کلاس میں اپنے خیالات کا اظہار کرنے پر حوصلہ افزائی کرتی ہے	0 0%	01 3.7%	0 0%	08 29.6%	18 66.7%	4.592	.693
10	Kahoot game is suitable to use in Mathematics classrooms. کاہوٹ گیم ریاضی کی کلاس میں استعمال کرنے کے لیے موزوں ہے	0 0%	01 3.7%	0 0%	09 33.3%	17 63.0%	4.5556	.697
11	Kahoot game allows me to obtain immediate feedback from the teacher. کاہوٹ گیم مجھے استاد سے feedback فوری رائے حاصل کرنے کی اجازت دیتی ہے۔	0 0%	01 3.7%	1 3.7	15 55.6%	10 37.0%	4.259	.712

Table 2 shows that the sixth question, "The Kahoot game gives me a chance to improve my math skills," کاہوٹ گیم مجھے ریاضی کی سمجھ کو بڑھانے کا موقع دیتی ہے۔ all of the students who answered agreed, with 96.3% saying they strongly agreed or agreed. The mean score was 4.444, and the standard deviation was 0.697, which shows that most of the students agreed that Kahoot helped them understand math. Seventh question: میں سمجھتا ہوں کہ کاہوٹ گیم میری ریاضی کی مہارتوں کو بڑھانے

میں میری مدد کرتی ہے۔"I think the Kahoot game helps me improve my math skills." All of the students who answered agreed, with 96.3% saying they strongly agreed or agreed. The average score of 4.629 and the standard deviation of 0.687 shows that most of the students agree on how Kahoot has helped them improve their math skills.

کاہوٹ گیم مجھے ریاضی کو زیادہ مؤثر طریقے سے "The Kahoot game helps me learn more effectively" سمجھنے میں مدد کرتی ہے was the eighth statement that students strongly agreed with (96.3%). The mean score of 4.296 and the standard deviation of 0.668 indicated that students strongly agreed that Kahoot helped them learn more effectively. When asked about item nine, کاہوٹ گیم مجھے ریاضی کی کلاس میں اپنے خیالات کا اظہار کرنے پر حوصلہ افزائی کرتی ہے "The Kahoot game makes me more likely to share my thoughts in math class," most of the students (96.3% of those surveyed) agreed or strongly agreed. The mean score was 4.592, and the standard deviation was 0.693, which shows that most of the students decided that Kahoot was an excellent way to get students to share their ideas in math class. In the same way, all of the students who answered question ten کاہوٹ گیم ریاضی کی کلاس میں استعمال کرنے کے لیے موزوں ہے ("The Kahoot game can be used in math classes") agreed, with 96.3% saying they strongly or agreed. The mean score was 4.5556, and the standard deviation was 0.697, which shows that most of the students decided that Kahoot should be used in math classes.

Item eleven, کاہوٹ گیم مجھے استاد سے feedback فوری رائے حاصل کرنے کی اجازت دیتی ہے۔

"The Kahoot game lets me get immediate feedback from the teacher," most of the students (92.6%) said they strongly agreed or agreed, showing that they saw Kahoot as a way to get feedback quickly. There is a modest amount of agreement on this problem, as demonstrated by the mean score of 4.259 and the standard deviation of 0.712.

In a nutshell, Students express a predominantly positive perception of using Kahoot in mathematics classes. With high means across the statements (from 4.259 to 4.629) and consistent agreement percentages, Kahoot is seen as a tool that enhances understanding, supports skill development, facilitates effective learning, and encourages class participation. The data supports the suitability and positive impact of Kahoot as an effective Game-Based Learning method in mathematics, fostering an engaging and supportive learning environment. The low standard deviations reflect consistent opinions across respondents, reinforcing these insights. The graphical representations are shown as under:

