EXPLORING TEACHERS' EXPERIENCES ON ICT-INTEGRATED GAMIFICATION IN SCIENCE CLASSES

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Abstract

This phenomenological inquiry focused on the lived experiences of junior high school teachers in the implementation of ICT-integrated gamification in science classes. The study was conducted in public schools in the municipality of Kapalong, Division of Davao del Norte, involving 12 junior high school science teachers: 7 for focus group discussions and 5 for in-depth interviews. The data were analyzed through thematic analysis. Results revealed that implementing ICT-integrated gamification can increase students' engagement; achieve better learning outcomes; gain confidence in teaching ICT; face technical issues; struggle with ICT skills and preparation; manage student inequality and distractions; and express a need for support. To cope with the challenges encountered in implementing ICT-integrated gamification in science classes, teachers sought help, adapted strategies, improved their ICT skills, managed resources, and remained resilient. Moreover, teachers' insights include the following: ICT gamification increases student engagement; gamification tools improve retention and understanding; implementation requires preparation and planning; ICT gamification encourages teaching innovation; limited access and infrastructure hinder use; and activities align better with lesson goals. The results of this study can raise awareness among all stakeholders in the academe, who, in turn, can help design appropriate interventions and policies associated with ICT-integrated gamification.

Keywords: *Science education, ICT-integrated, gamification, junior high school teacher, phenomenological inquiry, thematic analysis, Municipality of Kapalong, Philippines*

Introduction

The integration of ICT and gamification in science classes has changed the educational landscape. This study focuses on how this innovation has put more pressure and stress on teachers. It examines the important role of teachers' attitudes and mindsets in effectively integrating these innovations, which are often overlooked. To ensure a smooth shift to the digital age, we must address these challenges. This will help make innovative teaching methods accessible and sustainable in different educational contexts.

In Indonesia, Usman et al. (2024) conducted a study, stating that teachers are not provided with sufficient information about the significant role of learning games in engaging the learning environment, supporting innovative thinking, and enhancing subject-matter comprehension, particularly in science education. Additionally, in Pakistan, Akram et al. (2022) state that the government focuses specifically on integrating ICT into science classes and learning styles to meet international standards, despite challenges such as a lack of ICT facilities, technological proficiency, and electricity and internet access for Science teachers. On the other hand, in the United Kingdom, Sánchez-Mena and Martí-Parreño (2019) explain that teachers need to assess whether the use of digital gamification as an instructional approach coincides with their targeted learning competency, academic achievements, and learner benefits in science classes.

The 2023 UNESCO Global Education Monitoring (GEM) report identified the most important problems of the Philippine education system. It raised concerns about insufficient devices and web resources in schools, as well as a lack of teacher training. The above report informed that 35 percent of schools lack proper digital infrastructure. More than 40 percent of science teachers lack training to apply ICT in teaching. These are weaknesses that pose challenges to the use of ICT in science education across school administration and programs. The teachers' experience and skills in integrating technology into their lessons affect how they use technology in teaching science (Servallos, 2023). Additionally, a study by Sabornido et al. (2022) revealed a digital gap affecting many students and schools due to limited access to necessary technology. This gap makes it hard to use learning tools, especially in areas with insufficient funding. Distractions caused by other activities commonly divert students from academic objectives. The risk of lowering standards is among the concerns, as teachers would oversimplify scientific ideas to fit gamified platforms, thereby reducing knowledge. Monserate (2023) observed that standards must be upheld when employing technology in science instruction to prevent their decline.

Locally, in the Division of Davao del Norte, science teachers are experiencing numerous challenges in integrating ICT tools and gamification practices into classrooms. According to one of the teachers, "We do not have enough access to tablets and computers, so it is hard for us to conduct the digital lessons entirely." This lack of adequate resources, combined with inexperienced and untrained teachers, worsens matters. Another teacher suggested, "Even when we do have the tools, many of us have not been well trained on how to use them effectively." While there are advantages to incorporating gamification into science education, most teachers are unsure of the best ways to use these innovations to increase students' engagement and learning outcomes. A long-time teacher commented, "While gamification is fun, with a low level of direction, it can very easily turn into another distraction."

Despite the increasing number of studies on ICT integration in teaching and learning and on the use of gamification across fields, e.g., Dela Cruz et al. (2023) on gamification in tertiary English education and Alghamdi (2020) on gamified online math practice, there remains a niche. There is no research aimed at describing teachers' experiences with ICT-integrated gamification in the science

classroom. The majority of past studies have focused on the effects of ICT and gamification on learners' motivation and achievement, such as Ghosh's (2024) study of the impacts of gamification on motivation and learning in higher education and K-12, and Lampropoulos and Sidiropoulos's (2024) study comparing virtual, traditional, and gamified learning environments. Few have deeply explored the experiences and insights of educators who implement these approaches in their teaching.

Moreover, the relevance of this study is further reinforced by the rapidly changing context of the educational setting. With the Department of Education further advancing its agenda to meet the targets of the 2030 Sustainable Development Goals (SDGs), the incorporation of ICT and innovative teaching techniques is increasingly necessary. To improve teaching and learning, particularly in Davao del Norte, it is essential to consider how teachers experience and respond to these developments. By recognizing the areas where teachers need the most support, this study seeks to improve their capacity in technology and teaching. Improved support for teachers will not only enhance teaching with ICT and gamification but also improve students' learning outcomes.

To maximize the impact of the results, this study's findings will be disseminated through workshops, conferences, and publications. In addition, partnerships with local school administrators and other stakeholders will be sought to ensure that the results of this study contribute to sustainable improvement in science education through gamification using ICTs.

Research Questions

This study answered the following questions.

1. What are the lived experiences of Junior High School teachers in implementing ICT-Integrated gamification in Science classes?
2. How does a Junior High School teacher cope with the challenges encountered in implementing ICT-Integrated gamification in Science classes?
3. What insights can the teachers draw from their experiences that can be shared to others?

Methodology

Research Design

This research employed a qualitative design to analyze junior high school educators' lived experiences and perceptions of ICT-integrated gamification in Science class. Qualitative research focuses on exploring phenomena in their natural contexts to describe how people experience and interpret their world (Aper & Corte, 2019). It focuses on collecting and interpreting non-numerical data to gain in-depth insights into participants' ideas, perceptions, and experiences (Bhandari, 2020). In this study, the qualitative approach enabled the researcher to capture the authentic voices and experiences of teacher participants, providing a holistic understanding of the phenomenon.

Phenomenology is a means that focuses on shared experiences of individuals or groups. Its main objective is to reach the very core of a phenomenon (Qutoshi, 2018). Moreover, Qutoshi (2018) said that such an approach therefore suits information gathering from a small number of individuals, where emphasis is placed on their points of view, experiences, and perspectives. Moreover, according to Creswell (2013, as cited in Gumberg Library (2022), phenomenological research identifies several perspectives of individuals about lived experience to attain valid knowledge and information as appropriate. This allows researchers to gather the most precise accounts of phenomena grounded in participants' experiences.

In this study, the phenomenological approach was used to understand the experiences, perceptions, and challenges junior high school teachers face as they use ICT-integrated gamification strategies in their Science classes. By examining their lived experiences, the study aims to uncover the essence of their struggles and perspectives, providing a comprehensive understanding of how this approach impacts their teaching practices. Data were gathered through semi-structured, one-on-one interviews with selected junior high school Science teachers. This method enabled participants to freely express their thoughts on the matter while allowing the researcher to delve deeper if needed. The interview questions included experiences with ICT tools, the use of gamification activities, problems faced, benefits, and support needed. All interviews were audio-recorded with participants' consent to ensure the data gathered was accurate and complete. Field notes were also recorded to capture non-verbal observations and information that aided in understanding. The study used thematic phenomenological analysis. Initially, the audio recordings were transcribed verbatim. The researcher read the texts several times to become conversant with the topic. Statements that explained teachers' experiences were identified and coded. Finally, the codes were grouped into themes that symbolized the meaning of the participants' lived experiences. The themes were further synthesized to provide a clear description of teachers' experiences with ICT-enabled gamification tools. During the study, bracketing was used to avoid the researcher's biases in understanding.

Participants

This qualitative inquiry involved 12 junior high school teachers from the Division of Davao del Norte, with data collection limited to 7 for focus group discussions and 5 for in-depth interviews. The study adhered to Creswell's (2013) concept, which suggests that 3-15 participants are sufficient for conducting a qualitative inquiry, providing the basis for the sample size. Both in-depth interviews and focus group discussions were held in person.

Participants for this study were selected using purposive sampling. This method involved choosing participants who met specific criteria that the researcher had meticulously examined and confirmed with panelists (Crossman, 2020).

The researcher chose and identified participants according to these criteria: (a) a junior high school teacher of the Division of Davao del Norte for a minimum of 3 years; (b) have taught Science subjects from 2024 to 2025; (c) have applied ICT-Integrated gamification in Science class for a minimum of 2 years; and (d) endorsed by the school head or school principal.

Additionally, the researcher ensured that the participants came from diverse backgrounds in terms of gender, age, and school size. The screening procedure for the participants was conducted to ensure that each one of them had the required qualifications they fulfilled the criteria for inclusion.

Procedure

Several systematic procedures were implemented to ensure ethical, organized, and high-quality data collection. Prior to data gathering, formal permission was secured from the Research Ethics Committee of St. Mary's College of Tagum, Inc., followed by institutional endorsement from the Dean and approval from the Schools Division Superintendent. Subsequent permission was obtained from the School Heads of the participating schools, who also served as gatekeepers in facilitating access to prospective respondents. In line with ethical research standards, informed consent was obtained from all participants through an Informed Consent Form (ICF) and an orientation session that clearly explained the purpose of the study, participants' roles, rights, and the voluntary nature of participation. Participants were assured of privacy and confidentiality, provided with a Data Privacy Notice for Research Participants, and informed of the measures for data protection, storage, and disposal.

Data were collected using qualitative methods, specifically in-depth interviews (IDIs) and focus group discussions (FGDs), guided by a carefully developed interview protocol grounded in relevant literature and aligned with the research objectives. The interview guides were reviewed and refined with recommendations from panelists to ensure clarity, relevance, and neutrality. IDIs were conducted one-on-one in a conducive, confidential environment, scheduled at the participants' convenience. They followed a semi-structured approach based on Wengraf's model, allowing flexibility while maintaining focus. FGDs were likewise conducted face-to-face, moderated by the researcher using inclusive strategies such as the round-robin method to ensure equal participation, while allowing spontaneous interaction and follow-up probing to elicit deeper insights into participants' experiences and perceptions.

All interviews and discussions were audio-recorded with the participants' consent and supplemented by note-taking to capture key points. The recordings were transcribed verbatim, and all data were securely stored in password-protected electronic files and locked storage for hard copies. Data handling strictly followed ethical and institutional guidelines, with plans for proper retention and disposal after the required period. Thematic analysis was employed to identify patterns and emerging themes from the data, ensuring systematic interpretation. To enhance credibility and trustworthiness, member checking was conducted by allowing participants to review the interpretations of their responses. At the same time, peer debriefing was used to validate the coding process and ensure that the findings were grounded in the data.

Data Analysis

Thematic analysis forms the core of qualitative analysis, which seeks to identify, organize, and interpret patterns that reflect the essence of teachers' lived experiences. In systematic steps in qualitative data analysis that facilitate intensive exploration, Creswell and Poth (2019) identify organizing data, reading and note-taking, describing, coding, interpreting, and presenting data.

Data analysis for this research was informed by some key processes within Creswell's thematic analysis. Firstly, coding becomes a key process of data grouping and clustering. Saldaña (2016) characterizes coding as a process of creating labels or tags that allow one to categorize qualitative data into meaningful categories. Transcripts were reviewed meticulously in a critical context, and codes were applied to tag chunks summarizing recurring themes, patterns, or concepts to enable systematic exploration.

Subsequently, thematic analysis searched, looked, and observed for themes or patterns in data, as clarified by Braun and Clarke (2019). Coded data are carefully reviewed to identify broad themes that capture the study's overall findings. Thematic analysis yields a greater understanding by exposing similarities and differences in the data.

Once the theme has been determined, the process of developing core ideas follows. This entails merging findings on the meaning of each theme by combining information from the codes, as Miles, Huberman, and Saldaña (2019) argued. Core ideas are subsequently central to developing a comprehensible story that provides answers to research questions.

Lastly, the main ideas must be clustered into general themes. Merriam and Tisdell (2020) noted that clustering ensures complete representation of the dominant themes in the gathered information, allowing for the development of a systematic outline for a study's findings report.

