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DESIGN OF ACADEMIC GAMIFICATION MODEL BASED ON MYERS-BRIGGS TYPE INDICATOR (MBTI) THROUGH PRE-EXPERIMENTAL DESIGN

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ABSTRACT

Aim/Purpose	This study identifies gamification element preferences based on Myers-Briggs Type Indicator (MBTI) characteristics. It measures the influence of preferences on learning motivation through a pre-experimental design of one group pre-test post-test.
Background	Incorporating information technology in education has led to the introduction of e-learning, potentially enhancing the learning process. However, adopting e-learning also brings about negative effects that can lead to frustration, confusion, and reduced learning motivation. One strategy that can be used to address this issue is gamification. However, it is essential to note that a universal approach to gamification is not practical as user needs vary. It can result in less-than-optimal learning outcomes. Thus, gamification settings must be tailored to the user's characteristics, such as those identified through the MBTI, to provide a more personalized learning experience.
Methodology	This study conducted pre-experimental research in one group, pre-test, and post-test, divided into several stages: problem identification, research instrument design, pre-data collection and analysis, treatment, post-data collection

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	and analysis, and evaluation. Pre-test and post-test were used to measure student motivation towards the gamification elements implemented. This study utilized the MBTI, Academic Motivation Scale (AMS), and gamification preferences questionnaire throughout the pre-data collection and analysis stage. For gamification preferences, this study employed 45 questions representing nine elements of gamification frequently used in training and education. Kendall Rank Correlation Coefficient was used to determine the correlation between MBTI and the gamification element from the gamification preferences questionnaire.
Contribution	This research contributes to the body of knowledge in gamification experiments by adding one step in recognizing gamification preferences. The practical contribution to this research is aimed at educators in maximizing Moodle by considering the gamification element preference recommendations based on the MBTI type.
Findings	The analysis revealed that the gamification preferences of fourteen MBTI types were predominantly associated with extrovert types. Collection and Leaderboard elements showed the highest correlation with MBTI. The effect of gamification was assessed during the treatment stage to evaluate its impact on learning motivation for the dominant MBTI type. Pre-test and post-test measurements of learning motivation show changes that are dominated by the intrinsic motivation dimension.
Recommendations for Practitioners	This research is valuable for offering guidance to educators and practical insights to developers into integrating gamification effectively by taking gamification preferences based on MBTI. Tailoring gamification elements based on MBTI creates a more engaging learning experience for every user, ultimately enhancing motivation for learning.
Recommendations for Researchers	This study contributes one step to experimental research, mainly focusing on the preliminary identification of gamification preferences based on MBTI. Using the gamification preferences, researchers can broaden the experimental scope and provide validation evidence from quantitative research. This approach supports the robustness of the recommendation gamification elements.
Impact on Society	This study presents findings on gamification elements aligned with MBTI characteristics. These findings can be used as strategies for implementing personalized gamification in e-learning to the diverse needs of students, fostering a more tailored learning ecosystem and ultimately advancing education.
Future Research	We could expand the identification of gamification preferences in various management learning media to explore the use of gamification elements. Further surveys can be done by increasing the number of respondents from other majors and universities so that more respondents can represent each type of MBTI. This addition will contribute to the data's characteristics, enabling a more comprehensive gamification preferences analysis. Conducting experiments involving adaptive learning media to align gamification with personality-based preferences, ensuring that the gamification experiences align with personality-based preferences. Multiple groups with varying treatments can carry out experiments that validate gamification preferences.

Keywords	gamification, MBTI, gamified personalization, academic motivation scale, e-learning

INTRODUCTION

Information technology supports education by enabling information, personalization, flexibility, portability, and on-demand access, as demonstrated through the implementation of e-learning. The transition from physically delivering materials to digital formats can lead to boredom due to the lack of interaction in the learning process. Inappropriate utilization of e-learning can cause frustration, confusion, and reduced interest in learning (Bachtiar et al., 2018). If the learning material is provided without considering the abilities, preferences, and best learning styles of the learner, the learning process of the individual will be disturbed (Khamparia & Pandey, 2018). Furthermore, it may have a negative impact on assignments and students' academic performance (Roslan et al., 2023). Therefore, it is vital to design engaging e-learning experiences (Hallifax et al., 2020). Gamification refers to using electronic games and integrating element games into the context of non-games (Treiblmaier et al., 2018). Gamification aims to increase motivation and reduce dropout rates (Hassan et al., 2021); increase interaction (de la Peña et al., 2021), participation, control behavior, and enjoyment (Oliveira Jordao do Amaral & Kang, 2021); and develop connections (Wang et al., 2022).

