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# **Design And Development Of A Library Game-Resource Infrastructure For Stimulating Library Use In Federal College Of Education (Technical), Ekiadolor, Benin, Edo State, Nigeria**

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## **ABSTRACT**

This study designed, developed, and evaluated a Library Game-Resource Infrastructure (LGRI)—comprising a Recreational Game Centre and Art Gallery—to stimulate student library use at the Federal College of Education (Technical), Ekiadolor. Guided by gamification theory and user-centered design principles, the project integrated digital educational games, non-digital board games, and a creativity zone to transform the library into an interactive learning environment. Adopting a Design and Development Research (DDR) approach, the study was conducted in three phases: needs assessment, prototype development, and implementation and evaluation. A purposive sample of 50 students who were frequent users of existing recreational spaces on campus, five librarians, and three lecturers participated in the study. This sample size, while small, was deemed appropriate for an in-depth, iterative design and development study focused on rich feedback rather than statistical generalizability (Richey & Klein, 2014). Data were collected through a validated Needs Assessment Questionnaire, semi-structured interviews, an observation checklist, and the System Usability Scale (SUS). Quantitative data were analysed using descriptive statistics and a paired samples t-test, while qualitative data were analysed thematically. The findings revealed a statistically significant increase in regular library visits from 30% pre-implementation to 68% post-implementation,  $t(49) = 6.82$ ,  $p < .001$ , Cohen's  $d = 0.96$ , indicating a large effect size. Students reported high usability (SUS score of 82/100, placing it in the top 10th percentile for usability), improved digital literacy, enhanced teamwork, and increased creativity. The study concludes that integrating gamified and creative learning infrastructures within academic libraries can significantly improve student engagement and patronage. The model offers a replicable framework for innovation in colleges of education and similar institutions in developing contexts.

**Keywords:** Library gamification, academic libraries, game-based learning, student engagement, recreational learning, Nigeria

## INTRODUCTION

Academic libraries are central to teaching, learning, and research in tertiary institutions. However, they are at a crossroads. The rise of electronic information resources, mobile access, and distance learning has shifted user behavior away from traditional physical library visits towards digital spaces (Afolabi, 2020). Despite these trends, physical library spaces continue to play a vital role in student learning, collaboration, and community building when they support activities beyond silent study. As scholars note, contemporary academic libraries increasingly serve as social and learning hubs that accommodate a range of engagements including play, creative expression, and collaborative inquiry (Zhu et al., 2025). In Nigeria, academic libraries are often bound by legacy service models that emphasize quiet study and print collections, while newer types of student engagement spaces remain scarce (Nwosu & Nnadozie, 2022; Obinyan, 2021). This case study focuses on the Federal College of Education (Technical), Ekiadolor Library, a tertiary academic library experiencing fluctuating but generally low physical patronage despite offering essential information services. In response, this study tested an innovative intervention by integrating a Recreational Gaming Infrastructure (RGI) into the library environment—an intervention not previously documented in Nigerian academic librarianship.

Recreational infrastructures such as board games, digital gaming environments, and art and creative spaces have been shown elsewhere to encourage engagement, promote social interaction, and support cognitive and affective outcomes. For example, gamification—the application of game design principles in non-game contexts—is linked with increases in motivation and engagement in academic library settings when thoughtfully implemented (Aminu & Shehu, 2025; Durodolu, et al, 2025; Rathod & Charate, 2025). Makerspaces and creative hubs also provide opportunities for students to interact with technology, build prototypes, and engage in creative problem-solving, all of which are essential for 21st-century learning (Okuonghae, 2019).

### Statement of the Problem

Globally, academic libraries are being reimaged as participatory learning environments that must offer experiential value to remain relevant, yet many institutions in developing countries struggle to move beyond traditional service models that prioritize quiet study and print collections over interactive engagement (IFLA, 2022; Nwosu & Nnadozie, 2022). In Nigeria, this global challenge manifests acutely as declining physical patronage despite increased investment in digital resources, with students gravitating towards informal learning spaces that are more socially stimulating and flexible, leaving libraries underutilized for non-compulsory activities (Obinyan, 2021). Given the documented potential of gamification to enhance motivation and the pressing need for context-specific, evidence-based engagement strategies in Nigerian colleges of education, this study is expedient to design, implement, and evaluate a Library Game-Resource Infrastructure (LGRI) at the Federal College of Education (Technical), Ekiadolor, as a strategic intervention to reposition the academic library as a dynamic, inclusive, and student-centered learning environment that promotes increased patronage, social interaction, and holistic student development.

