

Gamification and the Arcs Model Constructs: Enhancing Motivation and Learning Satisfaction in Radiologic Technology Education

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ABSTRACT

Student engagement remains a persistent challenge in radiologic technology (RT) education, particularly as digital technologies increasingly compete for learners' attention outside formal instruction. Gamification, the integration of game design elements into non-game contexts such as instruction, has emerged as a promising strategy for sustaining motivation, yet its influence on the specific motivational constructs of Attention, Relevance, Confidence, and Satisfaction (ARCS) among RT students remains underexamined, particularly within Philippine higher education institutions. This study employed a descriptive research design combining qualitative and quantitative data to describe the role of gamification in RT education at the College of Our Lady of Mercy of Pulilan Foundation, Inc. A 20-item survey combining Likert-scale and open- and closed-ended questions was administered to 89 respondents selected through stratified random sampling from the BSRT population, covering four variables: Demographic Information, Motivation and Relatedness, Effects on Learning, and Significance and Application. Results showed a consistently positive relationship between gamification and the ARCS constructs, with highest-frequency responses ranging from 49 to 57 and highest percentages ranging from 55% to 64% for motivation and relatedness items, and comparably high "Agree" ratings across attention, relevance, confidence, and satisfaction items. Respondents most frequently used Quizlet (29%), Quizizz (27%), Kahoot (16%), and Gizmo (9%) for gamified learning, with the remaining 19% distributed across other tools such as Anki and Duolingo. These findings imply that embedding ARCS-aligned gamification techniques into RT curricula can meaningfully strengthen student motivation, engagement, and learning satisfaction, offering RT programs an evidence-based rationale for wider adoption of gamified instructional strategies.

Keywords: *Gamification, Game-based Learning, ARCS Model, Radiologic Technology Education, Student Motivation, Student Engagement*

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INTRODUCTION

Engaging students in the learning process can be challenging, especially in the present time when many students are intensely involved with digital technologies outside of formal learning. Several studies have shown that the longer students are motivated to learn, the more engaged they become in the learning process. Hence, more recently, there has been a surge of interest in exploring techniques that will motivate students to learn. One such technique is gamification.

In education, gamification has become one of the most notable technological developments for learner engagement (**Majuri et al., 2018**). Gamification uses game-related features or concepts in non-game contexts such as marketing or education (**Manzano-León et al., 2021**). It involves using game elements to make teaching and learning fun (**Torres-Toukourmidis et al., 2021**). According to **Cukurova et al. (2020)**, evaluating new technology platforms, such as games, is crucial in learning. It helps develop student potential and provides positive encouragement to boost performance (**Hamari, 2017**).

Although there are many related surveyed materials and studies conducted regarding gamification to explicitly understand and explore the different ways to enhance and better the teaching-learning process (**Zainuddin et al., 2020**), what remains the gaps are (1) the level of implementation in different educational levels, (2) the utilization and exploration of the game design elements in motivating students to be hooked in the activities, (3) scarcity of specific assessment and evaluation tools, and (4) the need for more assessment and evaluation studies on gamification in education (**Hamari et al., 2014**).

Extensive research has explored the implications of gamification in academia (**Yu et al., 2021**). While many studies have evaluated learning performance and outcomes of incorporating gamification in educational settings (**Bai et al., 2020**), several intriguing issues still need to be solved.

The existing literature has predominantly focused on gamification elements borrowed from specific gaming platforms, such as scores, badges, and leaderboards, which have been shown to affect learning performance and outcomes. However, these studies have overlooked crucial game elements like competitiveness, enjoyment, and challenge, directly and indirectly influencing learning effectiveness.

Moreover, although some studies have examined learning performance or learning outcomes, they have not fully considered learning effectiveness (**Van Roy & Zaman, 2018**). Including these elements can help develop a valuable tool for assessing the efficacy of learning technologies, such as online platforms or applications, and provide a comprehensive overview of students' achievements.

Beyond these gaps, broader literature underscores both the promise and complexity of gamification adoption. **Alomari et al. (2019)** synthesized evidence that gamification techniques such as badges and leaderboards can promote sustained student learning when appropriately designed, while **Filgona et al. (2020)** emphasized that motivation is foundational to any learning strategy, gamified or otherwise, since unmotivated learners rarely benefit from added game elements alone. From the educators' perspective, **Kabilan et al. (2023)** found that university academics view gamification as pedagogically valuable but report challenges in technology access, training, and workload that limit consistent implementation. Closer to the present context, **Medico et al. (2024)** reported that Filipino students exposed to digital gamification achieved better mathematics outcomes than those taught through traditional methods, reinforcing the relevance of gamification research within Philippine higher education. Further supporting this in the local context, **Feleo et al. (2024)** found that student teachers in Batangas perceived gamification—utilizing

platforms like Kahoot!—as a significant driver for increasing student participation, improving learning outcomes, and reducing subject anxiety, despite encountering implementation challenges such as technical limitations and time management constraints. These foundational findings across different Philippine educational settings highlight a growing consensus on gamification's motivational benefits, solidifying the need to investigate its specific application within specialized higher education fields.