To improve the rigor and validity of the study, the data were returned repeatedly, peer debriefing was used to assess the validity of the coding procedures, and member checking was used to ensure the accuracy of the themes developed.

Ethical Considerations

This study placed paramount importance on ethical considerations, recognizing that human participants are at the core of the research process. Guided by the ten dimensions of ethical research—namely, social value, informed consent, participant vulnerability, risk–benefit assessment, privacy and confidentiality, justice, transparency, researcher qualification, adequacy of facilities, and community involvement—the researcher ensured that all procedures adhered to established ethical standards, particularly given the in-depth and qualitative nature of the study.

The research was designed to generate meaningful social value by contributing to the literature on teachers' experiences with ICT-integrated gamification in science education, with the potential to inform evidence-based policies, enhance teaching practices, improve learning outcomes, and support digital inclusion. Proper authorization was secured from the Department of Education–Davao del Norte and school heads, and the study was conducted with adequate facilities, resources, and institutional clearances to ensure safe and effective implementation.

Informed consent was obtained through participant orientation, during which the purpose, process, and ethical safeguards of the study were clearly explained, emphasizing voluntary participation and the right to withdraw at any time. Special care was taken to protect participants' well-being by ensuring that interview questions were non-intrusive, validated by experts, and administered in a respectful environment that prioritized comfort and safety. Confidentiality was maintained. Anonymity was strictly maintained in compliance with the Data Privacy Act of 2012, with all data securely stored and used solely for research purposes.

Justice and transparency were upheld through fair participant selection, equitable treatment, and open communication of findings to stakeholders, including DepEd–Davao del Norte. Supported by appropriate research training, expert supervision, and active community engagement, the study upheld ethical integrity, valued participants' contributions, fostered trust, and promoted shared ownership of knowledge for the benefit of the wider educational community.

Results

Experiences of Junior High School Science Teachers in Implementing ICT-Integrated Gamification

After a thorough analysis of the participants' responses regarding their experiences in implementing ICT-integrated gamification in science classes, seven major themes emerged: (1) observed increased students engagement, (2) achieved better learning outcomes, (3) gained confidence in teaching with ICT, (4) faced technical issues, (5) struggled with ICT skills and preparation, (6) managed student inequality and distractions, and (7) expressed need for support.

Table 1 shows the different experiences of junior high school science teachers in the implemented ICT-integrated gamification.

Table 1. *Different Experiences of Junior High School Science Teachers in the Implemented ICT-Integrated Gamification*

Major Themes	Core Ideas
Observed Increased Student Engagement	• noted active participation and excitement • encouraged quiet learners to join activities • fostered teamwork during group games
Achieved Better Learning Outcomes	• achieving learning objectives easier • developed students' critical thinking • clarified complex concepts via visuals • improved digital literacy skills
Gained Confidence in Teaching with ICT	• validated content through gamified tasks • focused lesson planning with ICT tools • reduced instructional anxiety with structure
Faced Technical Issues	• encountered unstable power and Internet • faced frequent device malfunctions • lacked sufficient tools and gadgets
Struggled with ICT Skills and Preparation	• reverted to traditional methods due to tech gaps • struggled with device troubleshooting • needed training for gamification design • handled diverse digital literacy levels
Managed Student Inequality and Distractions	• managed limited gadget access among students • discouraged students' off-task behavior • faced cultural alignment challenges
Expressed Need for Support	• requested better infrastructure and tools • advocated student tech training • hoped for institutional support in ICT integration

Observed Increased Student Engagement

This enhancement was also witnessed in the active participation of the students during group activities, when team work and peer-to-peer interaction developed. Teachers also reported that inclusion of strategy in game play in science classes not only makes the students interested but also encouraged students to participate actively. Factors such increased active participation, increased excitement, and inclusion of introvert students, and heightened cooperation in group games can be seen in the response of the participants.

P1 said that:

"One of my positive experience no is gamification is an interactive strategy, makita nimo nga active kaayu sila mahg participate sa klase."

(One of my positive experiences with gamification is that it is an interactive strategy. You can see that the students are very active in participating in class.)

In connection, IDI-1 stated that:

"My positive experience sa pag implement sa ict integrated gamification is mas interactive ang pag deliver sa klase and mas naga participate ang bata nga maminaw because they feel belong in the class discussion."

(My positive experience in implementing ICT-integrated gamification is that the lesson delivery becomes more interactive, and the students actively participate and listen attentively because they feel a sense of belongingness in the class discussion.)

IDI-5 also shared a similar experience by saying:

"Makita nimo nga ganahan sila motungha sa klase kay interactive ug lingaw ang activities. Example, kung mag-quiz bowl ko gamit ang apps like Kahoot or Quizizz, excited kaayo sila mo-apil. Naa pud times nga ang mga quiet students kay motry gyud ug apil tungod sa games. Nagdevelop pud ang ilang teamwork kay magtinabangay sila especially sa group challenges."

(You can see that they are eager to attend class because the activities are interactive and fun. For example, when I hold a quiz bowl using apps like Kahoot or Quizizz, they get very excited to join. There are also times when even the quiet students try to participate because of the games. Their teamwork also improves because they help each other, especially during group challenges.)

IDI-4 supported the claims in which she stated:

"Mas na-engage ang mga bata, labi na kung adunay group activities kay nagtinabangay sila sa pagsabot sa mga tasks."

(The students became more engaged, especially when there were group activities because they helped each other understand the tasks.)

Also, IDI-3 stated:

"It also fostered teamwork and friendly competition among the learners. They helped each other understand the tasks labi na ug group activities aron mas mapadali ilang task."

(It also fostered teamwork and friendly competition among the learners. They helped each other understand the tasks, especially during group activities, which made completing their tasks faster.)

The use of gamified strategies empowered students to take charge of their learning in an enjoyable and meaningful way. By making science lessons fun and relatable, gamification brought more participation and enhanced comprehension.

Achieved Better Learning Outcomes

In addition to enhancing student engagement, ICT-integrated gamification has also contributed significantly to improved learning outcomes. Although ICT-integrated gamification is primarily used to promote enjoyment and engagement in class discussions it is equally important to recognize its role in achieving essential learning outcomes of our lessons and by the use of ICT-Integrated gamification teachers met learning objective efficiently, strengthen students' critical thinking, clarified complex concepts via visuals, and improved digital literacy skills. These outcomes were consistently reflected in the participants' responses, underscoring the instructional value of gamified approaches.

As P2 stated:

"mas dali makuha ang objectives ana kay nay ICT integration."

(It makes achieving learning objectives easier because of the support provided by technology.

Also, P7 had a similar experience as he stated:

"This would be very helpful for the teachers in order for them to achieve and at the same time give specific lesson objective."

(It enables them to effectively achieve and deliver specific lesson objectives.)

Also, P3 answered:

"Sa positive experiences in implementing ICT integrated gamification in science classes is ah base from my experience kanang mas creative siya, mas makahatag sya sa students og kanang more challenging and critical thinking."

(One of the positive experiences in implementing ICT-integrated gamification in science classes, based on my experience, is that it is more creative and provide students with more challenging tasks that develop critical thinking.)

Moreover, IDI-2 supported the claim by saying:

"Nakita nako nga na-e-enjoy nila ang lesson, at the same time, nade-develop pa gyud ilang digital literacy, critical thinking, ug problem-solving skills samtang nag-navigate sila sa mga gamified activities."

(They enjoyed my lesson as well as they develop their digital literacy, critical thinking and problem-solving skills while navigating gamified activities.)

Also, IDI-3 answered:

"It really help to understand complex concepts more easily when presented as a challenge or a game. It made learning more enjoyable where learners respond well to interactive and visual methods."

(It really helps to understand complex concepts more easily when presented as a challenge or a game. It made learning more enjoyable where learners respond well to interactive and visual methods.)

In connection, IDI-2 stated that:

"Nakita nako nga na-e-enjoy nila ang lesson, at the same time, nade-develop pa gyud ilang digital literacy, critical thinking, ug problem-solving skills samtang nag-navigate sila sa mga gamified activities."

(They enjoyed my lesson as well as they develop their digital literacy, critical thinking and problem-solving skills while navigating gamified activities.)

After analysis of the transcription, it was revealed that ICT-integrated gamification has transformative potential. Participants emphasized how this approach not only facilitates the more effective achievement of learning objectives but also enriches classroom experiences by promoting creativity, critical thinking, and problem solving.

Gained Confidence in Teaching with ICT

Utilizing ICT-Integrated gamification empowers teachers to teach more effectively by providing access to validated content through gamified tasks, focused planning with ICT tools, and reduced instructional anxiety with structure. These factors are evident in the responses of the participants.

As P4 shared:

"As teacher mabawasan imong fear of kanang tama ba ni akong gitudlo, nisubay bako."

(As a teacher, it reduces my fear of whether I am teaching correctly or following the curriculum properly.)

Also, IDI-2 answered:

"As a teacher, kinahanglan pud ug time ug effort sa pagplano ug pag-design sa quality ug meaningful nga gamified activities.

(As a teacher, it also takes time to plan and also effort in designing quality and meaningful gamified activities.)

P6 supported the claims in which she stated:

"during my first demo.. demonstration teaching I experience that my.. I don't know how to connect the tv and my laptop for duplicating so my.. na stress ko ato nga time nanawag kog ICT kay di gyud nku sya ma hibalan so atleast naa koy learning ato , kabalo nku mao tong experience pud ni ma'am Joy gitudloan poud nku sya unsaon pag connect

(I also encountered challenges during my first demonstration teaching. I didn't know how to connect the TV to my laptop for screen duplication, which stressed me out. I had to call the ICT coordinator for help. At least, through that experience, I learned how to do it, and I was later able to teach Ma'am Joy how to connect it as well.)

The integration of ICT-based gamification not only enhances the teaching process but also equips teachers with practical tools and structured strategies that ease instructional delivery.

Faced Technical Issues

Technical issues are one of the downside of utilizing ICT-integrated gamification. Teachers often encounter challenges such as unstable power and internet, frequent device malfunctions, insufficient tools and gadgets, and experienced delays implementation. These factors

are evident in the responses of the participants.

As P1 stated:

"I think isa sa mga negative experiences I encountered is wla nku na tanaw o na foresee daan nga di diay sya mo effect kung wla syay internet connection which is dili sya applicable pag abot sa akong lesson."

(I think one of the negative experiences I encountered was that I failed to foresee that the tool would not work without an internet connection, making it inapplicable to my lesson.)

Also, IDI-2 had a similar experience as she stated:

"The negative experiences in implementing ICT-integrated gamification in my class, especially kay na-assign ko sa sitio, kay dili stable ang internet connection."

(The negative experiences in implementing ICT-integration gamification in my class especially I was assigned in sitio, the internet connection is not stable.)

Also, P2 answered:

"Another negative experiences, so far sa akong pagtudlo sa science sa highschool is kuan, kining madaut ang laptop, madaut and nga gamit di gyud ma hit ang imong objectives once nay mga kakulian na mga ingon ana."

(Another negative experience I've had so far in teaching Science in high school is when my laptop or other devices break down. When issues like these arise, achieving my lesson objectives becomes difficult.)

Moreover, IDI-5 supported the claim by saying:

"Negative side gyud kay ang access sa technology. Dili tanan estudyante naa'y gadgets or stable internet connection."

(The negative side is really the access to technology. Not all students have gadgets or a stable internet connection.)

P5 also shared:

"Para sa akoa ang na encounter nku is mostly man gud ang mga estudyante dli sila kuan sa internet. Wala gani connection sa internet unya ang uban wala pud silay gadgets."

(For me, the challenge I encountered is that many students do not have access to the internet. Some don't even have an internet connection at home and others lack gadgets)

IDI-3 experienced:

"It is the limited access to technology. We only had a few working tablets for a large class, so it was difficult to ensure everyone could participate equally in the digital games or activities."

(The limited access to technology is a big issue. We only had a few working tablets for a large class, so it was difficult to ensure that everyone could participate equally in the digital games or activities.)

And IDI-4 answered:

"Ang Isa sa mga negatibong experience kay ang kakulang sa technology, kay dili tanan estudyante nay access sa gadgets ug stable nga internet. Usahay ang uban maglisod og apil sa online activities tungod kay ang mga devices limited ra. Ang laing challenge kay ang distraction, labi na kung ang internet connection dili stable, usahay magka-problema mi sa pagpadayon sa mga online activities."