Figure 2: Students Perception about the Use of GBL in Mathematics Subject (Item 6 to 11)
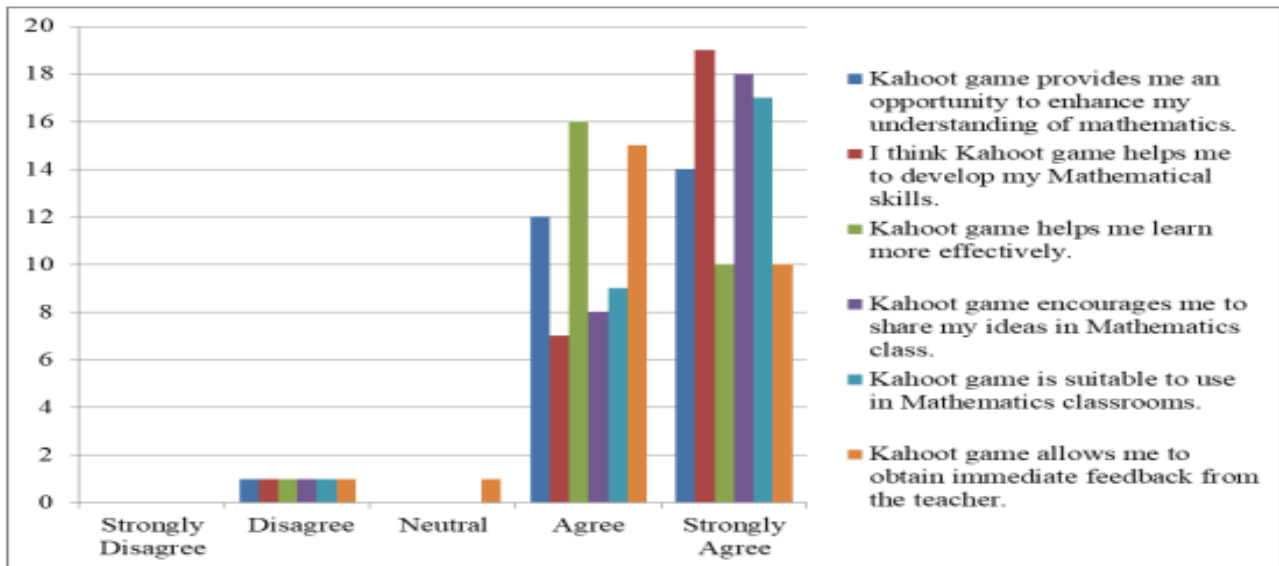

Table 2 shows that the students strongly agreed with item twelve, کاہوٹ گیم مجھے ریاضی میں اعلیٰ درجات حاصل کرنے میں مدد کرتی ہے "The Kahoot game helps me get better grades in math." In fact, 92.6% of them said they strongly agreed or agreed. The mean score was 4.407, and the standard deviation was 0.747, which shows that most of the students agree that Kahoot helps them do better in school. Thirteenth item: کاہوٹ گیم مجھے مزید مطالعہ کرنے کی ترغیب دیتی ہے۔ "The Kahoot

game makes me want to study more." Most students (92.6%) said they agreed or strongly agreed with this statement. The fact that the mean score was 4.148 and the standard deviation was 0.769 shows that most of the students agreed that Kahoot helped them learn more. When asked about item 14,جب میں کاہوٹ گیم کھیلتا ہوں تو انٹرایکٹو ماحول فراہم کرتی ہے۔ "When I play Kahoot, it makes the environment more interactive," most students (92.6%) said they agreed or strongly agreed. The mean score is 4.518, and the standard deviation is 0.752, which shows that most of the students agree that Kahoot is fun and engaging.

Table 3: Students perception about the use of GBL in mathematics subject (item 12 to 18)

S.#	Statements	SD F %	D F %	N F %	A F %	SA F %	Mean	SD
12	Kahoot game helps me obtain higher grades in Mathematics. کاہوٹ گیم مجھے ریاضی میں اعلیٰ درجات حاصل کرنے میں مدد کرتی ہے	0 0%	1 3.7%	1 3.7	11 40.7%	14 51.9%	4.407	.747
13	Kahoot game encourages me to study more. کاہوٹ گیم مجھے مزید مطالعہ کرنے کی ترغیب دیتی ہے۔	0 0%	01 3.7%	03 11.1	14 51.9%	09 33.1%	4.148	.769
14	When I play Kahoot game, it provides an interactive environment. جب میں کاہوٹ گیم کھیلتا ہوں تو انٹرایکٹو ماحول فراہم کرتی ہے۔	0 0%	01 3.7%	01 3.7	08 29.6%	17 63.0%	4.518	.752
15	It is fun to compete with the other students by Kahoot. دوسرے طلباء سے کاہوٹ گیم کےزریعے مقابلہ کرنا مزہ آتا ہے	0 0%	01 3.7%	01 3.7	10 37.0%	15 55.6%	4.444	.751
16	Kahoot game makes the class more interactive. کاہوٹ گیم کلاس کو زیادہ انٹرایکٹو بناتا ہے۔	0 0%	01 3.7%	02 7.4	11 40.7%	13 48.1%	4.333	.784
17	I try to win while playing Kahoot game. میں کاہوٹ گیم کا استعمال کرتے ہوئے جیتنے کی کوشش کرتا ہوں۔	0 0%	0 0%	01 3.7	12 44.4%	14 51.9%	4.444	.697
18	I feel relax while playing Kahoot game. کاہوٹ گیم کھیلتے ہوئے مجھے آسانی محسوس ہوتی ہے	01 3.7	01 3.7%	0 0%	16 59.3%	09 33.3%	4.148	.907