### Research Questions

The following research questions guided the study:

1. What is the effect of the Library Game-Resource Infrastructure (LGRI) on students' library visitation frequency at the Federal College of Education (Technical), Ekiadolor, Benin, Edo State, Nigeria?
2. Does the LGRI significantly improve students' intrinsic motivation to use the library at the Federal College of Education (Technical), Ekiadolor?
3. What is the perceived usability of the LGRI among students at the Federal College of Education (Technical), Ekiadolor?
4. Does the LGRI significantly enhance students' digital literacy, teamwork, and creativity at the Federal College of Education (Technical), Ekiadolor?

### Hypotheses

The following null hypotheses were formulated and tested at a 0.05 level of significance:

H<sub>01</sub>: There is no significant difference in students' library visitation frequency at the Federal College of

Education (Technical), Ekiadolor, before and after the LGRI implementation.

H0<sub>2</sub>: The LGRI implementation does not significantly improve students' intrinsic motivation to use the library at the Federal College of Education (Technical), Ekiadolor.

H0<sub>3</sub>: Students' perceived usability of the LGRI at the Federal College of Education (Technical), Ekiadolor, is not significantly high.

H0<sub>4</sub>: The LGRI does not significantly enhance students' digital literacy, teamwork, and creativity at the Federal College of Education (Technical), Ekiadolor.

## **LITERATURE REVIEW**

This review synthesizes empirical literature related to the study's research questions, examining the role of gamification and innovative library spaces in enhancing student engagement.

### **Libraries and Student Engagement**

The role of academic libraries has undergone substantial transformation in response to digital disruption and changing student learning behaviors. Historically, libraries functioned primarily as custodians of knowledge; however, the digital revolution has shifted information access from institution-centered systems to user-controlled platforms (Afolabi, 2020). This transition has reduced dependency on physical library spaces, particularly in developing countries where mobile internet usage has increased dramatically. While automation and digital subscriptions were expected to increase library relevance, empirical studies in Nigeria indicate a continued decline in physical patronage (Nwosu & Nnadozie, 2022). A study by Obinyan (2021) on students' perception and use of academic libraries in Nigerian colleges of education found that the issue is not merely access to information but experiential value—students gravitate towards environments that are interactive, flexible, and socially stimulating. International policy frameworks support this perspective. The International Federation of Library Associations (IFLA, 2022) redefines libraries as "participatory learning environments," emphasizing collaboration, creativity, and experiential engagement. Therefore, the challenge confronting academic libraries is not merely digital transformation but pedagogical and spatial transformation. This finding is critical for the present study as it underscores the need for interventions like the LGRI that offer experiential value to attract students.

### **Effect of LGRI on Library Visitation Frequency**

Empirical research on gamification in library contexts provides a strong foundation for this inquiry. A comprehensive meta-analysis by Hamari, Koivisto, and Sarsa (2014), which reviewed empirical studies on gamification, reported generally positive effects of gamification on engagement and motivation across various contexts. However, they cautioned that outcomes are context-dependent and significantly influenced by the quality of the design. In a Nigerian study directly relevant to the current research, Adebayo and Alonge (2023) investigated gamification as a strategy for enhancing academic library use among undergraduates. Their findings indicated that gamified orientation programs and interactive discovery tools led to increased library visits and improved learning outcomes. Furthermore, a recent study by Durodolu, et al. (2025) examined the characteristics and perceptions of gamification strategies among Library and Information Science students in four Nigerian universities. While their focus was on perceptions, they highlighted the essential role of academic libraries in supporting student learning and the potential of gamification to enhance library resource exploration. These studies collectively suggest a positive link between gamified interventions and library use, which the current study aims to test empirically through the implementation of a physical LGRI. The findings of this study will contribute to this body of knowledge by providing evidence from a Nigerian college of education context, an area with limited empirical research.