Students have different learning styles (Zaric et al., 2017); hence, learning experiences can be differentiated by identifying individual characteristics. Customizing game elements according to personal preferences is challenging, given that learners may have diverse preferences for games and motivation in learning (Hallifax et al., 2020). It also impacts motivation, whether intrinsic or extrinsic. In some cases, the reward element of gamification within the learning system encourages only extrinsic motivation (Hassan et al., 2021). Therefore, the application of gamification must be adjusted based on student characteristics. This notion is supported by the observation that the same game can have different consequences and responses for other users (Knutas et al., 2019).

The application of "one-size-fits-all" gamification is less practical than personalized gamification. It encourages further research to assess the efficacy of different combinations of gamification elements across diverse user traits, particularly concerning learning motivation (Oliveira et al., 2022). Using a personalized approach, gamification adapts to each user's characteristics and personalities, and enhances the experience and quality of learning activities (Fatahi, 2019). Hence, it is necessary to develop different gamification arrangements for individuals by considering their personal preferences based on their characteristics (Tsunoda et al., 2019). Previous research has explored student characteristic approaches such as Hexad Player Type, Brain-Hex, Big Five, Five-Factor Model (FFM), Myers Briggs Type Indicator (MBTI), and Felder-Silverman (Klock et al., 2020).

In the initial stages of this study, a literature review was conducted to explore personalized adaptive gamification, uncovering opportunities for research on gamification and MBTI (Rinjeni et al., 2022). The MBTI is based on four dimensions, resulting in a detailed of sixteen distinct personality types. As many as two million people use the MBTI to identify personality each year, and it has been identified by other researchers (Fatahi, 2019). Owing to its strong validity, this model has been widely recognized as a tool for predicting individual behavior and learning styles (Khamparia & Pandey, 2018). Nevertheless, the extensive scope of the MBTI also presents challenges for researchers, as seen in the study conducted by Khamparia and Pandey (2018), which focused only on the ESTJ and INFP types. The survey conducted by Fatahi (2019) indicated that future work might encompass more than 16 MBTI types because their research focused only on the ISTJ.

Several studies have conducted experiments on adaptive and personalized gamification based on a limited number of MBTI personality types. The gamification elements employed were drawn from previous research or assumptions, with no further identified preferences for gamification aligned with MBTI. Therefore, it is necessary to explore gamification elements for each MBTI type before implementing elements based on the MBTI. The purpose of this study is to identify gamification element preferences based on MBTI characteristics and measure the influence of preferences on learning motivation through a pre-experimental design one group pretest-posttest. This study formulates two research questions:

RQ1: What are the user's preferences for gamification elements based on MBTI characteristics?
RQ2: What is the influence of users' preferences for gamification elements based on MBTI characteristics on learning motivation?

The findings provide recommendations for the dominant gamification elements in the MBTI and verify the preference's effect on motivation through a pre-experimental design. Thus, the acquired preference outcomes can be verified in an actual learning environment.

LITERATURE REVIEW

Learning is a system encompassing diverse principles to elucidate how individuals acquire knowledge. Effective education demands constructive efforts in both delivering content and employing teaching methods. Games offer an attractive environment for activities while learning and achieving life goals and create a more captivating educational environment (Bakan & Bakan, 2018). Hence, the emergence of game-based learning plays a significant role in the educational process, integrating aspects of both games and learning (Zaric et al., 2021).

Game-based learning involves the use of games designed for educational purposes and enhances the learning experience by involving students in interactive game content. This content is centered around presenting students with problems and challenges, with the ultimate objective of better learning outcomes. The effects and results of game-based learning can be assessed through affective, motivational, behavioral, and cognitive learning outcomes. Success in designing game-based learning can be assisted by other theories, such as social cognitive theory, achievement goal theory, situated learning theory, and activity theory (Krath et al., 2021). Digital games can enhance student interest and improve learning outcomes, particularly in science education. Consequently, game-based learning should prioritize the theoretical foundation of educational games (Kao et al., 2017).

The use of educational games as a learning tool is a promising approach because it can reinforce not only knowledge but also critical abilities like problem-solving, cooperation, and communication (Yildiz et al., 2021). Gamification enhances game-based learning by integrating game elements into non-game contexts. Gamification represents a progression in the gaming industry, entailing the application of game concepts to diverse non-game domains (Rinjeni et al., 2020). Employing gamification in education seeks to enhance motivation (Hassan et al., 2021), elevate interaction (Bachtiar et al., 2018; de la Peña et al., 2021), bolster participation, regulate behavior, evoke pleasure (Oliveira Jordao do Amaral & Kang, 2021), attract interest (Aini et al., 2020), and foster engagement (Wang et al., 2022). Education can be gamified in physical classes or non-face-to-face learning presented by e-learning (Kao et al., 2017). In applying e-learning, it is crucial to understand the utilized media to effectively design suitable gamification strategies (Cuervo-Cely et al., 2022). The gamification strategies are also related to gamification elements that will be explored for media or tools.