The drive to innovate educational practices and produce highly motivated radiologic technologists aligns directly with the United Nations Sustainable Development Goals (SDGs), specifically SDG 4 (Quality Education). By exploring gamification to enhance student engagement, motivation, and learning effectiveness in higher education, this research addresses SDG Target 4.4, which aims to substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment and decent jobs **(United Nations, n.d.)**.

Therefore, gamification influences the growing trend in educational platforms and learning management systems, whereby several universities around the globe are taking advantage of it to deliver quality and equitable education for all **(Kheirkhahzadeh et al., 2016)**. **Tsay et al. (2018)** added that all applications and different ways of gamification in the learning experiences of the students are evolving, such as new plug-ins that have been developed to allow teachers to utilize content-rich materials accorded with game designs and mechanics **(Ke et al., 2019)** to make the discussion substantial and interactive. With this, traditional pedagogies, practices, and teaching methods have been revised and enhanced to make a more contextualized and personalized way of delivering classroom instructions **(Kim et al., 2018)**.

Gamification-based experiences impact basic and intermediate levels of education. They are gradually being incorporated into university environments **(Wiggins, 2016)** as a response to a demand to understand the learning processes of younger generations. Within this context, and framed around the Attention, Relevance, Confidence, and Satisfaction (ARCS) Model of Motivational Design, the present study investigates the role of gamification in the learning process among Radiologic Technology students enrolled at the College of Our Lady of Mercy of Pulilan Foundation, Inc.

Objectives

Generally, the study's problem is to investigate the role of gamification in Radiologic Technology students of COLM and assess such technology's impact on the learning process.

Specifically, this study will find answers to the following questions:

1. How do ready-made digital games impact the motivation of Radiologic Technology students to engage more deeply with their program?
2. How do integrating gamification techniques affect students' motivation to learn Radiologic Technology?
3. How do gamification techniques influence students' attention, relevance, confidence, and satisfaction in their educational process?
4. Does gamification enhance the educational journey of Radiologic Technology students?
5. Which gamification applications are most effective for Bachelor of Science in Radiologic Technology (BSRT) students?

METHODS

Research Design

This study aims to understand the significant role of gamification in improving and enhancing radiologic technology education at the College of Our Lady of Mercy of Pulilan, Inc. This study employed a mixed-methods approach (qualitative and quantitative) to systematically describe the role of gamification in radiologic technology education using survey data. The research design used in this study was a descriptive method. **Creswell and Plano Clark (2018)** explain descriptive research as the systematic procedure to outline a phenomenon, population, or situation in its natural state.

The researchers utilize a series of survey questions to gather data to support this research design, asking respondents how gamification influences students' engagement in participating in lectures and having the motivation to learn and study the topics related to the subjects included in the curriculum. For this data gathering, the researchers used stratified random sampling, where Parsons (2017) provides that it divides a population into subgroups, known as strata, based on shared characteristics to improve the precision of statistical estimates.

Population and Sample of the Study

The population of this study was the total number of 1st-year to 4th-year college students pursuing a Bachelor of Science in Radiologic Technology (N=745) and are currently enrolled at the College of Our Lady of Mercy of Pulilan Foundation Inc.

The researchers used Slovin's formula with a 0.1 margin of error, equivalent to 90% accuracy, to obtain a significant sample population of 89 respondents. These 89 respondents were divided based on the ratio of the number of students per year level: 40 first-year students, 25 second-year students, 14 third-year students, and 10 fourth-year students.

Research Instrument

The researchers used a survey questionnaire administered to the College of Our Lady of Mercy of Pulilan Foundation Inc. students pursuing a Bachelor of Science in Radiologic Technology. The questionnaire contains a combination of Likert questions and open- and close-ended questions. The survey questionnaire was adopted from the questionnaires developed by **Baah et al. (2023)** and **May (2021)**. The 4-point Likert scale ranged from: 4 – Strongly Agree, 3 – Agree, 2 – Disagree, 1 – Strongly Disagree.

Ethical Consideration

The researchers implemented research ethics that should be considered and referred to when each member conducts the study. The researchers respect the respondents' freedom and only gathered data if they are willing and approved. Private details regarding respondents are kept confidential, and the data gathered is only utilized for the study. It has complied with RA 10173, or the Data Privacy Act 2012.

Statistical Treatment

Verbal interpretation and ratio of observation were conducted through the use of the 4-Point Likert Scale Method. After the data collection procedures, the data were treated statistically using frequency and percentage.