(One of the negative experiences was the lack of technology, since not all students have access to gadgets and stable internet. Sometimes, some of them struggled to join the online activities because the available devices were limited. Another challenge was distraction, especially when the internet connection was unstable, and at times we had problems continuing the online activities.)

Teachers experienced these occurrences as they implemented ICT-integrated gamification in their classes and these affect the students' learning.

Struggles with ICT Skills and Preparation

ICT skills and preparation are vital to the successful implementation of ICT-integrated gamification, particularly in ensuring smooth, engaging, and well-organized activities. However, it is undeniable that teachers occasionally encounter challenges that prompt teachers to revert to traditional teaching methods. These challenges include technical gaps, struggles with device troubleshooting, and a need for training in gamification design. These hinder the seamless integration of ICT tools in the classroom. These are clearly evident in the statements participants shared.

As mentioned by P3:

"kay isa sa akong mga na face nga challenges kay kanang since kuan mn sya usahay ma tapol nlng gni ka kay lisod kanang di kaayu ko maayu sa technology so mubalik nlng sa traditional dli nlng magbuhat at okay tungod wla mn kaayu kay learning unya kapoyan naka si pangutana sa uban makasamok sab ka sa ilaha."

(One of the challenges I face is that sometimes I feel discouraged because it's difficult and I am not that good in technology. So, I end up going back to traditional teaching methods instead of creating ICT-integrated lessons. This happens because I lack the knowledge, and I feel hesitant to keep asking others for help, as I don't want to bother them.)

P2 also shared:

"once madaut ang gamit sa teacher or sa bata roubleshoting dli na kabalo unsaon pag ayu. Need pa gyud og kaalam sa teacher sa ICT or sa mga gadgets kung unsa sya pag ana"

(One challenge is when a teacher's or student's device gets damaged. Many struggle how to troubleshoot or repair them. Teachers need ICT knowledge or technical skills to address these issues.)

And P3 experienced:

"base sa akong na ingon gnina na mga negative experiences kdtong I need mo trainings kay isa sa akong mga na face nga challenges kay kanang since kuan mn sya usahay ma tapol nlng gni ka kay lisod"

(as I mentioned earlier, I need more training. One of the challenges I face is that sometimes I feel discouraged because it's difficult.)

The effectiveness of ICT-integrated gamification relies on the continuous development of teachers' digital knowledge and access to appropriate training.

Manage Student Inequality and Distractions

Managing students' inequality and distraction is vital parts in the implementation of ICT-integrated gamification. While teachers consistently strive to provide the best possible learning experiences, it is undeniable that various challenges arise within the classroom environment. Here are some of the factors, handled diverse digital literacy levels, managed limited gadget access among students, discouraged students' off-task behavior, and faced cultural alignment challenges. These were evident to the partcipants' responses.

IDI-3 said that:

"Syempre tung mga bata nga aresgadahon mag una2 jud ug gamit while ang uban kung di paguniton sa kauban okay nalang pud sa iya tan-aw2 nalang"

(Of course, the more aggressive kids would grab the devices first, while others, if not given a device by their classmates, would just watch.)

In connection, IDI-5 stated that:

"kalainan sa digital literacy sa mga estudyante. Naa'y uban tech-savvy, kabalo na kaayo, pero naa pud uban nga lisod pa kaayo ug navigate sa apps. So, kinahanglan pa nako mag-provide ug extra guidance para sa uban."

(I also encounter diverse students' digital literacy. Some are already tech-savvy and know how to navigate everything, but others really struggle with using the apps. So, I need to provide extra guidance for them.)

IDI-4 also shared an experience by saying:

"Isa pa sa mga challenge nga akong na-encounter kay ang limited sa access sa technology sa mga estudyante."

(Another challenge I encountered was the limited access to technology among the students.)

Also, IDI-1 answered:

"Students distraction and behavior issues naa juy uban students when using ict ma distract sila by using other apps, websites or chatting with peers."

(There are also issues with student distraction and behavior. Some students, when using ICT, get distracted by other apps, websites, or by chatting with their peers.)

IDI-3 supported the claims in which she stated:

"Another challenge is adapting the games to be culturally align and engaging for our indigenous learners that requires careful consideration."

(Another challenge is adapting the games to be culturally align and engaging for our indigenous learners, which requires careful consideration.)

Analysis of the transcriptions revealed that these factors make the teaching process more difficult and require thoughtful strategies and flexibility.

Express Need for Support

The successful implementation of ICT-integrated gamification is not solely dependent on teacher expertise and student engagement; it also centers on the availability of an appropriate support system. Throughout participants' responses, requests for better infrastructure and tools, advocating for students' technical training, and hope for institutional support in ICT integration were echoed.

As P6 stated:

"no gadget from the deped provided to the teachers and pupils mao nga lisud ang pag implement fully sa strategy. We really need better tools and infrastructure to support digital learning."

(There are no gadgets provided by the Department of Education for both teachers and pupils, which makes it difficult to fully implement ICT-integrated strategies. We really need better tools and infrastructure to support digital learning.)

Also, IDI-2 had a similar experience as she shared:

"One of the negative experience jud sa pag implement aning ict integrated gamification is device limitation not all students have access sa mga reliable devices"

(One of the negative experiences in implementing ICT-integrated gamification is device limitations not all students have access to reliable devices.)

Also, P7 answered:

"and to teach also our students on how to ahmm use the specific technology most specifically sa laptops no laptops, computers and cellphones."

(To teach our students how to use technology properly especially laptops, computers, and mobile phones.)

Moreover, IDI-5 supported the claim by saying:

"Nanghinaut mi nga mahatagan og suporta sa gobyerno more spicifically sa DepEd nga mag provide sila og reliable ug lig-on jud nga mga gamit ug resources para ma implement og maayu ang ICT integration."

(We are hoping for support from the government, specifically from the Department of Education to provide reliable and durable equipment and resources so that ICT integration can be properly implemented.)

The expressed need for support among educators underscores the critical role of systematic support in ICT integration. Without appropriate infrastructure, student training, and technical and pedagogical support the potential of ICT-integrated gamification may remain underutilized.

Junior High School Teachers Coping with the Challenges Encountered in Implementing ICT-Integrated Gamification in Science Classes

During the interview, the participants mentioned coping mechanisms for the challenges in implementing ICT-integrated gamification in science class. Based on their responses, the six major themes emerged: (1) seeking help, (2) adapting strategies, (3) improving ICT skills, (4) managing resources, (5) designing better lessons, and (6) staying resilient.

Table 2 presents the major themes and core ideas regarding junior high school teachers' coping with the challenges encountered in implementing ICT-integrated gamification in science class.

Table 2. *Major Themes and Core Ideas on Junior High School Teachers Coping with the Challenges Encountered in Implementing ICT-Integrated Gamification in Science Classes*

Major Themes	Core Ideas
Seeking Help	• asking co-teachers and ICT coordinators for assistance • collaborating on gamified tasks and tools • consulting master teachers for strategies • seeking peer advice
Adapting Strategies	• using groupings and peer tutoring • printing offline worksheets and downloading in advance • integrating local materials and indigenous games • modifying games for offline use
Improving ICT Skills	• attending training and workshops • learning through hands-on practice • outsourcing tools independently

Managing Resources	• researching new platforms and gamification strategies • sharing devices among groups • assigning tech-savvy students to assist peers • downloading content for offline use • using applications to block distractions
Designing Better Lessons	• using curriculum guides • adding reflection prompts to track learning • varying platforms to keep learners engaged
Staying Resilient	• praying for power and internet • persisting despite outages and limitations • remaining adaptable and goal-focused • downloading content in advance

Seeking Help

Seeking support has been a great help to teachers in solving many different problems. This holds in the context of implementing ICT-integrated gamification in a junior high school classroom. By seeking assistance, teachers identified practical solutions to emerging issues and enhanced the effectiveness of ICT-integrated gamification. These are asking co-teachers and ICT coordinator for assistance, collaborating on gamified tasks and tools, consulting master teachers for strategies, and seeking peer advice. These practices were consistently reflected in their responses during the interviews.

As P3 stated:

"akong gibuhat is ask assistance to your colleagues nga mas naka balo pa about ICT integration."

(What I did was seek assistance from my colleagues who were more knowledgeable about ICT integration.)

In connection, IDI-2 also said:

"mangayo gyud ka ug tabang ug mangutana pa ug dugang ideas sa imong mga co-teachers."

(And most importantly, seek assistance and ask for more ideas to my co-teachers.)

Also, P1 added:

"Yes always kay approachable mn pud among ICT and then naa pud koy mga kaubn nga mag take gyud silag time para mo tudlo."

(Yes, Our ICT team is very approachable, and I also have colleagues who are willing to take the time to teach me.)

P3 supported tha claim when she said:

"Yes nag seek kog assistance sa akong colleagues sa ating ICT coordinator kay I know knowledgeable jud sya ana nga part."

(I seek assistance from my colleagues and our ICT coordinator because I know they are very knowledgeable in this area.)

Furthermore, P6 added:

"I ask for assistance for my ahh from the ICT coordinator even though ahh dugay nako sa service but honestly speaking I am not knowledgeable enough for ICT integration."

(I ask for assistance from the ICT coordinator even though I've been in the service for a long time. Honestly, I'm not that knowledgeable about ICT integration.)

As mentioned by IDI-2:

"Yes, naga-ask ko sa akong mga kauban about sa ilang ideas ug uban pa nga strategies ug activities sa paggamit sa ICT-integration gamification, ug makatabang gyud siya. Ang pagtinabangay mas nakapadali jud para ma-align namo ang mga games sa among curriculum standards. Gidivide namo ang mga topics, naghimo mi ug mga gamified quizzes or tasks, ug gi review namo ang mga trabaho para masiguro nga sakto ug epektibo."

(Yes, I ask my colleagues about their ideas and other strategies and activities in using ICT-integration gamification and it was helpful. Collaborating made it easier to align games with our curriculum standards. We divided topics, developed gamified quizzes or tasks, and reviewed each other's work to ensure accuracy and effectiveness.)

P7 added:

"for me is that Yes it's a big yes yes yes because ahmm I ask consulation and at the same time I ask advices through my colleagues most specifically those masters teachers if they could give specific strategies for me to be use inside the classroom."

(it's a big YES! I always seek consultation and advice from my colleagues, especially master teachers, if they can suggest specific

strategies I can use in the classroom.)

Lastly, P5 shared:

"Yes, naga seek gyud kog advice kay usahay man pud maglisod man gyud ta dili man nato mamaster ang tanan aspects sa pagtudlo pero naa man tay mga colleagues nga pwede nato maduolan kay usahay sila pud naa silay mastery ana nga field so pwede ta makaduol sa ilaha."

(Yes, I really seek advice because sometimes we face challenges and we can't master all aspects of teaching. Bue we have colleagues we can approach, as some of them have expertise in certain areas, so we can ask for their help.)

Thus, seeking assistance from co-teachers and ICT coordinators is an effective strategy for teachers to address challenges encountered in implementing ICT-integrated gamification in science classes.

Adapting Strategies

Adapting strategies helps in effectively implementing ICT-integrated gamification in science class. This is why the participants provide a variety of strategies used in their classes, such as grouping and peer tutoring, printing offline worksheets and downloading them in advance, integrating local materials and indigenous games, and modifying games for offline use.

As mentioned by P7:

"I let my students ahhh have their groupings, Mag groupings ko in order for them to use my own laptop, computer in order for them to experience first-hand how to manipulate a specific technology most specifically in using such strategy in teaching."

(I implemented a strategy where I let my students work in groups. I grouped them so they could use my laptop or computer, allowing them to experience firsthand how to manipulate a specific technology, especially when applying certain teaching strategies.)

IDI-5 added:

"Instead nga per student, per group ang gadget or tablet para maka-apil gihapon tanan. Ako pud gi-assign ang mga students nga tech-savvy para tabangan ang ilang grupo."

(What I did was use groupings. Instead of one gadget per student, I assign one gadget or tablet per group so that everyone can still participate. I also assign the tech-savvy students to help their group.)

Furthermore, IDI-3 also said:

"To address the different level of learners in terms sa paggamit sa gadget I use peer tutoring where those learners who are tech-savvy help their classmates during free time."

(To address the different levels of learners in terms of gadget usage, I use peer tutoring where those learners who are tech-savvy help their classmates during free time.)

IDI-4 mentioned:

"Ang challenge nga akong na-mention kay ang kakulang sa gadgets ug internet connection. Ang akong gibuhat aron masulbad ni mao ang paggamit og offline gamified activities.Mag-download sad ko sa mga resources kung available ug stable ang internet connection para magamit namo sa klase."