A literature review focusing on personalized adapted gamification was conducted from 2017 to 2022 to identify the gamification elements in this study. The findings identified nine frequent gamification elements utilized in education, training, and teaching: points, levels, leaderboards, badges, progress bars, avatars, stories, collections, and time (Rinjeni et al., 2022). Points are numerical indicators that assess a player's performance (Rinjeni et al., 2022) or task completion (Hasan et al., 2019). Points were intended to measure success or achievement (Denden et al., 2018). Points can be accumulated or deducted with increments occurring when an individual completes an activity (Hassan et al., 2021), whereas points decrease when breaking or making mistakes (Smiderle et al., 2019). Levels represent the level of students in a course that provides a sense of progress (Denden et al., 2018). Levels can be realized in tiers with various difficulties (Ferro, 2018). Leaderboards serve as a platform to display and compare user achievements (Rinjeni et al., 2022) and show the highest score across all levels to foster a sense of competition (Denden et al., 2018). Leaderboards can be used as student ranking boards (Hasan et al., 2019) to facilitate students in enhancing themselves while fostering a spirit of

competition (Aljabali et al., 2020). Badges are virtual awards provided following the successful completion of an activity or special achievement (Rinjeni et al., 2022). These consist of visual representations or icons that players can acquire to execute an action or accomplish a goal (Ferro, 2018). Badges are self-boosting, fun, self-assessment, feedback, systematic, and ongoing (Saleem et al., 2022). The progress bar shows progress in learning activities (Denden et al., 2018) and indicates completed activities (Hasan et al., 2019). An avatar can be described as a space in which a student's photo or personalized image can be uploaded to a user profile (Denden et al., 2018). An avatar represents a player's vision in a game or gamification environment, which the player selects or creates (Xi & Hamari, 2019). The story can be interpreted as a narrative that accompanies a design and offers contextual depth to a gaming experience (Ferro, 2018). The story is also an essential part of gamification because it can change the meaning of real-world activities to game activities by adding narratives (Xi & Hamari, 2019). Collection can be interpreted as collectible items that are unnecessary (Ferro, 2018). Time refers to the allotted duration of quizzes or assignments to motivate students to complete their tasks promptly (Lavoué et al., 2019).

Previous studies on personalized gamification examined gamification features that were tailored to students' traits or learning styles to satisfy their demands. The individual learning process is disrupted if the learning content is delivered without knowing the learner's skills, preferences, and appropriate learning styles. None of the students had the same abilities, skills, interests, or learning styles. Learning styles can be identified based on the individual types or characteristics of the learner (Khamparia & Pandey, 2018). The MBTI recognizes individual characteristics based on four dimensions: extraversion/introversion (E/I), sensing/intuition (S/N), thinking/feeling (T/F), and judgment/perception (J/P). The MBTI has 16 specific dimensions based on combining these four dimensions, as illustrated in Figure 1 (Fatahi, 2019).

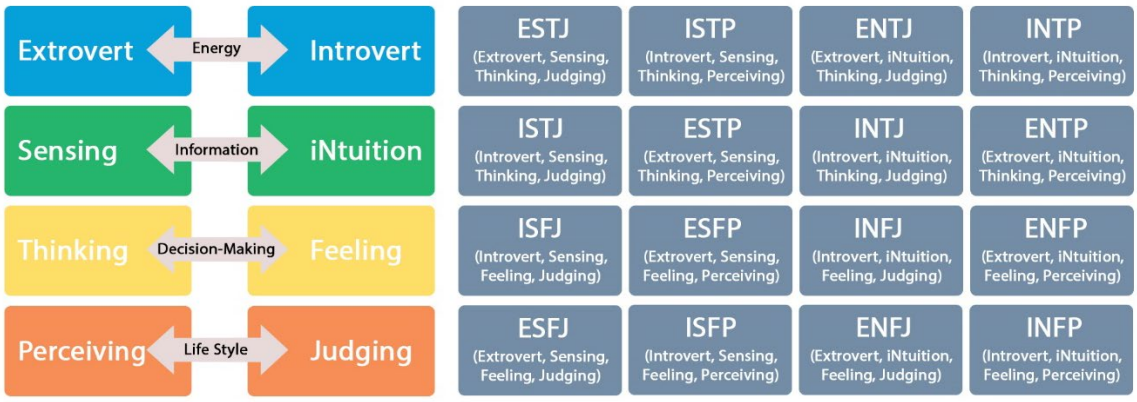

Figure 1. MBTI specific dimensions

Extraversion/introversion (E/I) distinguishes between reflexive and active information processing. Introversion is learned through personal experience. Extroversion learns through phenomena and expresses interpersonal communication (Zaric et al., 2017). Sensing/Intuition (S/N) categorizes students as detail-oriented, fact-seeking, or problem-solving, using established methods or standard approaches. Thinking/Feeling (T/F) defines thinking learners as focusing primarily on the logic and reasoning involved in solving problems in different situations. Judging/Perceiving (J/P) assessed how students solved problems or tasks. Owing to its robust validity, this model has gained widespread recognition as the most powerful tool used to predict individual behavior and learning styles (Khamparia & Pandey, 2018).