Frequency (f) refers to the number of times a particular response, category, or value occurs within the dataset collected from respondents. Percentage (P) was used to measure the ratio of respondents' demographic profiles using the formula: $\% = (f/N) \times 100$, where f = frequency of the respondents and N = total number of respondents.

RESULTS and DISCUSSION

Table 1

Demographic Information of Radiologic Technology Students in terms of Sex

	Number of Students	Percent
Female	58	65.2
Male	31	34.8
Total	89	100.0

Table 1 shows the frequency of the respondent's demographic information regarding their sex. The results show a higher frequency in females, with 58 or 65.2%, while males have a frequency of 31 or 34.8% out of 89 total respondents.

Table 2

Demographic Information of Radiologic Technology Students in terms of Year Level

	Number of Students	Percent
First Year	40	44.9
Second Year	25	28.1
Third Year	14	15.7
Fourth Year	10	11.2
Total	89	100.0

Table 2 shows the frequency of the respondent's demographic information regarding their year level. The results show a higher frequency in First Year students, with 40 or 44.9%, followed by Second Year students with 25 or 28.1%, Third Year students with 14 or 15.7%, and Fourth Year students with 10 or 11.2% out of 89 total respondents.

Table 3

Motivation and Relatedness Statements Highest Frequency, Highest Percentage, and Verbal Interpretation

Item Statements	Highest Frequency	Highest Percentage (%)	Verbal Interpretation
The fun generated by the gamified course motivated me to study.	49	55.06	Agree
The activities in the gamified course motivated me to study.	57	64.04	Agree

Through the gamified course, I have made friends who relate to me and around whom I feel comfortable.	51	57.30	Agree
Through the gamified course, I can learn from peers and freely share my views with them.	54	60.67	Agree
Through the gamified course, I have a good connection with the lecturer, who supports me and looks out for me.	54	60.67	Agree

Table 3 shows the accumulated data gathered from the 89 respondents for the motivation and relatedness questions. The data for the highest frequency ranges from 49 to 57, and the highest percentage ranges from 55% to 64%. The verbal interpretation falls in the "Agree" category for all items. Hence, the motivation of the students and the connections to their colleagues are highly affected by the kinds of gamification incorporated in the program.

Table 4

Attention Statements Highest Frequency, Highest Percentage, and Verbal Interpretation

Item Statements	Highest Frequency	Highest Percentage (%)	Verbal Interpretation
The quality of the text helped to hold my attention.	49	55.06	Agree
The way the information is arranged on the pages helped keep my attention.	46	51.69	Agree
The variety of reading passages, exercises, illustrations, etc., helped keep my attention on the user instructions.	48	53.93	Agree

Table 4 displays the total data collected from the 89 respondents, primarily for attention-related questions. It depicts the highest frequency ranging from 46 to 49 and the highest percentage ranging from 51% to 55%, with the verbal interpretation falling into the "Agree" category. Incorporating different gamification techniques in the program makes the students more engaged so that they will pay more attention to the lessons presented by the lecturers.

Table 5

Relevance Statements Highest Frequency, Highest Percentage, and Verbal Interpretation

Item Statements	Highest Frequency	Highest Percentage (%)	Verbal Interpretation
It is clear to me that the contents of the gamified course are related to things I already know.	58	65.17	Agree
The contents of the gamified course convey the impression that being able to use the gamified course is worth it.	59	66.29	Agree
The gamified course will be helpful to me.	49	55.06	Agree

Table 5 shows the overall data gathered from the 89 respondents, particularly for relevance-related questions. It illustrates the highest frequency ranging from 49 to 59, as well as the highest percentage ranging from 55% to 66%, with the verbal interpretation falling into the "Agree" category. The several gamification technologies brought into the

curriculum significantly influence relevancy, strengthening and instilling the information that radiologic technology students should possess.

Table 6

Confidence Statements Highest Frequency, Highest Percentage, and Verbal Interpretation

Item Statements	Highest Frequency	Highest Percentage (%)	Verbal Interpretation
As I studied through the gamified course, I was confident I could learn well.	55	61.80	Agree
After studying in the gamified course, I was confident I could complete the exercises.	52	58.43	Agree
The good organization of the content in the gamified course helped me to be confident that I would learn well.	53	59.55	Agree

Table 6 shows the overall data gathered from the 89 respondents for confidence-related questions. It depicts the highest frequency ranging from 52 to 55. The highest percentages, ranging from 58% to 61%, fall in the "Agree" category. The different gamification techniques incorporated in classes greatly influence the students' confidence in learning.