(The challenge I mentioned was the lack of gadgets and internet connection. What I did to address this was to use offline gamified activities. I also downloaded resources whenever there was a stable internet connection so we could use them in class.)

IDI-5 also added:

"Kung wala gyud available nga gadget, mag-print ko ug offline gamified worksheets para interactive gihapon"

(If there's really no available gadget, I print offline gamified worksheets so that the lesson is still interactive.)

Moreover, IDI-3 shared:

"I tried to integrate local materials and indigenous games into my lessons aron mas mahimong relevant ug engaging ang learning, labi na kung limitado ang technology."

(I tried to integrate local materials and indigenous games into my lessons to make learning more relevant and engaging, especially when technology is limited.)

Also, P7 stated:

"I could say its outsourcing and at the same time look for a specific game base activities nga dili sya online specially sa atoa nga walay stable nga internet connection look for a ahmm dli online nga mga activities, game-base activities so that those specific ahh lesson is

ma hit nmu sya with the different strategies and different game na pwede nmu magamit inside your classroom."

(For me, it's about outsourcing and, at the same time, finding specific game-based activities that don't require an internet connection. Since we don't always have a stable internet connection, I look for offline game-based activities. This way, I can still effectively teach my lessons using different strategies and interactive games inside the classroom.)

Lastly, IDI-4 shared:

"Nag-assign pud ko og mga tasks nga pwede ra magamit sa classroom mismo, dili magkinahanglan og internet connection, para ma-engage gihapon sila sa lesson bisan pa sa mga technical limitations."

(I also assigned tasks that could be done inside the classroom itself without needing an internet connection, so they would still be engaged in the lesson despite the technical limitations.)

These responses highlight the importance of adapting strategies that can help implement ICT-integrated gamification in science classes.

Improving ICT Skills

ICT skills are vital in the efficacy of implementing ICT-integrated gamification. Thus, teachers do their best to improve their ICT skill through attending training and workshops, learning through hands-on practice, and outsourcing tools independently. This is apparent in the responses of the participants on how they improve their ICT skills.

As stated by P5:

"Okay as I mentioned earlier most of ah problema gyud no kay kanang troubleshooting so naghun-huna ko og ways para ma cope up ni nga kuan. Ang akong nakita is mu apil og mga trainings ug mga support kanang naa man tay mga kanang usahay naa may gahatag og mga libre nga trainings for para aning troubleshooting para sa atong ICT unya naa pud tay mga pwede ma apilan nga medyo barato lang para makatabang pud sa atoa kung unsa atong pwede buhaton in everyday nga mugamit ta sa atong mga laptops."

(As I mentioned earlier, one of the major problems is troubleshooting. So, I thought of ways to cope with this challenge. What I did was attend training sessions and seek support. Sometimes, there are free training programs available for troubleshooting ICT-related issues, and there are also affordable ones that can help us learn how to handle everyday problems when using our laptops.)

P6 also shared:

":For me as I mentioned a while ago so, my challenges I mentioned how I cope up or address. So, I myself I challenge myself to learn, learning by doing on how to unsa ni manipulate the ICT inorder that I know."

(For me, as I mentioned earlier, regarding my challenges and how I addressed them, I challenged myself to learn. I engaged in hands-on learning to understand how to manipulate ICT tools so that I could use them effectively.)

Furthermore, P1 supports this notion in her statement:

"I think nag outsource. Outsourcing and research lang pud for new mas enticing pud nga mga games."

(I outsourced. It's just outsourcing and research for new and more exciting games.)

IDI-1 share:

"researched varied ict integrated gamification platforms para dili ma bored."

(researched varied ICT-integrated gamification platforms to avoid boredom.)

P2 also shared:

"mangitag lain way.. other platforms nga mas maka learn ka sa ICT integration."

(find alternative ways or other platforms that can help me learn more about ICT integrated gamification.)

And IDI-2 stated that:

"Nangita pud ko ug platform nga pinakamaayo gamiton para sa lesson"

(I searched for a platform that will best fit your lesson.)

Thus, improving ICT skills is an important strategy that teachers use to effectively implement ICT-integrated gamification in their science class.

Managing Resources

Effective resource management is vital to the successful implementation of ICT-integrated gamification in science classes. In their commitment to delivering quality education, teachers continually seek and employ diverse strategies and resources to provide

meaningful, engaging learning experiences for their students. Sharing devices among groups, assigning tech-savvy studentd to assist peers, and downloading content for offline use are the strategies used by the teachers to manage their resources in implementing ICT-integrated gamification in their classes. This is base on their responses during the interview.

P7 said that:

"I let my students ahhh have their groupings, Mag groupings ko in order for them to share my own laptop, computer in order for them to experience first-hand how to manipulate a specific technology."

(I implemented a strategy where I let my students work in groups. I grouped them so they could share my laptop or computer, allowing them to experience firsthand how to manipulate a specific technology.)

In connection, IDI-5 stated that:

"Instead nga per student, per group ang gadget or tablet para maka-apil gihapon tanan."

(What I did was use groupings. Instead of one gadget per student, I assign one gadget or tablet per group so that everyone can still participate.)

IDI-4 also shared a similar experience by saying:

"Lain pa nga strategy nga akong gibuhat mao ang paggamit og peer tutoring. Ang mga estudyante nga mas tech-savvy mao ang mo assist sa ilang mga classmates nga naglisod sa paggamit sa gadgets."

(Another strategy I used was peer tutoring. The students who were more tech-savvy assist their classmates who were struggling with using gadgets.)

IDI-4 supported the claims in which she stated:

"Nag-assign pud ko og mga tasks nga pwede ra magamit sa classroom mismo, dili magkinahanglan og internet connection, para ma-engage gihapon sila sa lesson bisan pa sa mga technical limitations."

(I also assigned tasks that could be done inside the classroom itself without needing an internet connection, so they would still be engaged in the lesson despite the technical limitations.)

Moreover, IDI-5 stated:

"ako pud gi-advance download ang mga materials for offline use para ready na during klase."

(I also pre-download materials for offline use, so everything is ready during class.)

IDI-1 shared:

"Using of application na ma block ang unnecessary apps na pwede maka distract sa mga students."

(use applications that can block unnecessary apps that might distract the students.)

Analysis of the transcription revealed that resource management helped implement ICT-integrated gamification in science class.

Designing Better Lessons

Designing lessons that are responsive to learners' needs is essential in the effective implementation of ICT-integrated gamification. This is done with using curriculum guides, adding reflection prompts to track learning, and varying platforms to keep learners engaged. These were evident in participants' responses during the interview.

As IDI-2 shared:

"Aron maka-cope anang challenge, nagkinahanglan gyud siya ug strategic planning ug creative adaptation. Ang isa ka teacher kinahanglan kabalo sa specific outcome sa lesson; paggamit sa curriculum guides nakatabang gyud nako sa pag-design sa gamified content."

(Coping with that challenges I involve strategic planning and creative adaptation. A teacher must know the specific outcome of the lesson, using the curriculum guides also helped me in designing gamified content.)

Also, IDI-4 added:

"The other strategies I used para maka-cope sa mga challenges nga akong na-experience sa pag-implement sa ICT-integration gamification kay ang pag-track sa learning progress. Para mabuhat na, sa akong mga gamified activities, nagbutang ko ug reflection prompts."

(The other strategies I used in order to cope with the challenges I had experienced in implementing ICT-integration gamification is to

track the learning progress. In order to do that in my gamified activities I added reflection prompts.)

Lastly, IDI-1 supported the claims by saying:

"Asking different platform and new trends na pwede nimo magamit so that engaging gihapon ang klase."

(I ask about different platforms and new trends that I can use in my classes to keep learners engaged.)

Participants' experiences emphasize that meaningful lesson design is essential to the successful implementation of ICT-integrated gamification.

Staying Resilient

In the evolving landscape of education and technology, challenges such as unstable internet connections and power interruptions are inevitable. However, amidst these difficulties teachers demonstrate determination and resilience. Praying for power and internet, persisting despite outages and limitations, and remaining adaptable and goal-focused emerged as themes from the interviews.

As mentioned by P2:

"For me, sa akong experiences is kuan pag naa koy mga ICT integration sa akong klase akong ginahimo gyud first of all is mag pray nalang gyud. Ampo gyud ka nga dili mo brownout mag cooperate si Daneco. Nga dili gyud sya mo broiwnout dri kay once mu brownout mapalpak tanan nimong trabaho."

(Based on my experience, whenever I integrate ICT into my classes, the first thing I do is pray. I really pray that there won't be a power outage and that Daneco (the electricity provider) will cooperate. If there's a power outage, all my work goes to waste.)

P4 also said that:

"Other strategies mapgprepare ka for ICT na kanang nga pwede onhand nga pwede isa ka laptop ang magamit and then mag prepare pud og kanang pwede na strat. nga magamit even isa lng ang laptop nga gamiton by groupings or through bitaymas or ither strategy pwede gihapon makuha or ma apply gihapon nmu ang ICT."

(Another strategy, aside from what I mentioned earlier, is thorough preparation by the teacher. When it comes to ICT, you need to prepare resources that can be used hands-on, like a laptop. You also have to prepare strategies that allow ICT integration even if there's only one laptop available—such as group work or other techniques that still enable ICT use effectively.)

IDI-3 also shared:

"We often share ideas and resources with my colleagues, especially those who have also tried integrating technology in their classes. It's helpful to learn from their experiences and find solutions together. And base sa akong experience mas nindot ug mag share-share aron mas daghan pag ideas, input or even techniques nga mas mapadali ang tanan."

(We often share ideas and resources with my colleagues, especially those who have also tried integrating technology in their classes. It's helpful to learn from their experiences and find solutions together. Based on my experience, sharing ideas makes everything easier and allows us to come up with more ideas, inputs, or techniques that speed up the process.)

P5 experienced:

"Mangayo ko og advice sa akong mga colleagues nga mas makatabang pa sila sa akoa kay ang ila mang advice kay ako pud gina sunod so mao lang to."

(mangayo ko og advice sa akong mga colleagues nga mas makatabang pa sila sa akoa kay ang ila mang advice kay ako pud gina sunod so mao lng to.)

And IDI-3 stated that:

"I also downloaded in advance whenever a stable connection was available."

(I also downloaded content in advance whenever a stable connection was available.)

Ultimately, these factors reflected a powerful narrative of resilience. They show the importance of maintaining faith, determination, and flexibility in facing challenges in implementing ICT-integrated gamification in their science classes.

Insights of Junior High School Teachers Regarding the Implementation of ICT-Integrated Gamification in Science Classes for Sharing with Other Educators

The participants shared their different insights in relation to the implementation of ICT-integrated gamification in science class. After a deep analysis of the transcription, the following themes emerged: (1) ict gamification increases student engagement, (2) gamified tools improve retention and understanding, (3) implementation requires preparation isnd planning, (4) ict gamification encourages teaching innovation, (5) lack of resources and limited internet access, and (6) activities align better with lesson goals.

Table 3 presents the themes and core ideas from the insights of Junior High School Teachers regarding the implementation of ICT-integrated gamification in Science classes shared during the interviews.

Table 3. *Insights of Junior High School Teachers Regarding the Implementation of ICT-Integrated Gamification in Science Classes for Sharing with Other Educators*

Major Themes	Core Ideas
ICT Gamification Increases Student Engagement	• capture attention through visuals and interaction • strong motivator and interest in lessons • encourage participation in class activities
Gamified Tools Improve Retention and Understanding	• strengthen learners understanding through active and enjoyable engagement • support deeper comprehension of abstract concepts • enhances retention of lesson and long-term recall • promote contextualized learning experience
Implementation Requires Preparation and Planning	• need adequate planning time and preparation • involve gamified tool testing before use • ensure smooth delivery with readiness
ICT Gamification Encourages Teaching Innovation	• inspire creative lesson design • support flexible adaptation to context • expand strategies beyond traditional methods
Lack of Resources and Limited Access to Internet	• limited student access to gadgets and stable internet • disrupt learning in remote areas • require offline or low-tech alternatives • encounter issues with connectivity and devices
Activities Align with Lesson Goals	• reflect instructional objectives • maintain focus on learning outcomes • design concrete and meaningful activities that support the attainment of the lesson goals

ICT Gamification Increases Student Engagement

The integration of ICT in gamification has been a new way of improving classroom teaching like improving the motivation and engagement of students. With the integration of interactive and game-based approaches, ICT-integrated gamification provides an interactive learning environment that bring out the interest of learners. As the participants attest, the strategy succeeds in enhancing student engagement by grabbing attention with images and interactive features, engaging students with interest-orientated lessons, and fostering active class participation. These are just some of the implications that highlight the spectacular potential of ICT gamification as an effective tool in maintaining attention and enhancing participation in the process of learning.