### **Effect of Library Game-Resource Infrastructure on Intrinsic Motivation**

According to Ryan and Deci, (2017), The theoretical underpinning for this is found in Self-Determination Theory (SDT), which posits that intrinsic motivation is fueled by satisfying the psychological needs for autonomy, competence, and relatedness. Gamification, when meaningfully designed, can address these needs. Nicholson (2015), in his work on meaningful gamification, critiques superficial, reward-based

systems, arguing that extrinsic incentives alone may produce short-term participation without fostering intrinsic motivation. He advocates for designs that support user autonomy and create meaningful connections. In a library context, Koivisto and Hamari (2019), in their review of gamification research, demonstrated that gamified information systems can improve user satisfaction and continued use, which are indicators of sustained, internally motivated engagement. Durodolu, et al. (2025) provided specific data from Nigerian students, finding that clear goals and objectives were deemed essential by 47.7% of users, highlighting the role of structured frameworks in enhancing user participation, which is a precursor to intrinsic motivation. The current study will contribute to this discourse by measuring changes in students' self-reported motivation following their interaction with the LGRI, offering empirical data from the Nigerian context.

#### **Perceived Usability of the Library Game-Resource Infrastructure (LGRI)**

Usability is a critical factor in the adoption and continued use of any system or service. Norman (2013), in his seminal work on user-centered design, emphasizes that intuitive, easy-to-use systems are key drivers of user adoption and satisfaction. The System Usability Scale (SUS) is a widely used, reliable tool for measuring the perceived usability of a product or service. In the context of educational technologies and library innovations, high usability is essential for ensuring that students can engage with the infrastructure without frustration. Cheng, She, and Annetta (2020), in a systematic review of game-based learning and library engagement, found that poorly designed games or systems could distract from learning objectives and discourage use. This highlights the need for rigorous usability testing. The current study's use of the SUS will provide a standardized, benchmarked measure of the LGRI's usability, allowing for comparison with other systems and providing actionable feedback for future iterations.

#### **Effect of LGRI on Digital Literacy, Teamwork, and Creativity**

This question explores the broader educational outcomes associated with the LGRI. Koivisto and Hamari (2019) suggest that gamified systems can promote technological familiarity and collaborative digital engagement. In the context of a teacher education institution like FCET Ekiadolor, these outcomes are particularly significant, as graduates are expected to integrate technology and collaborative pedagogies into their future classrooms (TETFund, 2023). The creative arts zone within the LGRI is supported by UNESCO's (2021) emphasis on play and creativity as essential drivers of innovation, emotional well-being, and problem-solving capacity in higher education. Kapp (2012), in his work on the gamification of learning and instruction, argues that well-designed games mirror effective pedagogical principles such as active problem-solving and situated cognition, thereby enhancing both cognitive and collaborative skills. By incorporating physical board games, the LGRI also encourages face-to-face collaboration, which can reduce digital isolation while maintaining an educational focus. This study will provide empirical evidence on whether these theoretical benefits translate into practice within a Nigerian college library setting.

### **METHODOLOGY**

This study adopted a Design and Development Research (DDR) approach is a systematic study of design, development, and evaluation processes with the goal of establishing an empirical basis for the creation of instructional and non-instructional products and tools (Richey & Klein (2014)). This approach was most appropriate as the study involved three distinct phases: (i) needs analysis, (ii) design and development of the LGRI, and (iii) implementation and evaluation. The DDR framework is widely recognized for its suitability in creating and testing innovative solutions to practical problems in educational and library science contexts, allowing for iterative refinement based on empirical feedback.

#### **Population and Sampling**

The target population for this study comprised all students, librarians, and relevant academic staff at the Federal College of Education (Technical), Ekiadolor. A purposive sampling technique was adopted to select participants. The sample included:

50 students: These students were purposively selected from various academic departments. The selection criterion was being a self-reported frequent user of existing recreational or social spaces on or off campus

(e.g., sports facilities, game centers). This approach, known as purposive sampling for information-rich cases (Patton, 2015), was chosen to ensure participants had a relevant frame of reference to provide meaningful feedback on the new LGRI during the iterative design and evaluation phases.

5 librarians: Librarians were purposively selected based on their availability and willingness to participate in the usability assessment and provide professional insights.

3 lecturers: Lecturers from the School of Education and ICT department were purposively selected for their expertise in pedagogy and technology.