Item 15, دوسرے طلباء سے کاہوٹ گیم کےزریعے مقابلہ کرنا مزہ آتا ہے "It is fun to compete with other students on Kahoot," most of the students (92.6%) said they agreed or strongly agreed. Students are very much in agreement about how much they enjoy Kahoot games, as shown by the mean score of 4.444 and the standard deviation of 0.751. Item sixteen refers to کاہوٹ گیم کلاس کو زیادہ انٹرایکٹو بناتا ہے "The Kahoot game makes the class more interactive," most of the students (92.6%) said they agreed or strongly agreed. Students are very much in agreement about Kahoot's ability to make the class more fun and interactive (mean score: 4.333, standard deviation: 0.784). When asked about item seventeen, میں کاہوٹ گیم کا استعمال کرتے ہوئے جیتنے کی کوشش کرتا ہوں۔"I try to win when I play the Kahoot game," most of the students (92.6%) said they agreed or strongly agreed.

Students agree about how much they enjoy Kahoot games, as shown by the mean score of 4.444 and the standard deviation of 0.697. Item 18 refers to کاہوٹ گیم کھیلتے ہوئے مجھے آسانی محسوس ہوتی ہے "I feel calm when I play the Kahoot game," most of the students (92.6%) said they agreed or strongly agreed. Students agree about how relaxing Kahoot is, as shown by the mean score of 4.148 and the standard deviation of 0.907. The analysis shows that students generally perceive Kahoot positively, especially in areas of engagement, interactivity, and academic support. High agreement across items (between 85% and 96.3%) and mean scores ranging from 4.148 to 4.518 suggest that Kahoot successfully contributes to creating a dynamic and motivational learning environment in mathematics. Kahoot's competitive nature and interactivity enhance engagement, while its perceived benefits in understanding and motivation encourage students' academic and personal efforts. The graphical representations are shown as under:

Figure 3: Students Perception about the Use of GBL in Mathematics Subject (Item 12 to18)
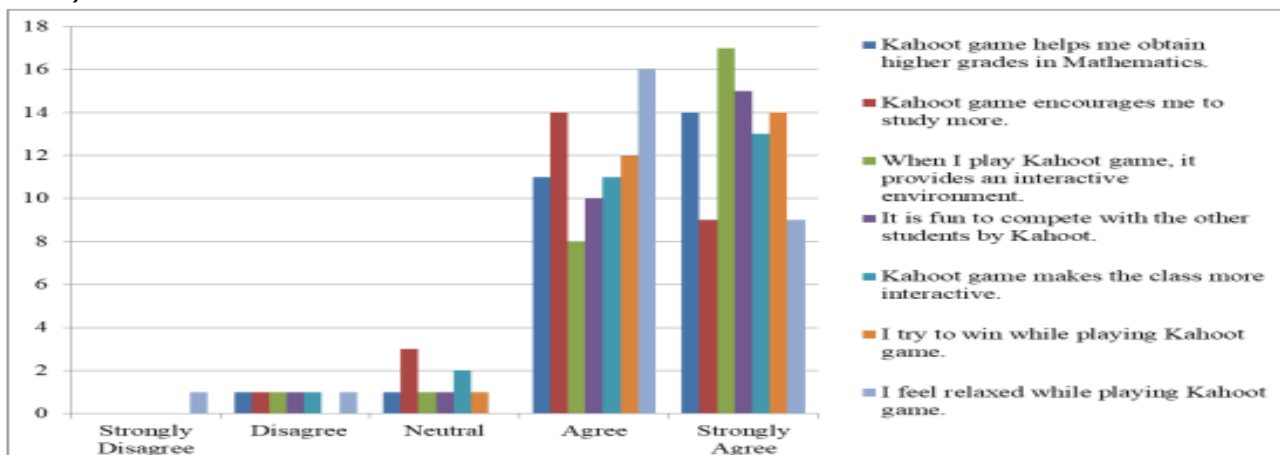

Table 4: Students perception about the use of GBL in mathematics subject (item 19 to 22)