As P2 said:

"Sa ako, akoang na realize, lingaw gyud sya, lingaw sya sa bata then ma attract gyud ang bata. Dali nato ma capture ilang attention pag mugamit og visuals ug interactions."

(For me, I realized that it's really fun. It's enjoyable for the students, and it captures their attention through visuals and interactions.)

Also, IDI-5 mentioned:

"Na-realize nako nga gamification is a strong motivator. Mas engaged ang bata, mas ganahan sila mosulod sa klase, ug mas dali nila ma-retain ang lesson."

(I realized that gamification is a strong motivator. The students are more engaged, they are more eager to attend class, and they retain the lesson more easily.)

IDI-3 shared a similar experience:

"I realized that gamification can be a powerful tool for motivation and interest in lesson, even with limited technology."

(I realized that gamification can be a powerful tool for motivation and interest in lesson, even with limited technology.)

In connection, IDI-4 added:

"Ang akong realization sa pag gamit sa ICT-integrated gamification mao nga dako kaayo og epekto sa motivation ug participation sa mga class activities. Nakita nako nga bisan pa og naay mga challenges sa technology, ang pag-adapt sa mga activities ug paggamit sa ICT makatabang sa pag-improve sa pagkat-on sa mga estudyante."

(My realization from using ICT-integrated gamification is that it has a huge impact on students' motivation and enourage participation in class activites. I saw that even though there are challenges related to technology, adapting the activities and using ICT can help improve the students' learning.)

The results therefore validate that gamification with the integration of ICT plays a crucial role in increasing the motivation and participation of students in the science classes. The participants highlighted that the application of images, interactive sections, and reward mechanisms not only captures students' attention but also maintains them engaged throughout the lesson. By converting standard lessons into interactivity games, the students tend to be more interested in joining and working together with other students. This increased interaction creates an increasingly supportive class environment in which students are prompted to discover additional scientific principles. Gamification of ICT does more than just make learning fun; it also aids in understanding and memorization, recall, and thus is an effective tool for worthwhile learning.

Gamified Tools Improve Retention and Understanding

Teachers utilize gamified tools to help students improve retention and understanding especially on complex science concepts. Through the use of ICT-integrated gamification it reinforce learning through enjoyable tasks, support comprehension of abstract concepts, enhances retention of lesson, and promote contextualized learning. This is based on the responses of participants during the interview.

As P3 said:

"Improves the learning outcomes kay tungod mas dali ra sa students masabtan ang concept sa imong lesson ug mas mo retain sa ilang huna-huna kay dali nlng sa ilaha ay kadto mn to akong gibuhat so, dali lng nila ma recall kay tungod na retain sa ilang huna-huna and yes, mas enjoyable sya kay student- centered."

(It improves learning outcomes. It makes it easier for students to understand the lesson concepts, and the information stays in their minds longer. They can easily recall what they did because it was retained in their memory. Plus, it's more enjoyable since it's a student-centered approach.)

P4 also mentioned:

"Mas ma retain gyud sa estudyante ang tinudloan nmu in ICT kay kuan kay naa mn tay mga estudyante nga mas makatuon sila pag nakita nila. Mas effective sya in teaching in ICT kay mas dghan silag masabtan nga abstract concept kaysa kdtong traditional teaching strat."

(Students can retain the lessons better when ICT is used because some students learn more effectively when they see things visually. Teaching with ICT is more effective because it support comprehesion of abstract concept more compared to traditional teaching strategies.)

Furthermore, IDI-2 shared a similar experience:

"Ang gamification makapataas sa engagement ug motivation, kinahanglan nga meaningful ni ug aligned sa learning objectives. Dili lang ni basta-basta lingaw-lingaw sa klase, pero para pud mas mapasabot sa mga estudyante ang lesson especially ang mga abstract concepts."

(Gamification can increase engagement and motivation, it must be meaningful and in line with learning objectives. It's more than just having fun in class; it's also about supporting comprehension especially on abstract concepts.)

IDI-5 expressed:

"Na-realize nako nga gamification is a strong motivator. Mas engaged ang bata, mas ganahan sila mosulod sa klase, ug mas dali nila ma-retain ang lesson."

(I realized that gamification is a strong motivator. The students are more engaged, they are more eager to attend class, and they retain the lesson more easily.)

Moreover, IDI-3 supports the claim by saying:

"The key is creativity in promoting games and activities to our context aron mas more engaging pa sa learners."

(The key is creativity in promoting games and activities to our context so that they become even more engaging for the learners.)

The results validate that when implemented effectively, ICT-integrated gamification is not only a motivational process but a facilitator of transformative learning. Through blending of interactive aspects with pedagogical goals, it not only strengthens students' conceptual knowledge but also cultivates an engaging and enjoyable learning environment. This double-impact effect highlights the potency of gamification in facilitating reconciliation between cognitive and affective growth, making science learning productive and satisfying.

Implementation Requires Preparation and Planning

While ICT-integrated gamification really motivates and engage our learners in discussion but we cannot also deny the fact that implementing such tool needs a generous of time in planning as well as preparation. According to participants implementing ICT-integrated gamification need adequate planning time, involve tool testing before use, and ensure smooth delivery with readiness. This are found in the responses of participants during the interviews.

As P1 said:

"Na realize nku sya no nga kailangan syag time. It takes gyud syag sapat nga planning time, Unya kailangan nmu nga mag engage og more."

(I realized that it really takes time. It need adequate planning time, and you also need to engage more.)

P1 also shared:

"I recommend sa teacher nga mo engage pud sa gamification prepare ahead of time para dli sya dagdag labor sa imong trabahuon"

(I recommend that teachers who want to engage in gamification should prepare ahead of time so that it doesn't add extra workload to their tasks)

P6 also expressed:

"For me ahm I realized that before giving the lesson you need to involve tool testing because for ICT if you would not practice so it will be possible na maraming mga mali mali didto sa mga answer nmu. Na dapat kana unta ang mo gawas pero lahi ang mo resulta. So kailangan more practice gyud sya."

(For me, I realized that before delivering the lesson, you need to involve tool testing. If you don't practice beforehand, there might be a lot of mistakes in the answers or outputs. What is supposed to appear might turn out differently, so practicing is really necessary.)

IDI-2 also shared a similar experience by saying:

"Kinahanglan pud ni ug oras, maayong pagplano, ug mga strategy aron masiguro nga makat-on smoothly ang mga learners sa leksyon."

(It also takes time, planning and strategies in order for the lesson to be learned smoothly by the learners.)

The insights of the participants highlight that the impact of ICT-integrated gamification lies not only in its ability to engage students but also in the thoughtful and well prepared implementation behind it. With sufficient time investment and strategic planning, teachers can maximize the benefits of this strategy.

ICT Gamification Encourages Teaching Innovation

As we evolve in a digital world today, gamification encourages teachers to embrace innovations especially on strategies we can use in the delivery of lessons. It fosters the development of creative and flexible teaching methods that move beyond traditional strategies. Key factors such as inspire creative lesson design, support flexible adaptation to context, and expand strategies beyond traditional methods. These are found in the responses of participants during interviews.

As P3 stated:

"Using or implementing ICT integrated gamification really inspire teacher's creativite lesson design."

(Using or implementing ICT-integrated gamification really inspire teachers' creative lesson design.)

Also, IDI-3 had a similar experience as she stated:

"The key is creativity in lesson design aron mas engaging pa sa learners."

(The key is creativity in lesson design to make it even more engaging for the learners.)

Also, IDI-3 answered:

"ICT-integrated gamification is effective during class because the children really participate, and learning becomes more engaging, especially when the activity used has contextualization."

(ICT-integrated gamification is effective in class because the students really participate, and learning becomes more engaging, especially when the activity is contextualized.)

Moreover, P7 supported the claim by saying:

"My insights and realization for this specific experiences is that, cguro is be patient because all of those things na atong gipangbuhat is dili nato kontrolado especially kana sa atong kuryente dili mn nato sya makontrol and at the same time with ICT integration mas ma expand ang atong strategies beyong traditional methods."

(My insights and realizations from this experience are that patience is really important. Many things we do are beyond our control, especially power interruptions. At the same time, ICT-integration expand strategies beyond traditional methods.)

The integration of gamification not only supports dynamic and student-centered instruction but also equips teachers to become more inventive, resourceful, and resilient in the face of unpredictable teaching conditions.

Lack of Resources and Limited Access to Internet

Lack of resources and limited access to stable internet impedes teachers to use ICT-integrated gamification amidst its great help in the learning of our students. Key factors such as limited student access to gadgets, disrupt learning in remote areas, require offline or low-tech alternatives, and encounter issues with connectivity and devices. These are evident from the responses of participants during the interviews.

IDI-1 answered:

"Na realize nako nga mas engaging jud ang klase by using ict integrated gamification but naa pud syay downside coz dili tanan nga students have the access to gadgets."

(I realized that classes really become more engaging when using ICT-integrated gamification, but there's also a downside because of the limited student access to gadgets.)

As mentioned by P7:

"My insights and realization for this specific experiences is that, cguro is be patient because all of those things na atong gipangbuhat is dili nato kontrolado especially kana sa atong kuryente nga usahay makadisrupt jud sa learning labi na sa mga remote nga lugar. Mao nga importante pud nga magengage more on different teaching strategies nga dili lng pud sya ingon nga maka destruct sa bata sa sulod sa classroom."

(My insights and realizations from this experience are that patience is really important. Many things we do are beyond our control, especially power interruptions, which often disrupt learning in remote areas. At the same time, it's important to engage in different teaching strategies that won't be too distracting for students inside the classroom.)

IDI-3 also said that:

"First, sa Department of Education: kung pwede ma expand ang provision sa laptops or tablets that are not easily broken and cheap, but rather durable so that the children can benefit from them sa dugay nga panahon? Hopefully, it will be a 1:1 ratio and not 1:30, because it's more effective if all children can have hands-on experience. At the same time, importante pud nga unta nay ma provide nga offline bitaw or low-tech alternatives labaw na diri nga limited ang device ug connection sa internet"

(First, to the Department of Education: if possible, could the provision of laptops or tablets be expanded? These should be durable and affordable so that students can benefit from them for a long time. Hopefully, it will be a 1:1 ratio and not 1:30, because it's more effective when all students can have hands-on experience. At the same time, it is also important to provide offline or low-tech alternatives especially in areas where access to devices or internet connectivity is limited.)

Lastly, IDI-5 experienced:

"kinahanglan gyud creativity ug flexibility sa teacher kay dili tanan time mag-smooth sail ang ICT, labi na kung maka encounter og issues sa connectivity and devicest."

(It really requires creativity and flexibility from the teacher because not everything will run smoothly all the time when using ICT especially when encountering issues woth connectivity and devices.)

In sum, while ICT-integrated gamification can enhance classroom engagement and learning outcomes, its success is often hindered by limitations beyond teachers' control.

Activities Align with Lesson Goals

While ICT-integrated gamification brings enjoyment and enhances student motivation, it is essential that such strategy aligns with specific lesson objective to ensure that the core competencies are still address. Key factors such as reflect instructional objectives, maintain focus on learning outcomes, and guide meaningful activity design are some of the things need to be consider. These are evident in the responses of participants during the interview.

As IDI-2 mentioned:

"I recommend nga magsugod ka sa simple nga mga gamified activities nga align sa imong learning goals and clearly reflect your instructional objectives. Pwede pud ka makig-collaborate sa imong mga kauban nga teachers para mag-design ug mag-test sa mga activities. Ang pag-share sa trabaho makapaminus sa load ug makapa-improve sa quality."

(I recommend that you must begin with a simple gamified activities that align in your learning goals and clearly reflect your instructional objectives. Also, work with colleagues to design and test activities, sharing lessens the workload and improves quality.)

P5 also shared:

"Ang akong insight about ana is ahh although good ang ing ana nga strategy pero ahh ilessen lang pud kaayu nato di pud nato ikuan

kay ang downside pud ani kay ma distract pud ang mga bata kay kinahanglan nga ma maintain gihapon ang focus sa atong learning outcomes."

(My insight about this is that while this strategy is good, we should also limit its use. We should not overuse it because the downside is that it can also distract the students. We still need to maintain focus on out learning outcomes.)