The sample size of 50 students, while small for statistical generalization to the entire institution, is justified for this type of in-depth Design and Development Research. As Richey and Klein (2014) note, DDR often focuses on rich, qualitative feedback and iterative testing with targeted user groups to refine a product or model, rather than on broad statistical inference. Furthermore, for usability testing, a sample of this size is considered more than adequate to identify the vast majority of usability issues (Nielsen, 2012).

### **Instruments for Data Collection**

Four main instruments were used for data collection:

1. **Needs Assessment Questionnaire (NAQ):** A structured questionnaire developed by the researcher to determine students' library use patterns and engagement preferences prior to the intervention. It included both closed and open-ended questions.

2. **Semi-Structured Interview Guide:** An interview guide was developed to collect in-depth insights from librarians and lecturers regarding current library practices, perceived challenges, and opportunities for gamification.

3. **Observation Checklist:** A structured checklist was used during the implementation phase to systematically record student interactions with the various components of the LGRI.

4. **System Usability Scale (SUS) and Post-Implementation Evaluation Questionnaire:** The SUS, a standardized 10-item questionnaire with 5-point Likert scale responses, was used to assess the perceived usability of the LGRI. This was supplemented by a researcher-designed questionnaire to evaluate user satisfaction, perceived changes in motivation, digital literacy, teamwork, and creativity.

### **Validation and Reliability of Instruments**

instruments were administered to two senior colleagues (professor and principal lecturer respectively). In the departments of Library and Information Science and Educational Measurement and Evaluation, university of Benn, Benin City to help ascertain the face validity. Their feedback on the clarity, relevance, and comprehensiveness of the items was used to refine the instruments before pilot testing.

A reliability test was conducted on the questionnaire, which measures the degree or extent of consistency of a research instrument. Pilot Testing the validated questionnaires were pilot-tested with 15 students from College of Education, Igueben (a similar institution not involved in the main study). The internal consistency of the quantitative items in the NAQ and the Post-Implementation Evaluation Questionnaire was assessed using Cronbach's Alpha coefficient. The NAQ achieved an alpha of 0.79, and the Post-Implementation Evaluation Questionnaire achieved an alpha of 0.84, both exceeding the acceptable threshold of 0.70 (Pallant, 2020). The SUS is a well-established, highly reliable instrument (Bangor, Kortum, & Miller, 2008).

### **Procedure for Data Collection**

Data collection proceeded in three phases. Phase 1 (Needs Assessment) involved administering the NAQ to the 50 student participants and conducting interviews with librarians and lecturers to gather baseline data. Phase 2 (Design and Development) involved iterative prototyping of the LGRI based on the needs assessment findings. Phase 3 (Implementation and Evaluation) included a 10-week implementation period during which student interactions were observed. At the end of this period, the SUS and Post-Implementation Evaluation Questionnaire were administered to the 50 student participants.

### **Method of Data Analyses**

The analyses of data in this study were done with the aid of descriptive, inferential statistics and thematic analysis while quantitative data from the questionnaires were analyzed using descriptive statistics (frequencies, percentages, means, standard deviations) and inferential statistics. A paired samples t-test

was conducted to compare mean library visitation frequency before and after the intervention. Effect size (Cohen's d) was calculated to determine the magnitude of the difference. The 95% confidence interval for the mean difference was also calculated. Qualitative data from interviews and open-ended questions were analyzed using thematic analysis to identify key themes and patterns.

#### **Intervention Description subsection**

The Library Game-Resource Infrastructure (LGRI) was designed and installed in the designated library section prior to the commencement of data collection. The infrastructure comprised a board games corner with many distinct board game varieties, digital gaming stations with educational and recreational software, a creative activity zone including art, painting and craft materials, and a general spatial redesign incorporating colourful furnishing, flexible seating arrangements, and interactive display boards. The physical configuration and components of the FCET Ekiadolor Library Game-Resource Infrastructure are presented in figure 1:

**Figure 1: Conceptualization of FCET Ekiadolor Game-Resource & Arts Gallery Room (digital and non-digital)**





**Note:** The figures show the integrated board game zone (chess, scrabble, monopoly, ludo, checkers etc.), television, gaming shelf, digital gaming station with time-regulated access, collaborative rectangular-table seating, chairs and creativity activity corner within the main library space.