Shabihi et al. (2016) investigated the impact of different gamification elements on learning outcomes through a survey and experiment. The study clustered six elements of gamification based on four MBTI dimensions, including Point/Score, Leaderboard, Badges, Clear goal, Feedback, and Progress

to Vocabulary learning game, with 29 participants. This study demonstrates that adaptive learning enhances learning outcomes. However, the insignificant difference in outcomes between the experimental and control groups may be attributed to the small sample size and the brief duration of the experiment. This study presents comprehensive stages for identifying gamification elements based on MBTI. However, the results are limited to the identification of gamification elements based on the four MBTI dimensions and do not extend to the full spectrum of the MBTI personality types (Shabihi et al., 2016).

Fatahi (2019) compared a control group that utilized non-personalized gamification with an experimental group that employed personalized gamification tailored to the ISTJ type within an online course. OCC Model was utilized for the desirability variable in the gamification element progress bar, quiz, and hints. The results indicated that the experimental group achieved higher post-quiz scores than the control group. The experimental group exhibited a reduced utilization of hint elements designed to assist students in quiz completion compared to the control group. The determination of ISTJ preferences is based on general MBTI characteristics without an in-depth investigation following the limitation gamification elements (Fatahi, 2019).

Student performance in implementing gamification can be assessed across various aspects. One key factor is learning motivation (Berestova et al., 2022), which can be described as a tendency and intention of students to achieve a goal (Cuervo-Cely et al., 2022) with external or internal stimulation (Yildiz et al., 2021). The Academic Motivation Scale (AMS) serves as a motivational assessment instrument grounded in the principles of self-determination theory and has been extensively utilized across various countries (Marvianto & Widhiarso, 2018). Self-determination theory is one of the principles of learning (Bakan & Bakan, 2018). AMS can measure academic motivation for specific assignments (Hallifax et al., 2020). AMS was administered before and after implementing personalized gamification to assess participant motivation. The motivation assessment instrument was initially introduced in French as *Echelle de Motivation en Education* (EME), which was subsequently adapted into English as AMS (Vallerand et al., 1992). AMS evaluates the dimensions of motivation, which are divided into Intrinsic Motivation (IM), Extrinsic Motivation (EM), and Amotivation (AMO) (Berestova et al., 2022). Each of these dimensions identifies the reason for engagement in an activity (Lavoué et al., 2021). The measurement approach in AMS employs a questionnaire comprising four questions for each dimension. Intrinsic motivation (IM) consists of Intrinsic Motivation for Knowledge (IMTK), Intrinsic Motivation for Accomplishment (IMTA), and Intrinsic Motivation Stimulation (IMTE). Extrinsic motivation encompasses EM External Regulation (IR), EM Introjected Regulation (INR), and EM Identified Regulation (ER). AMotivation is a dimension that evaluates someone without intending to engage in an activity (Hallifax et al., 2020).

Hallifax et al. (2020) also conducted motivation measurements using AMS to examine three conditions in a mathematics learning experiment incorporating user characteristics based on the Hexad Player Type. This study utilizes LudiMoodle to design tailored gamification, including avatars, badges, progress bars, leaderboards, points, and timers. Motivation measurements before the experiment were administered in addition to a Hexad Player-Type questionnaire, both translated into French. This study calculated variations in IM, EM, and AMO as differences in motivation scores between the pre-test questionnaire (initial motivation) and the post-test questionnaire (final motivation). A combination of player type and initial motivation can result in a greater increase in intrinsic motivation and a reduction in amotivation. This research suggests that results may vary if applied to higher education levels; therefore, it is essential to explore gamification implementation strategies in greater depth (Hallifax et al., 2020).

Lavoué et al. (2021) analyzed and evaluated the relationship between learner motivation and the gamification learning environment using AMS. This study employed LudiMoodle (a customized version of Moodle) to incorporate elements such as avatars, badges, progress, ranking, scores, and timers to construct a gamification learning environment centered on fundamental algebra concepts. Applying

AMS measures initial motivation, final motivation, and motivation variation for each type. The implementation of different gamification elements has specific impacts on motivation. The achievement-oriented engagement was found to decrease intrinsic motivation, while perfection-oriented engagement led to an increase in extrinsic motivation and a decrease in amotivation. Due to the short experimental period of approximately six weeks, this study recommends conducting longitudinal research to gain a deeper understanding of student behavior (Lavoué et al., 2021).