IDI-2 experienced:

"Ang ICT-integrated gamification makes scientific classes more interactive, inspiring, ug student-centered. It promotes discovery, makapadugang sa retention, ug makatabang nga masabtan ang mga abstract o lisod nga scientific subjects pinaagi sa simulations, challenges, ug lain pa nga mga meaningful activity design."

(ICT-integrated gamification makes scientific classes more interactive, inspiring, and student-centered. It promotes discovery, increases retention, and helps to bring abstract or complex scientific subjects to life through simulations, challenges, and guide meaningful activity design.)

Lastly, IDI-7 shared:

"Daku og tabang ang gamification like quizziz ug kahoot sa pag attain sa lesson goals kay aside sa malingaw sila mas masabtan nila ang mga lisud nga scientific concepts."

(Gamification tools like Quizziz and Kahoot are a big help in attaining lesson goals because aside from enjoying the activities, students are also able to better understand difficult scientific concepts.)

Overall, the findings support a common sense that gamification based on ICT can enhance learning and increase students' engagement, and its effectiveness depends greatly on responsible design, moderation, and coordination among teachers to ensure learning outcomes are always prioritized in all activities.

Discussion

This study aims to investigate and deepen understanding of the lived experiences of Junior High School teachers in the implementation of ICT-integrated gamification in Science classes, guided by a phenomenological research approach. Both in-depth interviews and focus group discussions were used to gather relevant data from participants, with a validated questionnaire to ensure the credibility and trustworthiness of the study. The participants answered the research questions, providing rich, experiential data, and the data have undergone thorough analysis with the help of experts.

Experiences of Junior High School Teachers in the Implemented ICT-Integrated Gamification in Science Classes

The participants shared important information on their lived experiences in the implemented ICT-integrated gamification in science classes. From the data gathered, the following themes emerged: (1) observed increased student engagement, (2) achieved better learning outcomes, (3) gained confidence in teaching with ICT, (4) faced technical issues, (5) struggled with ICT skills and preparation, (6) managed student inequality and distractions, and (7) expressed need for support.

Observed Increase Students Engagement

Student engagement is widely recognized as a dynamic, multidimensional construct encompassing academic, behavioral, cognitive, and affective domains (Reschly, Phol, & Christenson, 2020). On this basis, the results of this research indicate that ICT-based gamification in science class improved students' engagement, motivation, and contributions to classwork. The evident enhancement in engagement underscores the imperative of crafting active, interactive, and technology-mediated learning environments. Moreover, gamification methods are a direct fit for Reschly et al.'s dimensions of engagement, as they require cognitive effort through problem-solving, encourage positive behavioral participation, and foster affective involvement by engaging learning in a more meaningful and enjoyable manner.

One of the most compelling reasons to expand the use of web tools and platforms is the enhancement of student engagement by enabling a more participatory, interactive learning environment. Appleton (2020) demonstrates that electronic resources and academic libraries are, at the moment, leading the way in student engagement. In addition to independent study, they provide opportunities for interactivity and exposure to diverse learning materials, which are required to maintain students' interest and motivation.

Additionally, Lowe and El Hakim (2020) suggest a "student-as-partners" approach in which students are considered equal partners in developing the learning environment. Such inclusive approaches are said to induce ownership, motivation, and engagement. This vision aligns with what participants in this research observed: engaging students in gamified activities enabled them to "take charge of their own learning" and be more invested in classroom activities. Consistent with the logic of the student-as-partners approach, the findings echo the idea that ICT-blended gamification enhances not only active participation but also shared responsibility among students and teachers in the learning process.

All these results confirm that student engagement is not a supplement to instruction delivery but a conscious consequence of responsive,

inclusive, and well-supported practices. These results underscore the importance of designing instruction that deliberately incorporates ICT-based gamification, emphasizing the value of professional development initiatives that equip teachers with digital pedagogical competencies, and guiding policy directions that support innovative, student-centered learning environments.

Achieved Better Learning Outcomes

The findings of this study indicate that the application of ICT-based gamification strategies in science learning significantly improves learners' outcomes. Kalogiannakis, Papadakis, and Zourmpakis (2021) assert that gamifying science instruction fosters scientific thinking and class participation through features such as points, levels, and feedback. In line with these findings, this study found that participants were more engaged and had greater comprehension when lessons were taught through gamified media.

Similarly, Smirdle et al. (2020) found that gamification has a positive effect on the learning behavior and achievement of students, provided it is designed according to personality. The subjects of this study reported greater participation during class and in cooperative learning, both of which were associated with improved academic outcomes. Macayan et al. (2020) emphasize that learning science through computer-based games not only increases content knowledge but also improves students' problem-solving and critical thinking abilities. Across the board, students in the current study enjoyed the instant feedback and realistic simulations provided by gamified ICT tools, resulting in quantifiable learning gains.

However, its effectiveness depends on the implementation. Kalogiannakis et al. (2021) advice that even better-designed gamified spaces can be counterintuitive when poorly implemented. The authors highlight the need for institutional support and professional development to amplify the effect of gamification.

In summary, the application of ICT-based gamification in science education shows strong potential in improving student learning outcomes. These findings underscore the value of further research and investment in well-structured, institutionally supported pedagogical gamification strategies.

Gained Confidence in Teaching with ICT

The integration of ICT-based gamification into science classes not only revolutionized pedagogical practices but also significantly supported teacher professional growth. One of the most significant accomplishments of this research is the increased confidence educators have when implementing ICT-integrated gamification in science instruction. This result aligns with an overall trend identified by Batanero et al. (2021), who found that instructional ICT tools reduce teaching anxiety by providing highly structured, well-tested material. Technology-based instructional designs make teachers more comfortable providing accurate and practical instruction.

Likewise, Zain (2021) stressed that ICT integration success is highly dependent on meticulous, time-consuming instructional planning. Teachers who invest time in developing meaningful digital activities will have greater confidence in their instructional approaches. Additionally, Wang and Chen (2020) showed that cooperative ICT projects not only improve technical skills but also strengthen teacher confidence when peer assistance is enabled to counter instruction issues.

Faced Technical Issues

While ICT-based gamification provided new avenues for motivation and imagination stimulation in science teaching, it also places rigorous technical demands. Teachers are most commonly faced with interrupted internet connectivity, hardware failure, restricted access to web content, and lagging implementation of new technology, which can interfere with the efficacy of gamified instruction and disrupt the continuity of learning at the class level.

A stable internet connection remains one of the most significant challenges, especially in rural or underdeveloped areas. Akmad and Abatayo (2024) also note that poor internet connectivity hinders access to learning materials and reduces opportunities for collaborative interaction, leading to repeated delays in task completion and diminished student engagement. Such instability not only discourages students but also puts extra pressure on teachers, who are forced to continually make readjustments to their instructional schedules.

Aside from connectivity, hardware limitations are the second constraint to gamification. Broken laptops, outdated computers, and a lack of equipment for students create unequal opportunities to register. Jose et al. (2024) stated that students' participation in interactive digital learning activities depends on access to limited technology tools. The inequalities often force teachers to make adjustments or delay scheduled lessons, thus draining the desired learning outcomes.

In addition, structural deficiencies within the ICT infrastructure make implementation even harder. Ntorukiri et al. (2022) noted that poor policies and institutional constraints typically hinder the successful execution of digital projects in schools. Lacking systematized support, teachers are unable to incorporate technology regularly; as a result, they have reduced motivation and irregular use of gamification activities.

Lastly, the unequal availability of the internet among students also tends to intensify these problems. Malipot-Hernando (2021) contends that the majority of Filipino students lack access to personal computers or reliable internet connections and thus cannot engage as much in gamified learning as they ought to. The digital divide not only limits the inclusivity of ICT instruction but also hinders teachers' ability to design inclusive, participative, and interactive learning spaces.

Struggles with ICT Skills and Preparation

The use of gamification in science, supported by ICT, is highly dependent on ICT literacy and teacher readiness. Gamified tools are built on engaging, interactive learning environments; their implementation is typically constrained by teachers' limited ICT knowledge, unproductive problem-solving strategies, and insufficient training in gamification content design. These issues often push teachers to revert to traditional pedagogies, especially when technology malfunctions or when unfamiliar digital environments are involved.

Sabayao (2024) identified that though the majority of pre-service and in-service teachers in the Philippines have basic ICT skills, many of them cannot do more advanced tasks like debugging, maintenance of platforms, and gamifying content into teaching. Such ICT skill imbalance will most likely lead to ICT tool resistance or avoidance. Macabangon and Sambo (2023) similarly contended that even if teachers possess basic ICT capabilities, limited training in gamification design and digital pedagogy limits their potential to craft contextually relevant and pedagogically practical gamified lessons. The teachers are then susceptible to cognitive overload, frustration, and decreased inclination to innovate through technology.

The need for extensive in-service training is also underscored by Theodorio (2024), who noted that through systematic training and peer mentoring, eSafety "enriched teachers' confidence in handling ICT tools and applications". Teachers articulated that, with sustained assistance in overcoming technical difficulties and in developing adaptive strategies for permanently integrating ICT into their teaching situations, they felt they could troubleshoot. Those who did not have the benefit of professional help, on the other hand, were forced to rely on trial and error, all too often hampered by self-doubt and ineffective troubleshooting.

Manage Student Inequality and Distractions

The integration of ICT-based gamification to science education offers excellent potential to enhance participation and innovation but at the same time presents challenges that teachers should take into account and for which they should devise an adaptive response. Challenges faced are diverse, including inequity in access to technology, varying levels of digital literacy, students' contexts of distraction, and the need for diversity-sensitive educational materials.

Unequal access to technology is one of the most significant problems. Some students do not have a device or access to a reliable internet connection; these students cannot engage in gameful activities. Jose et al. (2023) argued that disadvantaged students typically use outdated equipment, leaving many unable to participate in live digital activities. This unequal access creates a digital divide that requires instructors to adapt instructional strategies to facilitate inclusive and equitable participation.

In addition to access, inequalities in students' digital literacy are a significant challenge to successful implementation. While some students show proficiency with digital tools, others cannot navigate past the game-like interface. Price-Dennis et al. (2020) noted that weaving digital literacy practices into classroom rituals and routines is critical for all students, particularly those with limited access to educational technology prior to entering school. Closing these gaps frequently means educators need to supplement the time and effort needed to deliver differentiated instruction for a wide range of learners' needs.

The second issue is distraction. Gamification is more engaging but at the same time brings distraction when students use technology for achieving tasks unrelated to learning. Schuett (2024) found that technology-related distractions, such as switching between programs or browsing irrelevant content on the web, significantly diminish learning and reduce the quality of ICT-based learning. More on Gamification and Education, More on Distraction in Technology Communication. To minimize such risks, teachers should adopt controlled digital practice and establish specific rules of use to promote sustained attention and care.

Lastly, gamified material must be culturally responsive in multicultural learning situations. Shonfeld et al. (2021) noted that virtual learning environments need to respond not only to culture but also to context. Teachers should embed gamified activities for indigenous or minority groups with learners' values, practices, and experiences in mind. This makes gamification more inclusive and effective as a teaching strategy.

Express Need for Support

Effective implementation of ICT-based gamification in science learning is not simply dependent upon teacher competence or students' interest but on the presence of supportive institutional systems. Struggling teachers always focus on the need for proper infrastructure, a technological setup for students, and contextualized digital content to make gamified instruction a force to be reckoned with and accessible.

Among the most significant issues is insufficient access to stable hardware and internet connections, especially among rural and public schools. Albert et al. (2021) indicate that only a quarter of Filipino households have a computer, and that digital access remains uneven along socioeconomic lines. Such a digital divide prevents students and teachers from realizing the full potential of gamified platforms, forcing them to sacrifice or cancel intended ICT-based activities continually.

Besides infrastructure, digital literacy among students is promoted extensively through training. As noted by Ghavifekr and Rosdy (2020), ICT integration is most effective when learners can work with learning tools independently. Without such fundamental knowledge, gamefied tools become causes of confusion rather than sources of inspiration, placing additional burden on teachers to provide one-on-one technical support throughout the learning process.

Moreover, institutional assistance through policy guidance, staff training, and technical support is needed to sustain ICT-based innovations. Tuiloma et al. (2022) asserted that whenever invested support mechanisms are utilized within schools, for instance, ICT coordinators and digital learning specialists, teachers will be more likely to overcome implementation challenges and innovate with confidence. However, its absence can lead to underutilization of available facilities and inefficiency in teaching.

Lastly, the appropriateness of the context for gamified material is a significant yet unnoticed aspect of support. Shonfeld et al. (2021) argued that learning spaces within virtual environments should be culturally responsive to resonate with students' worlds. Teachers require time and institutional capacity to adapt gamified materials, especially when educating indigenous or marginalized populations.