S.#	Statements	SD F %	D F %	N F %	A F %	SA F %	Mean	SD
19	Kahoot game is a better platform than the traditional paper quiz for tests. کاہوٹ گیم ٹیسٹ کے لیے روایتی پیپر کوئز سے بہتر پلیٹ فارم ہے۔	01 3.7	01 3.7%	0 0%	14 51.9%	11 40.7%	4.222	.933
20	Kahoot game facilitates me to understand the material and the lesson. کاہوٹ گیم مجھے مواد اور سبق کے بارے میں سمجھنے میں سہولت فراہم کرتی ہے	0 0%	1 3.7%	02 7.4	11 40.7%	13 48.1%	4.333	.784
21	Kahoot game strengthens the teacher-student interaction in the class. کاہوٹ گیم کلاس میں استاد اور طالب علم کے تعامل کو مضبوط کرتا ہے	0 0%	0 0%	01 3.7	10 37.0%	16 59.3%	4.518	.70002
22	Kahoot game promotes collaboration among students in the class. کاہوٹ گیم کلاس میں طلباء کے درمیان تعاون کو فروغ دیتا ہے	0 0%	05 18.5%	03 11.1	12 44.4%	7 25.9%	3.777	1.05003

Table 4 demonstrates that the question 19, کاہوٹ گیم ٹیسٹ کے لیے روایتی پیپر کوئز سے بہتر پلیٹ فارم ہے۔ "The Kahoot game is better than the traditional paper quiz for tests," most students (92.6%) said they agreed or strongly agreed. The average score of 4.222 and the standard deviation of 0.933 shows that most students agree that Kahoot is better than regular paper quizzes. When asked about item twenty, کاہوٹ گیم مجھے مواد اور سبق کے بارے میں سمجھنے میں سہولت فراہم کرتی ہے "The Kahoot game helps me understand the material and the lesson," most of the students (92.6%) said they agreed or strongly agreed. The mean score was 4.333, and the standard deviation was 0.784, which shows that most of the students agreed that Kahoot helped them understand. Item 21 refers to کاہوٹ گیم کلاس میں استاد اور طالب علم کے تعامل کو مضبوط کرتا ہے "The Kahoot game makes it easier for teachers and students to talk to each other in class," most of the students (92.6%) said they agreed or strongly agreed. The average score of 4.5185 and the standard deviation of 0.70002 show that most of the students agree that Kahoot makes it easier for teachers and students to talk to each other. کاہوٹ گیم کلاس میں طلباء کے درمیان تعاون کو فروغ When asked about item 22, دیتا ہے "The Kahoot game encourages students to work together in class," most of the students (92.6%) said they agreed or strongly agreed. The average number of 3.7778 and the standard deviation of 1.05003 shows that students agree on how Kahoot can help them work together. For the most part, the study of each item shows that students usually like the idea of using gamification-based formative assessment. The graphical representations are shown as under:

Figure 4: Students Perception about the Use of GBL in Mathematics Subject (Item 19 to 22)
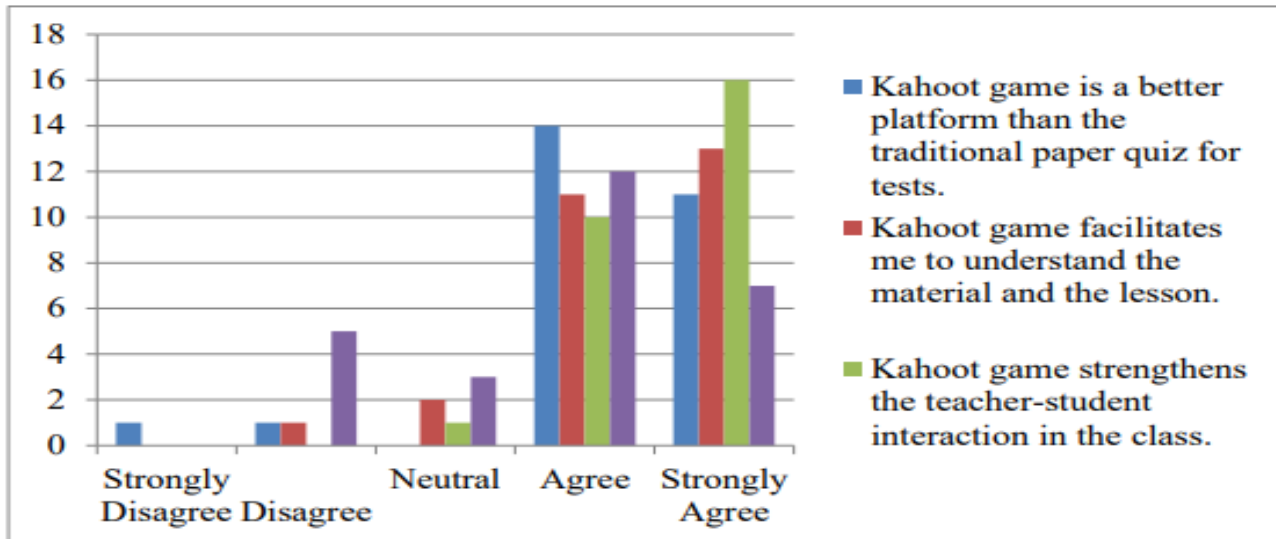
Overall, students view Kahoot positively in enhancing mathematics learning, particularly in understanding the material, improving teacher-student interaction, and serving as a preferable alternative to traditional quizzes. While Kahoot is perceived to enhance interactivity and engagement significantly, its role in fostering collaboration among students needs to be revised, possibly due to its competitive nature. The high standard deviation in the collaboration item reflects varied perspectives, indicating that while Kahoot is effective in individual engagement and teacher interaction, its impact on teamwork may vary based on student preferences and class dynamics.