RESEARCH METHOD

This study employs a pre-experimental design, one-group pre-test post-test, comprising three key stages: pre-test, treatment, and post-test. The research methodology in this study commences with identifying the problem and progresses through data collection and analysis in the post-test stage. The research methodology is shown in Figure 2.

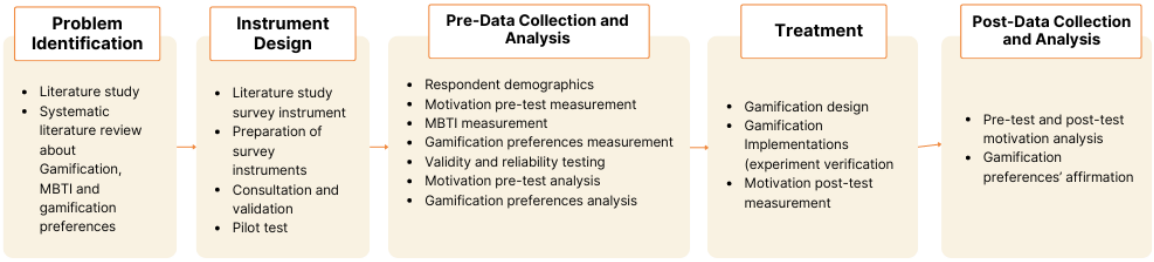

Figure 2. Research method

PROBLEM IDENTIFICATION

The initial phase involves identifying issues associated with implementing gamification in education. Based on the identification, static gamification is deemed ineffective due to variations in individual motivation and drivers, as highlighted by multiple studies (Hassan et al., 2021; Kang & Kusuma, 2020; Khamparia & Pandey, 2018). Consequently, several studies have focused on developing adaptive gamification, which can be tailored to individual users and is often called personalized gamification. A literature review was conducted to emphasize the application of gamification in education, focusing on user characteristics, gamification elements, and implementation (Rinjeni et al., 2022). Gamification elements, including avatars, points, badges, collections, leaderboards, levels, progress bars, points, stories, and time, are the most utilized elements, particularly in integrating e-learning. These elements are employed in this study to identify gamification elements aligning with MBTI preferences.

INSTRUMENT DESIGN

This research utilizes three instruments: the Academic Motivation Scale (AMS) Survey, the User Type Survey, and the Gamification Preferences Survey. All three surveys were administered before and after the treatment, and an AMS post-test was conducted. The AMS Survey and User Type Survey were modified to meet the research requirements, while the Gamification Preferences Survey was developed based on prior research concerning gamification implementation. Experiments in education require instruments that are valid and reliable (Cohen et al., 2007). This idea was also demonstrated in previous experiments including 29 participants, which used validity and reliability tests to assess the study questionnaire (Tossell et al., 2024); for this reason, surveys on AMS and gamification preferences are presented with reliability and validity values before the data is processed.

Academic Motivation Scale (AMS) Survey

AMS, previously known as EME, was translated into English and demonstrates adequate levels of internal consistency (mean alpha value = .81) and temporal stability over one month (mean test-retest correlation = .79) (Vallerand et al., 1992). Marvianto and Widhiarso (2018) adapted the AMS items

from Vallerand et al. (1992), conducting tests on 617 high school students in Yogyakarta. The adaptation of the 28 AMS items occurred in three stages: construct review, forward translation design, and psychometric testing. Psychometric testing yielded reliability values ranging from 0.73 to 0.90. Construct validity was obtained through correlation results among the seven AMS dimensions, indicating significant correlations across most dimensions. Endorsement values ranging from 3 to 5 were categorized as very good, and the standard deviation for all AMS items was quite good.

The preparation of AMS for this study followed the research conducted by Marvianto and Widhiarso (2018), who adapted the Indonesian version of AMS (Marvianto & Widhiarso, 2018). As part of the adaptation for this study, statements in AMS were modified to emphasize e-learning, ensuring that the motivation obtained aligns with the use of e-learning. The AMS comprises 28 items representing the seven dimensions in AMS, each rated on a scale ranging from 1 (strongly disagree) to 7 (strongly agree).

User Types Survey

Participants' personality types were measured using the MBTI questionnaire provided by NERIS Analytics Limited (2011). This MBTI questionnaire has been in development and distributed since 2011 and comprises 60 questions with response options ranging from 1 (agree) to 7 (disagree). The MBTI questionnaire is accessible in 30 languages, including Indonesian, which is the language utilized in lectures for the experimental classes in this research. The questions are in sequence, with six on each page representing the MBTI dimensions. The questionnaire outcomes will reveal the categorization of students into one of the 16 MBTI types. After participants have determined their MBTI type, they are requested to upload the results of the MBTI test to myITSClassroom.