## PRESENTATION AND ANALYSIS OF DATA

### Baseline Library Usage (Pre-Implementation)

**Table 1: Frequency of Students' Library Visits Before LGRI Implementation in Federal College Education (Technical) Ekiadolor, Benin Edo State. (N=50)**

Frequency of visit	Number of students	Percentage (%)
Daily	5	10
2-3 times per week	10	20
Once per week	12	24
Rarely (1-2 times per month)	15	30
Never	8	16
Total	50	100

The findings in Table 1 reveal low regular patronage prior to the intervention. Only 30% of students visited the library frequently (daily or 2-3 times weekly), while 46% visited rarely or never. This confirms the problem of underutilization identified in the literature (Obinyan, 2021).

### Post-Implementation Library Usage

**Table 2: Frequency of Students' Library Visits After LGRI Implementation in in Federal College Education (Technical) Ekiadolor, Benin Edo State.**

Frequency of visit	Number of students	Percentage (%)
Daily	18	36
2-3 times per week	16	32
Once per week	9	18
Rarely (1-2 times per month)	5	10
Never	2	4
<b>Total</b>	<b>50</b>	<b>100</b>

Table 2, shows regular library visits (daily and 2-3 times weekly) increased substantially from 30% to 68% following the introduction of the LGRI.

**Hypothesis Testing**

**H0<sub>1</sub>: There is no significant difference in students' library visitation frequency before and after LGRI implementation in Federal College Education (Technical) Ekiadolor, Benin Edo State.**

A paired-samples t-test was conducted to compare students' mean weekly library visitation frequency before and after the LGRI implementation.

**Table 3: Paired sample t-test Analyses of Library Visitation Frequency Before and After LGRI Implementation in federal College of Education Ekiadolor, Benin Edo State.**

	Pre-Intervention	Post-Intervention	t (49)	P	Cohen's d	95% CI for Mean Difference
Mean Weekly Visits (SD)	1.24 (0.86)	2.48 (1.12)	6.82	<.001	0.96	[0.88,1.60]

Table 3 shows a statistically significant increase in mean weekly library visits from pre-intervention (M= 1.24, SD = 0.86) to post-intervention (M = 2.48, SD = 1.12),  $t(49) = 6.82$ ,  $p < .001$ . The effect size (Cohen's  $d = 0.96$ ) indicates a large practical significance, and the 95% confidence interval [0.88, 1.60] does not contain zero, further confirming the robustness of the increase. Therefore, the null hypothesis (H0<sub>1</sub>) is rejected.

**Usability and Engagement Ratings**

**H0<sub>3</sub>: Students' perceived usability of the LGRI is not significantly high in FCET Ekiadolor, Benin Edo State.**

**Table 4: Descriptive Statistics for Students' Perceptions of the LGRI (N = 50)**

Variable Assessed	Mean score ( $\bar{x}$ )	Standard deviation SD	interpretation
Ease of Use (SUS)	82.0/100*	8.5	Excellent (Top 10%ile)
Enjoyment Level	4.5	0.60	Very High
Motivation to visit Library	4.4	0.65	Very High
Improvement in digital literacy	4.1	0.70	High
Teamwork & collaboration	4.3	0.62	Very High
Creativity Enhancement	4.2	0.68	High

**Note:** SUS score is on a 0-100 scale, with a score above 68 considered above average (Bangor, Kortum, & Miller, 2008). These variables were measured on a 5-point Likert scale (1 = Very Low, 5 =very high). The results in Table 4 indicate a high level of perceived usability, with an excellent SUS score of 82. This score places the LGRI's usability in the top 10th percentile of all products tested with the SUS (Bangor et al., 2008). Students also reported high levels of enjoyment, motivation, and teamwork, with mean scores above 4.3. Digital literacy and creativity enhancement were also rated highly (above 4.1). These findings lead to the rejection of H0<sub>3</sub>.

**Table 5: Testing of Remaining Hypotheses**

**Summary of Hypotheses Testing Results**

Hypotheses	Test Used	Result	Decision
H0 <sub>2</sub> : LGRI does not significantly improve intrinsic motivation	One – sample t-test (against a neutral test value of 3)	* $t(49) = 15.45$ * $P < .001$	Rejected

Ho4: LGRI does not significantly enhance digital literacy, teamwork, and creativity.	One sample t-test (against a neutral test value of 3)	*t*(49)=12.68, *P* < .001	Rejected
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As shown in Table 5, all remaining null hypotheses were rejected, indicating statistically significant improvements in intrinsic motivation, digital literacy, teamwork, and creativity following the LGRI implementation.