6.   Discussion

The study established that the students have an overall positive attitude towards the use of Kahoot in mathematics learning at the primary level. The findings are also in accordance with previous works that recognize Kahoot for increasing motivation, participation, and improved learning achievements (Balaskas, Zotos, Koutroumani, & Rigou, 2023; Licorish et al., 2018). Besides, the use of a platform with gamification elements enables students to contribute to their class activities. Also, such platforms tend to bring behaviour changes so that students are more relaxed to deal with assessments, thus enhancing their performances (Tóth, Lógó, & Lógó, 2019). The popularity of Kahoot can be analyzed with an eye on the critical discussion of gamification in education. This approach uses features from games like scoring, competition, and instant feedback to teach. Games, especially those applied to learning environments, are best known for bringing an engaging perspective to learning and are mostly observed in primary education. However, the current studies indicate that the platform does that while enhancing fun, as well as enhancing students' thinking ability and comprehensiveness, besides promoting collaboration within the classroom setting. These elements fit well within the literature on gamification in education, which argues that the approach has the potential to motivate learners under an extrinsic reward system while supporting intrinsic interest in learning (Hamari, Koivisto, & Sarsa, 2014).

In addition to the present findings about the positive effects of Kahoot on students' engagement and performance, a review of the gamification theories may strengthen this study more by pointing out that too much focus on extrinsic motivation, as Kahoot brings (e.g., scores, badges), may lead to potential risks of students' disengagement. While the use of tools in gamification such as Kahoot is known to trigger initial engagement and participation, there is evidence proving that any long-term use of these tools in classroom agenda is best determined by how the tools impact the student's performance in other additional lessons that may not be taught in the classroom (Hamari, Koivisto, & Sarsa, 2014). It should also include a discussion on Bandura's notion of self-efficacy, which is people's conviction in their ability to perform the right things to achieve certain goals (Bandura, 1997). According to the findings of this study, there is a rationale for how Kahoot helps students to be more motivated and engaged during mathematics lessons: the role of self-efficacy. The respondents' self-efficacy beliefs could also

be attributed to the real-time feedback from Kahoot and continuous reinforcement quizzes to solve and learn the concepts. Kahoot increases student confidence because students are able to engage in it and compete fairly in simple quizzes, providing them with a platform for measuring their competence level in every quiz. These are positive feelings that can increase students' self-efficacy and, in turn, increase their tenacious behaviour toward solving other difficult problems involving math. According to Bandura (1997), a high level of self-efficacy improves performance levels. It may be attributed to the fact that students have the confidence to use Kahoot to enhance their learning and may get better academic results.

Subsequent studies might then investigate which of the particular gamification components used in Kahoot particularly affects the students' self-efficacy. For example, competition, which is an element of the platform, may cause different levels of self-efficacy due to students' preferences regarding competition or cooperation. Also, the presence of innovative styles, fully supported by technology, suggests the general shift towards more technologically integrated nontraditional learning approaches. The positive attitude towards Kahoot enlightens the fact that it is making progress towards leaving behind the traditional forms of instruction in favour of new and engaging ones. This is an educational model that has gained currency due to the emphasis on learner-centred self-organization, freedom and activity. Therefore, it can also be concluded in this study that students positively accepted Kahoot as an application to support primary-level mathematics education through game-based learning. This paper seeks to establish its function in promoting motivation, recommending positive changes, and facilitating collaboration, which explains its function as a powerful instrument in education. Nonetheless, a more critical examination of the gamification literature, coupled with the conceptualization and empirical assessment of Bandura's self-efficacy model, illuminates not only the results but the psychological processes that underpin them. Therefore, it is still necessary to maintain a balance between the use of Kahoot and the formation of intrinsic learning motivation, which remains essential for using such technologies in the long-term learning process.