Table 7

Satisfaction Statements Highest Frequency, Highest Percentage, and Verbal Interpretation

Item Statements	Highest Frequency	Highest Percentage (%)	Verbal Interpretation
I enjoyed the gamified course so much that I was stimulated to keep interacting with it.	58	65.17	Agree
It was a pleasure being part of the gamified course.	53	59.55	Agree
Completing the activities in the gamified course gave me a satisfying feeling of accomplishment.	57	64.05	Agree

Table 7 displays the total data from the 89 respondents, focusing on satisfaction-related questions. It illustrates the highest frequency range of 53 to 58, and the highest percentage ranges from 59% to 65%, with all falling into the "Agree" category. The satisfaction and enjoyment of the radiologic technology students towards learning are reached with the help of different gamification techniques incorporated into the program.

Table 8*Gamification Techniques Used by the Respondents*

Application	Percentage (%)
Quizlet	29
Quizizz	27
Kahoot	16
Gizmo	9
Others (Anki, Duolingo, Word Games, etc.)	19

Table 8 depicts the data obtained in response to the question, “*What application/s have you used for gamification and game-based learning?*” The largest amount, 29%, goes to those who utilize Quizlet as part of their game-based learning. Following that, 27% use Quizizz, 16% use Kahoot, and 9% use Gizmo. The remaining 19% use gamification tactics with five or fewer votes, such as Anki, Duolingo, word games, and other gamification approaches.

These preferences align with prior findings on individual gamified platforms. **Tóth et al. (2019)** found that Kahoot quizzes improved students' exam performance compared to non-gamified review methods, while **Wassalwa and Iffah (2022)** reported that Quizizz-based instruction similarly enhanced learning outcomes, corroborating respondents' favorable use of these tools in the present study.

Most respondents indicated that gamification is more interactive than traditional practices, while others noted that it boosts students' confidence and improves performance compared to traditional methods. Additionally, some respondents highlighted that a gamified system provides reliable results, helps assess learning capacity, and fosters collaboration, skill development, and problem-solving.

Despite some mixed opinions, gamification benefits radiologic technology students at the College of Our Lady of Mercy Inc. This is evident from the majority of responses falling under the “*Agree*” category in questions related to “*Motivation and Relatedness*” and “*Effects on Learning*.”

Theoretical Interpretation of Findings

Interpreted through the ARCS Model of Motivational Design, these results suggest that gamification operationalizes all four motivational constructs the model identifies. High agreement on Attention items indicates that gamified content design successfully captured and held learners' focus, while strong Relevance ratings suggest that respondents perceived the gamified material as connected to prior knowledge and future usefulness – both core levers of the ARCS framework. Similarly, elevated Confidence scores imply that structured, well-organized gamified tasks helped students build expectations of success, and high Satisfaction ratings reflect the intrinsic and extrinsic rewards (e.g., completion, recognition) that gamified activities provide. These patterns are also consistent with Self-Determination Theory (**Ryan & Deci, 2017**), which posits that motivation is sustained when learning environments support autonomy, competence, and relatedness; the Motivation and Relatedness findings in this study, particularly students' reports of stronger peer and instructor connections, align with the relatedness component of that theory. Taken together, the findings support rather than challenge both frameworks, reinforcing the argument that gamification is not merely an engagement tactic but a mechanism that activates well-established motivational principles in a Philippine allied-health education setting.

CONCLUSION

The study found a significant relationship between gamification and increased student motivation, focus, relevance, confidence, and overall learning satisfaction.

Based on the demographic profile of the respondents, the majority were first-year students with a frequency of 44.9% (40 students), while second-year students comprised 28.1% (25 students), third-year students 15.7% (14 students), and fourth-year students 11.2% (10 students). Additionally, more than half of the respondents were female, with a frequency of 58 students or 65.2%.

Participants agreed that the gamified course motivated them to study, kept them engaged, and helped them feel comfortable with peers and lecturers. Most respondents found the course content relevant, clear, and helpful to their learning journey, leading to an overall high level of satisfaction. This positive experience with gamification tools is further reflected in a survey on the use of gamification and game-based learning apps, where Quizlet emerged as the most popular at 29%, followed by Quizizz at 27%, Kahoot at 16%, and Gizmo at 9%.

Furthermore, the researchers concluded that gamification has the potential to enhance radiologic technology education for students at COLM significantly. While there are areas for improvement to increase its effectiveness, gamification proves to be a valuable teaching tool for BSRT students. Therefore, the hypothesis "*There is a significance of gamification in Radiologic Technology students' educational journey*" is accepted.

Based on the findings and conclusions presented, the researchers recommend that the College of Our Lady of Mercy of Pulilan Inc. increase the use of gamification in the Radiologic Technology program. Gamified learning has positively impacted student motivation, focus, confidence, and overall satisfaction. Additionally, the researchers suggest that the administration of the Allied Science Department continuously implement diverse gamification techniques relevant to course content and student needs, such as incorporating simulations and group activities. Providing additional training for instructors to manage gamified learning effectively enhances student interactions and learning outcomes.

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