Junior High School Teachers Coping with the Challenges Encountered in Implementing ICT-Integrated Gamification in Science Classes

The Science teachers identified ways of handling the challenges they encountered in implementing ICT-integrated gamification. From the responses of the participants, the following themes emerged: (1) seeking help, (2) adapting strategies, (3) improving ICT skills, (4) managing resources, (5) designing better lessons, and (6) staying resilient.

Seeking Help

The process of implementing ICT-integrated gamification in science is highly multifaceted and demands not only technical expertise but also pedagogical imagination and flexibility. Such complexity directly informs this study's interest in exploring Junior High School teachers' lived experiences in coping with it. The most practical strategies employed by teachers to overcome such challenges include seeking help—an adaptive approach in the interest of professional development, problem-solving, and creativity.

Teachers typically consult with colleagues, ICT coordinators, and master teachers for advice regarding planning, debugging, and standards-based gamification activities. These peer-to-peer activities are not accidental but part of essential critical professional development stages. As Theodorio (2024) explained, context-specific support provides teachers with the skills needed to integrate technologies effectively. Participant experiences reinforce this finding, with one of the teacher-participants stating, "I am not ashamed to ask co-teachers for assistance because it makes me more confident to try gamification again." This shows how peer support not only builds expertise but also sustains teacher confidence in embracing ICT-integrated practices.

Instructional leaders and mentors have a similar significant role in creating a culture of collaboration. McTigue et al. (2023) indicated that school leaders who encourage co-teaching and collaborative planning provide vital support that inspires teachers to test innovative strategies, such as gamification. This is a similar theme of collective expertise, and it runs parallel to this study, where educators repeatedly demonstrated reliance on peer mentoring and shared problem-solving as inspiration for ongoing ICT use in the classroom.

In the context of the Philippines, collaborative culture is promoted by master teachers' roles. As Mantilla (2023) reiterated, master teachers are not only offering technical assistance but also pedagogical assistance, empowering colleagues to foster professional growth. This implicitly accommodates participants' practice, especially gamified teaching, in which they primarily ask for help selecting appropriate tools, crafting active activities, and mediating the classroom atmosphere. For instance, as one of the teacher-participants noted, "Our master teacher guides us in learning how to choose games that actually suit our science lessons. Without her, we wouldn't know where to begin."

Besides, peer co-work also improves technical competence and confidence in instruction. Wang and Chen (2020) claimed that collaborative professional growth substantively improves ICT skills, especially when teachers co-design gamified instructional content. This can be seen in the participants' identification of co-planning sessions and collective reflection as valuable practices for idea-sharing and practice-development. The collaborative work illustrates how collegiality helps bridge knowledge gaps at the individual level, sustains teachers' motivation, and supports the long-term sustainability of ICT-facilitated gamification.

Adapting Strategies

Effective gamification of science classes through ICT also calls for teachers to be not only technically proficient but also innovative and flexible in adapting their approaches to varying classroom realities. Such sophistication at once mirrors the study's goal on how teachers respond to the subtleties of gamification with ICT. In schools where the provision of gadgets, internet access, or technical knowledge is uneven, teachers are required to adapt their teaching to make gamified learning accessible, enjoyable, and educationally beneficial. The subject also draws on previous addresses in the context of teacher preparedness and peer support to demonstrate that adaptability is an extension of technical knowledge and peer support.

One widely adopted strategy is peer tutoring and group learning to address limited access to devices and unequal levels of digital literacy among students. Technology-enhanced reciprocal peer tutoring has been found by Oikarinen et al. (2022) to enhance fairness through enabling more technologically advanced students to serve as tutors, fostering collaboration and enhancing cognitive investment in game-based learning activities.

In areas with unreliable internet, teachers use offline gamified activities. Wang and Chen (2020) highlighted that pre-downloading resources or replacing online functions with printed resources and offline simulations provides a level of consistency of interactive learning even in low-tech situations. Among Philippine rural classroom stakeholders, they also enumerated utilizing "making digital

quizzes board games" or "print gamified worksheets" s exercises that capture gamification's motivational aspects without being bogged down by connectivity concerns. Adaptive practices in the above instances illustrate how solutions, in general, can inspire learners regardless of infrastructural disparities.

The second powerful adaptation is the addition of locally played games and materials that align with local culture. According to Colendra and Carada's (2023) argument, not only does localization render gamification more accessible but also more culturally and socially applicable. According to this study, teachers testified that integrating local indigenous play into crafting gamified science activities enabled students to "relating better to the lesson" while still maintaining cultural identity. This is in line with the earlier comment on where gamification is in the game of collegial and peer support, yet also that turning is not just technical but also socio-cultural.

Lastly, ICT-based gamified activity outsourcing to offline apps remains a crucial component of low-resource Philippines classrooms. Videnovik et al. (2023) indicated that converting interactive quizzes into print or board versions preserves the very essence of gamification without relying on real-time digital network connectivity. The policy implications here are far-reaching: education officials need to identify and support such bottom-up innovations by providing teachers with formal training in adaptive instructional design and ensuring that ICT integration guidelines reflect resource-poor conditions. Adaptive, culturally responsive pedagogical behaviors that enable teachers to maintain student interest despite infrastructural constraints, however, are not the only thing training programs ought to emphasize.

Improving ICT Skills

Teacher perceived self-efficacy and ICT literacy are predictors of effective gamification in teaching science. Gamified strategies involve leveraging interactive tools, multimedia resources, and immediate feedback, necessitating ongoing professional development of high-level ICT capabilities by teachers to design, implement, and debug such learning sessions effectively. In the Filipino context, where technology infrastructure and connectivity may differ between urban and rural schools, teachers' adaptability is even more essential to ensure equal opportunity to learn.

One of the most common ways to enhance ICT proficiency is through formal training and workshops. Theodorio (2024) again states that professional development programs based on experiential, context-oriented training greatly enhance teachers' capability to embed technology in instruction. These workshop sessions not only enhance technical proficiency but also support innovation and experimentation—both central to gamified learning. This formal training, however, is inadequate in reliance. Most Filipino teachers, particularly those in low-resource schools, self-study ICT and conduct independent discovery to develop their ICT proficiency. Lubuva et al. (2024) explain that when teachers design ICT-construction activity lessons independently, they achieve significant technology integration in teaching.

Independent learning is also promoted through independent discovery and experimentation with web materials, as facilitated by Trivedy (2024). All these professional activities are highly significant in the Philippines. Initiative-taking teachers not only become resilient but also serve as role models of flexibility for students. In addition, ICT skill acquisition must go beyond technical expertise to encompass problem-solving, resourcefulness, and digital literacy—skills essential to enabling learners to succeed in a technology-driven world. Experiential learning, as Kline et al. (2021) explain, fosters technical and soft skills that enable instructors to effectively address classroom challenges.

Lastly, cultivating teachers' ICT capabilities through systematic education, autonomous learning, and hands-on engagement is essential to ensuring the sustainability of gamification as an extended pedagogical strategy in Philippine classrooms. Stakes are that education policies must not only embark on infrastructure investment but also located teacher education that makes the teacher innovative and self-sufficient. Empowering teachers with such capacities will have a direct reflection on the maintenance, extension, and remixing of gamified learning in various Philippine contexts.

Managing Resources

The successful application of ICT-based gamification in science education also depends on how teachers cope with limited resources, especially in resource-constrained schools where internet connectivity is still unevenly distributed between urban and rural areas. Limitations such as limited device access, weak internet connections, and limited digital infrastructure force teachers to develop creative measures to facilitate equitable participation in gamified learning. Through effective utilization of resources through device sharing, peer instruction, and offline material preparation, teachers can sustain active student engagement in gamified science courses despite structural constraints. Sharing equipment is a practical approach that includes students learning in teams with shared equipment. It not only optimizes the utilization of limited gadgets but also facilitates team learning and problem-solving. Oikarinen et al. (2022) further point out that simultaneous use of digital tools by groups maximizes engagement while facilitating struggling digital learners through guided interaction. Likewise, peer support that pairs digitally competent students with their less digitally competent peers enables digital skill transfer while promoting inclusivity. Mentzer et al. (2024) observe that such peer tutoring by word of mouth has advantages for both the student being instructed and the student reinforcing his/her skills by teaching.

In schools with weak or inconsistent internet connectivity, a frequent situation in rural Philippine barangays is that instructors preload

online content or create offline gamified worksheets. This allows for continuity of instruction independent of live internet availability. Nyakarundi (2024) confirms that rendering content offline available greatly enhances poor communities' learning achievement by reducing digital interruptions and enabling smooth engagement. Beyond technical modifications, localizing gamified content with local language, images, and cultural examples increases learners' accessibility and understanding. Shonfeld et al. (2021) argue that culture-sensitive digital spaces are central to facilitating inclusive learning, especially when students exhibit diverse levels of digital literacy.

Considering all aspects, these steps demonstrate that resource management, peer-to-peer learning, and cultural contextualization are complementary steps that enhance gamified learning in conditions of scarcity. For the Philippines, this emphasizes policies that support ICT infrastructure and teacher training in adaptive resource management. Training has to extend beyond technical proficiency to encompass strategy on collaboration, peer-to-peer learning, and culturally responsive pedagogy. By integrating these strategies into teacher training packages, education policymakers can make gamification using ICT not only an inclusive, scalable practice but also a tool for privileged schools and one that caters to the various Philippine classrooms.

Designing Better Lessons

Effective lesson planning is the first issue in the ICT-integrated gamification of learning science to function successfully, since it directly affects the goal of maximizing students' motivation without sacrificing curriculum quality. As Philippine education moves further towards technology-based and interactive instruction, strategic lesson planning, curriculum mapping, and student-centered design become essential. Gamified lessons not only must awaken learners' curiosity but also must be based on national learning competencies and meet learners' diverse learning needs across contexts.

One of the most significant methods is the use of curriculum guides that align gamified materials with national standards and competency-based models. ICT curriculum standards, according to Bonifacio (2020), provide a roadmap for incorporating technology into teaching, enabling instructors to create lessons that are pedagogically sound and technologically relevant. Within the Philippine context, where flexibility and alignment of competencies are emphasized under the MATATAG curriculum, the curriculum guides ensure that gamification activities support higher learning goals while remaining aligned with national policy.

Also notable is the inclusion of reflection questions within gamified lessons to monitor student learning and develop metacognitive abilities. As Lu (2020) describes, reflective practice in technology-based instruction enables students to internalize abstract ideas and helps teachers better monitor learning achievement. In this sense, a reflective element is highly supportive of the development of teachers' Technological Pedagogical Content Knowledge (TPACK), a framework that facilitates ongoing growth in instructional practice over time.

In addition, maintaining the learners' engagement is made easier by the deliberate choice and use of numerous tools and applications. Timotheou et al. (2023) found that using a range of platforms—such as quiz applications, interactive models, and collaborative software—satisfies multiple learning preferences and boosts learner engagement. However, educators need to balance innovation and purpose by staying up to date with the latest technologies without further diluting their tool choices through instructional design. In the Philippines, where access to ICT tools is unequal, training would also help teachers adapt their decisions, such as selecting lightweight applications for low-bandwidth contexts or offline-compatible tools.

Overall, these findings demonstrate that good gamified lesson design is not so much a matter of adding tools as it is of harmonizing curriculum needs, reflective practice, and the responsive use of tools. To the Philippines, this offers the recommendation of professional development programs to equip teachers to create gamified lessons in the context of the MATATAG curriculum with consideration given to common factors like digital inequality. These education policies should thus focus on recurrent training in lesson planning so that teachers are equipped to provide gamified, contextual, and interactive science instruction.

Staying Resilient

ICT strength in gamifying science learning is less a function of technical failure to be overcome than one of vision, responsive pedagogy, and troubleshooting collaboration. Causevic et al. (2019) believed that ICT strength is enhanced by decentralization, flexibility, and continuity, even in the event of infrastructure breakdown. In a Philippine classroom environment, that means preparing offline substitutes, rotating device sharing, and creating lessons so flexible they can adapt to unstructured learning environments—practices most essential in rural communities with outages and unreliable internet connectivity.

Digital resilience relies on the ability to be flexible, Ospina et al. (2020) note. Teachers who are committed to learning goals and flexible in their instructional styles are better able to respond to interruptions, such as equipment failures or unexpected power outages. In the Philippines, amid frequent disruptions, resiliency depends on perceptions of objectivity and teachers' passion for sustaining the continuity of learning among students even in challenging contexts. This sets a requirement for technical skill building as well as affective resilience in teacher professional development.