Gamification Preferences Survey

The gamification preferences survey design began by gathering items survey related to gamification preferences, which are associated with nine gamification elements: points, levels, leaderboard, badges, progress bar, avatar, story, collection, and time. The questionnaire was formulated based on previous research that incorporated nine elements in gamification (Eisingerich et al., 2019; Feng et al., 2018; Jahn et al., 2021; Mora et al., 2019; Roosta et al., 2016). We formulated five survey items pertaining to points based on the studies conducted by Roosta et al. (2016) and Feng et al. (2018). In relation to the gamification element of level, we devised five items drawing from the research conducted by Eisingerich et al. (2019).

A survey item design concerning the gamification leaderboard element, utilizing the analysis of Statements analyzed per game design element proposed by Mora et al. (2019). Survey items related to the badge gamification element were devised, drawing from the development of questionnaire questions by Roosta et al. (2016). The survey items concerning the progress bar were designed based on studies by Roosta et al. (2016) and Eisingerich et al. (2019). The design of survey items for the avatar gamification elements was informed by studies by Feng et al. (2018) and Jahn et al. (2021). The survey items concerning the gamification element of the collection were formulated using principles from gamification aimed at enhancing customer engagement through rewards, as outlined in the research by Eisingerich et al. (2019). Survey items regarding the story and time gamification elements were designed based on the integration of gamification within Moodle myITSClassroom.

Forty-five questionnaire items were developed to represent the nine gamification elements and aim to facilitate the assessment of user preferences for each gamification element. Respondents completed the gamification preference questionnaire using a 7-point Likert scale ranging from 1 (indicating a negative response) to 7 (indicating a positive reaction). The respondents' demographic information included in this survey was collected to ascertain their gender, educational level, and current semester. Furthermore, the questionnaire included inquiries regarding weekly gaming and e-learning engagement frequency.

The pilot test was conducted on students who had utilized learning materials or e-learning incorporating elements of gamification or games to measure the AMS and Gamification Preferences. Validity and reliability assessments were conducted on pilot data, using R and Cronbach's alpha values for measurement. The pilot test outcomes from the Gamification Preferences Survey yielded validity values ranging from 0.583 to 0.938 and reliability values ranging from 0.678 to 0.936. Meanwhile, the AMS Survey yielded a validity range from 0.751 to 0.952 and a reliability range from 0.805 to 0.944. According to the validity and reliability results, all statements in the gamification preferences survey in the pilot test were valid and reliable, except those in the leaderboard element. Hence, face and content validity were conducted to review unclear questions, aiming to validate the provided suggestions.

The gamification preference questionnaire was improved by adding a description of each gamification element. This was done to facilitate the respondents' understanding of the gamification elements. Additionally, a preliminary explanation was added at the beginning of the questionnaire, which consisted of several sections corresponding to the number of gamification elements. Furthermore, improvements were made to several questionnaire items based on feedback from the respondents, with particular attention paid to the leaderboard.

PRE-DATA COLLECTION AND ANALYSIS

This study used survey data to gather information on the traits and gamification preferences of the participants. Participants were chosen using a purposive sampling technique, which means that samples were only collected if they met particular requirements. The population requirements are active students in the information systems department at Institut Teknologi Sepuluh Nopember who have used e-learning (MyITSClassroom) for more than one year. Before data collection, a research presentation was conducted in the second week, and the data collection approval was obtained. Based on the process, 32 students were eligible as the sample for this study. The study sample comprised 32 participants meeting the minimum experimental requirements, necessitating at least 15 participants (Cohen et al., 2007) or five respondents for each personality or construct (Oliveira et al., 2022). Consequently, after gathering MBTI-type data, various personality-type groups comprising at least five participants were chosen as constructs. These groups will be studied further through experiments to confirm the outcomes of gamification preferences. The three surveys were conducted in class using an online questionnaire completed by participants through a self-administered process. During 16 meetings, this study collected data using four instruments: AMS, demographic information, MBTI user type, and gamification preferences.

Participants' demographic information and personality types were subjected to descriptive analysis to reveal the distribution and characteristics of the participants. Validity and reliability tests were conducted to ascertain the accuracy and reliability of the AMS and preference gamification questionnaire, which validity was calculated to determine its significant correlation with the total score in r-value (Safitri et al., 2020) and reliability was gauged based on consistency. The consistency of the questionnaire under repeated administrations and similar conditions was assessed using Cronbach's alpha (Tondello et al., 2016). The recommended minimum Cronbach alpha values are 0.70 ($\geq$0.70) (Al-Rahmi et al., 2020; Celik et al., 2014; Durak et al., 2024).