7. Conclusion and Recommendations

The investigation of the student's perception of the integration of Kahoot in primary level mathematics education in the District Astore has yielded overwhelmingly positive results. Kahoot consistently proves effective in fostering both mathematical skills and academic understanding. Similarly, it promotes an engaging and interactive learning environment. The platform significantly enhances academic performance, motivation, and engagement, facilitates collaboration, and provides timely feedback in a supportive environment. Kahoot calls these findings 'an adaptation in a general way of how formative assessment in a gamified setting can drive fundamental improvements in learning.' Kahoot facilitates the development of vibrant learning environment by enhancing student motivation, promoting active learning and boosting student academic performance. Nevertheless, to see the full potential of Kahoot, further study is needed to delineate the volume and duration of use that would most effectively serve to improve creativity and critical thinking in mathematics. Future research should also investigate whether the instantiation and outcomes of the Kahoot program can be sustained across additional schools in District Astore, working with different student populations. To ensure effective implementation of Kahoot in District Astore's primary-level mathematics education, the following recommendations are proposed:

➢ The government of Gilgit Baltistan may provide comprehensive trainings for teachers in how to effectively integrate gamification based learning like Kahoot into the mathematics curriculum. Strategies during training should include how to create quizzes, how to sustain student engagement with the platform, and how to use platform data to meet the needs of individual students. Because students' perceptions are more favorable toward the use of gamification-based learning in mathematics, it is difficult to implement effectively without proper teacher training.

➢ In schools with low resources, there is more emphasis on access to digital devices and connectivity to the internet. To be more inclusive, they need to explore partnerships or initiatives to provide the needed technology or offline modes of Kahoot-based tools. Besides, Kahoot gamification is a highly recommended learning platform that is freely available. It can be downloaded freely and utilized to teach the learning process effectively and efficiently.

➢ By combining Kahoot-based gamification with the curriculum, it will be aligned with the curriculum, so the content reinforces our key mathematical concepts and also supports

classroom teaching. It will realign for more meaningful learning outcomes beyond engagement.
Using Kahoot allows you to promote collaborative activities as students work in pairs or teams. It will promote peer learning, promote teamwork, and create a more inclusive learning environment.

7.1. Limitations of the Study

Despite the valuable insights gained from this study on the impacts of gamification-based learning using Kahoot, several limitations need to be acknowledged to provide a balanced understanding of the research:

➢ The research was restricted to 27 students in the fifth grade at Boys High School, Gorikote, Astore. This makes the results found not very generalizable to other patients in larger population. Despite employing purposive sampling method that made sure that all participants had ever used Kahoot, the participants' views fails to represent the view of all students in the district and other regions. More research should be conducted on a large population cover and different gender and age, in order to gain the clearer understanding of the fact whether the gamification can enhances the learning effectiveness or not.

➢ The study was carried out in one school in Astore District of Gilgit-Baltistan area which has features of education, geography and economy. These limitations may affect the transferability of the findings to other regions with dissimilar environments or resources. Thus, it is recommended that more schools or districts be incorporated into future studies or in other areas of Astore to enhance generalizability of the study results.

➢ Data was collected exclusively through the adapted questionnaire about students' perceptions toward gamification based learning in mathematics teaching. Using a self-complete questionnaire was chosen as it was purposively designed to be understandable for primary school students Although using questionnaire data is convenient, it can include various sources of bias, for example, social desirability bias when the students complete the questionnaires in the way they believe is most favorable. Further, studies can be conducted through observation and interview but does not necessarily translate into real life learning enhancements. Using other supplementary or alternative methods like performances based assessments may also have also given a comprehensive oversight on the effects of gamification.

➢ The study mainly focused on the instant student responses to the experiences they had with the Kahoot-based gamification. It did not pursue the correlation analysis with tests' scores retention, and sustained use of gamification. A longitudinal study approach would allow for a deeper understanding of the sustained benefits or challenges associated with gamification in education.

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