Collaboration also supports ICT integration resilience. Prazian (2024) further adds that peer support, interdisciplinary collaboration, and collective problem-solving construct resilience by building collective knowledge and enhancing emotional intelligence. Filipino teachers who are sharing resources, peer-mentoring each other, or troubleshooting in a collective mode are bearing witness to the fact that resilience is a communal endeavor and not an individual activity. These efforts are befitting examples of the bayanihan spirit

pervasive in Philippine society, bearing witness to how social solidarity advocates technological adaptation.

Finally, sticking to ICT-based gamification amidst adversity is a demonstration of teachers' professional agency and resilience. It shows that they can turn adversity into innovation, ensuring that science education remains in good condition even in poverty- and technologically-challenged settings. For policymakers, this means policies need to institutionalize practices that foster resilience in teacher education courses. Aside from technical seminars, training must prepare teachers for contingency planning, cooperative behavior, and socio-emotional skills to help them maintain gamified learning in situations of uncertainty. With resilience as policy and practice, ICT-enabled science gamification can flourish as a transformative tool in different Philippine learning settings.

Insights of Junior High School Teachers Regarding the Implementation of ICT-Integrated Gamification in Science Classes for Sharing with Other Educator

The different insights from the participants were gathered in which they expressed their insights regarding the implementation of ICT-integrated gamification in science classes. From the transcribes and analyzed responses, the following themes were identified: (1) ict gamification increases student engagement, (2) gamified tools improve retention and understanding, (3) implementation requires preparation and planning, (4) ict gamification encourages teaching innovation, (5) lack of resources and limited internet access, and (6) activities align with lesson goals.

ICT Gamification Increases Student Engagement

Gamification in ICT-based instruction has been more effective in motivating students in taking up the study of science as an interest. By using game mechanics such as points, badges, leaderboards, and dynamic challenges, teachers can turn classroom lessons into interactive learning experiences that encourage and motivate learners.

Gamification works very well in increasing students' motivation, involvement, and focus, especially for students with less exposure to digital tools in the first place. Smiderle et al. (2020) believe that gamified learning environments can replicate the motivational pull of games and thereby help achieve higher levels of motivation and improved classroom behavior. These learning environments prompt learners to engage actively, which is particularly helpful in science classes that involve conceptual reasoning and critical thinking.

Moreover, gamification has been shown to boost intrinsic motivation, another key driver of long-term academic achievement. Li et al. (2024) found that gamified learning significantly enhances learners' sense of autonomy and relatedness—two psychological needs that, when satisfied, foster greater engagement and long-term interest in learning activities. This is most especially true in ICT-integrated science lessons, where students will generally learn collaboratively and investigate materials through interactive simulations and video games.

In addition to motivating learning, gamification also promotes retention. Subhash and Cudney (2018) found that students in gamified learning environments retain knowledge better, particularly when collaborative learning methods are integrated with gamification. This summarizes that science lessons that resort to gamification are not only fun to learn and participate in but are also more effective.

Finally, gamification also depicts flexibility in maintaining student interaction with various learning spaces. Even in offline or low-resource situations, teachers can reorganize gamified approaches that retain the necessary qualities of interaction, engagement, and motivation, keeping students engaged with the lesson. Indeed, as Smirani and Yamani (2024) pointed out, properly planned gamification, whether online or offline, actually raises learners' motivation, engagement, and learning retention.

Gamified Tools Improve Retention and Understanding

Abstract and complex scientific concepts are more straightforward to comprehend and remember when complemented by gamified settings. They offer cognitive scaffolding, visual cues, and interactive learner-centered activities that stimulate deeper learning. Structuring lessons around challenges with intrinsic rewards and feedback not only strengthens the integration of complex concepts but also improves long-term retention. This is used to illustrate the instructional potential of gamification as a tool for enhancing conceptual understanding and memory attachment in science education.

One of the key benefits of gamification is that it enables cognitive processing by actively engaging players. For Al-Khresheh (2025), gamified learning environments facilitate greater management of working memory and attention by turning hard material into game-like challenges. The cognitively demanding task strengthens encoding and recall of information, thereby increasing retention.

Furthermore, gamification encourages experiential and visual learning, which suits students who struggle with conventional text-based instruction. According to Smirani and Yamani (2024), visual elements like progress bars, animations, and interactive simulations enable learners to construct stronger mental representations of scientific ideas. Not only do such tools engage students more, but they also enhance understanding and memorization.

The student-centered aspect of gamification learning also leads to a deeper understanding. Since students are indeed engaged in the process—deciding, solving problems, and receiving prompt feedback—they are more likely to acquire knowledge. Barber (2021) highlighted that student-centered gamification systems foster a better understanding and retention, which are necessary for meaningful learning.

Reflection prompts added to gamified activities, as proposed by Lu (2020), induce learners to reflect on what they have acquired, strengthening both comprehension and memory.

Implementation Requires Preparation and Planning

The successful integration of ICT-based gamification in science education is not an impromptu process; it requires meticulous planning, prior preparation, and ongoing refinement. It requires teachers to invest time and effort in learning the tools, incorporating them into learning outcomes, preparing for potential technical problems, and making the gamified material pedagogically sound.

Pre-lesson preparation and practice are probably the most important components of implementation. Lubuva et al. (2024) emphasized that experiential education in developing ICT-integrated lesson activities significantly enhances educators' teaching competence and reduces technical errors during lesson execution. Without proper preparation, well-designed gamified tools might, even otherwise, fail to achieve expected learning outcomes due to misalignment or technical errors.

Moreover, there is a need for planning to ensure that gamified activities are not only fun but also meaningful and compliant with curricular specifications. Msafiri et al. (2023) mentioned that successful integration of ICT depends on teachers embracing backward design and learning outcome mapping models of planning. In this manner, every gamified activity will lead to the development and improvement of scientific knowledge and critical thinking skills.

Another critical element is time management. According to De Vera et al. (2021), teachers cannot juggle teaching and integrating technology because they do not have adequate preparation time. Yet if teachers are provided with ample support and time, they can create interactive, error-free, and goal-oriented gamified lessons that improve students' learning.

Furthermore, reflective planning, in which teachers evaluate and refine their methods based on students' responses and learning outcomes, is also important for sustaining the effectiveness of ICT-based gamification. Through constant refinement in this manner, teachers can continue to refine their methods and become more skilled when implementing digital technology.

ICT Gamification Encourages Teaching Innovation

Gamification in ICT-based learning is a driving force behind overall educational innovation, particularly in science education. Because teachers need to learn to mold themselves in ever-evolving virtual environments, gamified technology not only assures innovative channels for reaching the students but also allows teachers to reimagine their pedagogies with imagination, contextual appropriateness, and student-centeredness.

Gamification encourages educators to try innovative pedagogical approaches by merging data with gaming elements through challenges, prizes, and narratives. Aibar-Almazán et al. (2024) conclude that the use of gamified resources such as Kahoot! Significantly increases educators' capacity to create lessons that attract attention, imagination, and analytical thinking. The resources stimulate imagination by forcing educators to break with traditional forms and adapt content to suit their students' interests and needs.

Moreover, gamification ensures contextualized and culturally responsive pedagogy. According to Pegalajar-Palomino and Martínez-Valdivia (2024), ICT-facilitated gamification enables educators to adapt content to local contexts, making learning more acceptable and empowering. Flexibility of the teacher in innovating through indigenous games integration, local references, and offline modifications—especially in less online areas.

Gamified learning also promotes teacher creativity and professional development. Amornrit et al. (2025) discovered that gamified learning systems enhance digital creativity among teachers by pushing them to create missions, challenges, and collaborative work. The practice not only enhances the value of lessons but also develops teachers' confidence in technology as an innovative tool.

Finally, gamification encourages teachers' flexibility and resilience. Where power outages or hardware constraints are endemic, teachers learn to devise creative solutions—e.g., pooled device configurations or off-grid worksheet-driven activities—to sustain student engagement. Such innovations are part of a larger cultural transition toward flexible, student-focused instruction that is responsive to real-world constraints.

Lack of Resources and Limited Access to Internet

Although ICT-supported gamification has the potential to transform science education, its use is still constrained by limited access to devices, poor internet connectivity, and unstable electricity, particularly in rural and under-resourced schools.

A lack of quality ICT infrastructure, such as broadband connectivity, power supply, and robust devices, is a significant hindrance to the effective adoption of technology in schools, according to Ntorukiri et al. (2022). Beyond infrastructure, the lack of gadgets creates an even bigger challenge. This infrastructural gap not only compromises gamified learning but also widens learning inequalities, as learners without devices or stable internet access cannot fully benefit from online learning opportunities.

Moreover, Espinosa et al. (2023) noted that financial constraints and traditional procurement systems also discourage schools' adoption of ICT tools. Lacking direct government action and policy reforms, teachers resort to improvisation, utilizing available limited resources, even on personal devices or offline alternatives, to apply gamified instruction.

Despite these challenges, teachers demonstrate remarkable creativity and flexibility in adapting their strategies. However, as Timotheou et al. (2023) noted, the lack of institutional and infrastructural support, such as devices and connectivity, can lead to burnout and a waning of innovation in the long term, especially when teachers have to compensate for system deficits.

Activities Align Better with Lesson Goals

One of the most significant advantages of gamification in science education using ICT is that it has the ability to align learning activity with specific learning objectives. Well-designed gamified activities not only motivate students but also intentionally address intended learning outcomes. By connecting motivation to well-defined goals, gamification ensures that activities in class are not only fun but also goal-oriented, resulting in more meaningful and quantifiable learning outcomes.

Gamified learning activities are most compelling when they are specifically designed to align with cognitive objectives and curriculum needs. Wood and Drew (2025) created the Gamification Alignment Model, which synergistically aligns game mechanics with Bloom's taxonomy to help educators design activities to foster higher-order thinking. From a learning science perspective, this convergence occurs through activities such as interactive quizzes, problem-solving exercises, and simulation games, where students transition from recall to analysis, evaluation, and application. Through this process of development, gamification not only becomes fun but is also educationally sound, so classroom interaction ultimately leads to meaningful learning results directly.

In addition, collaborative active lesson planning is important for ensuring both fun and aligned gamified lessons that achieve the desired learning outcomes. Celasun and Kaya (2024) observe that peer co-design of gamified content enhances instructional integration and improves individual responsibility for planning. By co-designing, teachers can create activities precisely aligned with curriculum needs, so that quizzes, role-play challenges, or simulations are geared towards particular skills rather than being games in their own right. Co-design also supports professional learning communities where teachers pilot, test, and hone gamified instruments, aligning them with common goals and, in turn, making classroom engagement measurable in student results.

However, gamified elements generally facilitate motivation; misalignment or exploitation can contribute to superficial engagement. For instance, Mogavi et al. (2022) reported that, in a language-learning application, users sometimes pay greater attention to leaderboards, badges, or points than to learning content, thereby reducing the tool's effectiveness.

Conclusions

In the context of a continuously changing learning environment, using Information and Communication Technology (ICT) in science teaching, specifically through gamification, has emerged as a potential solution to enhance student learning. The task of science teachers these days goes beyond traditional teaching; they are expected to think innovatively and embrace practices that connect with digital-age learners and their various learning contexts.

This research found the experiential truth of science teachers' implementation of ICT-integrated gamification. Through focus group discussions and in-depth interviews, the participants uncovered their successes and challenges in adjusting to new sites and extensive preparations, as well as to varied student participation and technological limitations.

From these findings, I learned more about the truth about instructors in trying to provide more interesting and worthwhile lessons. Gamified activity boosted student motivation, according to some respondents, while others cited the difficulty of maintaining interest due to unreliable internet and limited access to resources. I understood that as educators, we need to keep improving our digital literacy and become more thoughtful in creating game-based learning opportunities that better serve our students. We also need to exercise empathy, recognizing that each student engages with these tools uniquely based on access, ability, and learning style.

Despite the setbacks, the most clearly evident was the teachers' resilience and flexibility. Teachers demonstrated immense creativity and perseverance in integrating gamification into their classes, driven by an earnest desire to enhance science as an interactive, student-focused endeavor.

Based on these findings, several key recommendations can be made: there should be support from schools and school administrations to make it easier on teachers in terms of reducing their workload of implementation strategies related to gamification; teachers must engage in professional development activities related to the integration of ICT and gamified learning; and ICT and gamified training programs should be developed as part of teacher professional development by curriculum developers and policymakers. These recommendations are relevant to the challenges teachers face and can improve the use of gamification in ICT-integrated science education.

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