Motivation was classified according to the total score within each AMS dimension. This classification system is based on the minimum and maximum scores, average values, and standard deviation. It is divided into five categories: very high (ST), high (T), medium (S), low (R), and very low (SR). Data from the MBTI personality types and gamification preferences were processed and analyzed to derive gamification preferences for each personality type. Data from the gamification preferences questionnaire underwent the Kendall Rank Correlation Coefficient statistical test to establish correlations between each gamification element. A Kendall coefficient value surpassing 0.20 (τ>0.20) was chosen to denote a significant correlation. Each gamification element is represented by five statements, and at least one statement requires a coefficient value exceeding 0.2 (>0.20) to determine gamification preferences (Mora et al., 2019).

TREATMENT

This study developed treatments through experimental verification to observe the analysis results from pre-data collection. The validation experiments focused on MBTI types that fulfilled the minimum number of experiments. In this study, gamification was integrated into the Moodle Learning Management System (LMS) according to the preferences of two primary MBTI types: ENFP and ESFJ. Gamification preferences for the dominant MBTI types (ENFP and ESFJ) include Levels, Avatars, Badges, Collections, Points, Leaderboards, and Time. Of the nine elements studied, only two were not preferred by the two MBTI.

Given that only two elements were not included in the dominant MBTI type preferences, this study incorporated these elements (story and progress bars) in gamification implementation. Consequently, this study applied all nine gamification elements. Therefore, this study incorporated data on the frequency of accessing gamification to determine the aspects significantly influencing the two MBTI types. Gamification elements are integrated by integrating learning media and face-to-face learning through the myITSClassroom. The MyITSClassroom platform allows lecturers to manage their online and offline learning processes. The intervention administered via myITSClassroom is evident in Table 1.

Table 1. Gamification implementation

Element	FITUR moodle	Implementation
Points	- Block Level Up - Resource file - Resource URL - Activities Assignment - Activities Quiz	- Open course (1 point) - Reading material (10 points) - Submit assignment (30 points) - Take quizzes or practice questions (30 points) - Received a certificate of appreciation (25 points)
Levels	Block Level Up	The default Moodle value determines the minimum point value (Massart, 2018). - Level 1 minimum 0 point - Level 2 minimum 120 points - Level 3 minimum 276 points - Level 4 minimum 479 points - Level 5 minimum 742 points - Level 6 minimum 1085 points - Level 7 minimum 1531 points - Level 8 minimum 2110 points - Level 9 minimum 2863 points - Level 10 minimum 3842 points
Leaderboards	Block Level Up	Participants are ranked based on the points earned, which are displayed on leaderboards. The leaderboards show the ranking, level, participant profile photo, name, total points, progress, and the points needed to advance to the next level.
Badges	Badges	- Badges are presented as rewards to users for specific accomplishments. The badges awarded include: - The Most Active Participants - The Most Active Group - Fastest Participant in Submitting Assignments - Fastest Group in Submitting Assignments - Best Group in Paper Assignments - The Highest Midterm Scores

Element	FITUR moodle	Implementation
Progress Bar	- Block Level Up - Block Course Completion	A bar or page shows participants' learning progress and accumulated points. It allows participants to track points, levels achieved, and the points needed to reach the next level. This progress bar displays their activities within myITSClassroom, including reading materials, completing assignments, taking quizzes, and other lecture-related tasks.
Avatar	Profile	Avatar is integrated into the user's profile image and is prominently displayed on the leaderboard element.
Story	Section	The story is incorporated via descriptions related to activities and learning objectives integrated within the course sections. The story is also presented in images to represent the learning progress visually.
Collection	- Custom Certificate - Activities Assignment - Activities Quiz	Participants will be rewarded with certificates for activities in myITSClassroom, which can be collected. The certificates awarded are as follows: - Certificate of Appreciation for Completing Quizzes - Best Paper Certificate - Certificated for High-Performing Groups
Time	- Activities Quiz - Activities Assignment	- Deadline for practice quizzes and mid-term exams - Assignment submission deadline

POST-DATA COLLECTION AND ANALYSIS

Following the implementation of gamification, students were given a post-test in the form of an AMS questionnaire in the final week of lectures to measure student motivation after implementing gamification on MyITSClassroom. The outcomes of this stage are discussed in the Results chapter.

RESULTS

This section presents the results of the questionnaire distribution for gathering participants' motivation and MBTI data. The validity and reliability of the data were tested.