### DISCUSSION OF FINDINGS

The finding of a statistically significant increase in library visitation frequency ( $t(49) = 6.82$ ,  $p < .001$ , Cohen's  $d = 0.96$ ) provides robust empirical evidence that the LGRI effectively stimulates library use. This large effect size aligns with and extends the findings of Adebayo and Alonge (2023), who observed increased engagement following gamified programs in Nigerian universities. It also supports the broader conclusions of Hamari et al. (2014) that gamification, when well-designed, can positively influence user engagement. The implication for FCET Ekiadolor and similar institutions is that a thoughtfully designed, gamified physical space is not merely a recreational addition but a strategic tool for reversing declining patronage and repositioning the library as a central hub of campus life.

The significant improvement in students' intrinsic motivation, as measured by the post-implementation survey, provides practical support for the principles of meaningful gamification advocated by Nicholson (2015). By offering social features, clear goals, and opportunities for autonomy and competence—elements preferred by Nigerian students (Durodolu et al., 2025)—the LGRI successfully fostered an internal drive to use the library, moving beyond superficial, reward-based engagement. This finding has important implications for library administrators, suggesting that the design of such spaces must prioritize user autonomy and meaningful interaction over simple extrinsic rewards to cultivate sustained, self-motivated use.

The excellent System Usability Scale (SUS) score of 82, placing the LGRI in the top 10th percentile for usability, is a critical finding. It confirms that the user-centered design principles (Norman, 2013) employed during the iterative development phase were effective. High usability is a prerequisite for adoption; if students found the LGRI complex or cumbersome, its benefits on motivation and engagement would be negated (Cheng et al., 2020). This finding validates the participatory design approach used and provides confidence that the LGRI can be used intuitively by its target audience, maximizing its potential for impact.

Finally, the reported enhancements in digital literacy, teamwork, and creativity have significant pedagogical implications. This finding directly supports Koivisto and Hamari's (2019) assertion that gamified environments can promote technological familiarity and collaborative engagement. For a teacher-training institution like FCET Ekiadolor, this is particularly valuable. The LGRI is not just a space for recreation; it functions as an informal learning laboratory where future educators can develop the 21st-century skills (TETFund, 2023; UNESCO, 2021) they are expected to cultivate in their own students. The combination of digital games and physical board games successfully promoted both technological competence and essential interpersonal skills, a key outcome for holistic student development.

### CONCLUSION

This study successfully designed, developed, and evaluated a Library Game-Resource Infrastructure (LGRI) at the Federal College of Education (Technical), Ekiadolor, providing robust empirical evidence that such an intervention can significantly stimulate library use, enhance intrinsic motivation, and foster critical 21st-century skills including digital literacy, teamwork, and creativity. By demonstrating a statistically significant and practically large increase in visitation frequency and high user satisfaction, the research contributes a validated, replicable model for academic library transformation in developing

contexts, moving beyond theoretical discussions to offer concrete evidence for how thoughtfully designed, gamified, and creative spaces can reposition libraries as dynamic, student-centered hubs that support holistic development and align with national educational priorities.

## RECOMMENDATIONS

Based on the findings and conclusions of this study, the following recommendations are made:

1. Academic libraries in Nigerian Colleges of Education should consider incorporating structured recreational gaming infrastructures to enhance student engagement and increase physical patronage. Specifically, minimum environmental standards for academic libraries should be revised to incorporate interactive, recreational, and collaborative infrastructure components. This study provides a validated model that can be adapted to local contexts.
2. Library administrators should ensure the design of gamified spaces prioritizes user autonomy, social interaction, and clear goals to foster sustained, intrinsic motivation, rather than relying on superficial, reward-based systems alone.
3. Institutional management should provide dedicated funding and policy support for innovative learning infrastructures, with a strong emphasis on user-centered design and iterative testing to ensure high usability and adoption.
4. Recreational and creative spaces should be intentionally integrated into academic programming and monitored for their impact on broader educational outcomes, such as digital literacy and collaborative skills, to maximize their pedagogical value for student development.

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