DESCRIPTIVE ANALYSIS

The respondents in this study were dominated by 21 male respondents (65.6%), as there were only 11 females, representing 34.4%. Most respondents (28 respondents), were in the sixth semester (87.6%). The remaining respondents (12.5%) were in the eighth semester. According to the questionnaire results, among the 32 respondents, 19 accessed games weekly. This number was nearly equal to the number of respondents without access within a week (13 respondents). Nineteen respondents engaged in gaming activities each week: 15 were male, and the remainder were female. Among the 13 respondents who did not engage in gaming activities during the week, seven were female, and six were male. All the respondents utilized e-learning, which aligns with the fact that all respondents are currently pursuing active education. 34.4% of respondents access e-learning 3-4 times a week. Another 28.1% of respondents access e-learning 5-6 times a week. Interestingly, a smaller percentage, specifically 6.3%, access e-learning only 1-2 times a week. These statistics underscore the importance of engagement in e-learning to bolster learning motivation.

PERSONALITY

Based on personality type data, 14 MBTI types were identified from 32 participants. Of the 16 MBTI types, the two that were not represented by the participants were ISTP and ENTJ. According to the

MBTI results, 21 out of 32 participants were extroverted, while the remaining 11 were categorized as introverted. The ENFP and ESFJ personality types stand out as the most prevalent, collectively accounting for 5 participants, equivalent to a 15.6% representation. In contrast to Fatahi's (2019) findings, the ISTJ emerged as the predominant MBTI type among first-year students specializing in electrical and computer engineering. Other studies have explored ESTJ and INFP in the context of learning with visual maps (Khamparia & Pandey, 2018). This variation enriches gamification preferences based on various MBTI personality types.

Each statement in the gamification preferences questionnaire shows an r-count value ranging from 0.599 to 0.952, surpassing the r-table value of 0.349. These results indicate that all data related to gamification preferences are valid. Moreover, each gamification element exhibited a reliability value ranging from 0.794 to 0.934. These values exceed the accepted minimum threshold of 0.70, as recommended in prior studies (≥0.70) (Al-Rahmi et al., 2020; Celik et al., 2014; Durak et al., 2024). Notably, the reliability of the leaderboard element increases from 0.679 in the pilot test to 0.794 in the experiment, demonstrating that the questionnaire improvements have enhanced its reliability.

This study used Kendall Rank Correlation Coefficients to assess the correlation between the MBTI and game elements for gamification preferences. Kendall is calculated as the disparity between the number of value pairs that match and those that do not, normalized by the total number of pairs (Couso et al., 2018). $\tau>0.20$ is a threshold representing small correlations (Tondello et al., 2017). Based on the analysis of Kendall Rank Calculations, it becomes evident that certain gamification elements exhibit potential associations with specific MBTI types (gamification preferences). The number of statements refers to the number of questions with a coefficient value exceeding 0.2.

Table 2. Gamification preferences

MBTI	Gamification element preferences (number of statements)
ENFP	Levels (1), Leaderboards (1), Collection (1)
ESFJ	Avatar (5), Badges (3), Collection (3), Points (3), Leaderboards (2), Time (1)
INFP	Progress Bar (1), Collection (1)
ESFP	Avatar (5), Collection (4), Points (3), Badges (3), Time (3), Progress Bar (2), Leaderboards (2), Story (2), Levels (1)
ESTP	Levels (1), Leaderboards (1), Story (1)
ENFJ	Avatar (5), Leaderboards (2), Story (2), Collection (2), Points (1), Time (1)
ENTP	Avatar (2), Levels (1), Collection (1), Time (1)
INFJ	Leaderboards (3), Avatar (2)
ESTJ	Avatar (5), Points (3), Badges (2), Levels (1), Story (1), Collection (1)
INTJ	Points (2), Progress Bar (2), Story (2), Collection (2), Levels (1), Leaderboards (1), Avatar (1)
INTP	Points (2), Progress Bar (2), Time (2), Leaderboards (1), Collection (1)
ISFJ	Points (3), Badges (3), Levels (2), Progress Bar (1), Story (1)
ISFP	Avatar (5), Points (4), Collection (4), Badges (3), Levels (2), Leaderboards (2), Story (1)
ISTJ	Avatar (5), Badges (4), Collection (4), Points (3), Levels (2), Leaderboards (2), Story (2), Time (1)

Based on gamification preferences, every element correlates with the MBTI types. The element most correlated with the 14 MBTI types is Collection, which is associated with 11 MBTI types. In contrast, the Progress Bar element has a relationship with only 5 MBTI types. Extrovert participants have the highest correlation in the Collection, followed by levels, leaderboards, and avatars. Meanwhile, the

element that has a slight correlation with extroverts is the progress bar. Points, leaderboards, and collections significantly correlate with introverted participants, while introverts correlate less with time. A comparison of the number of correlations for each element is shown in Figure 3.

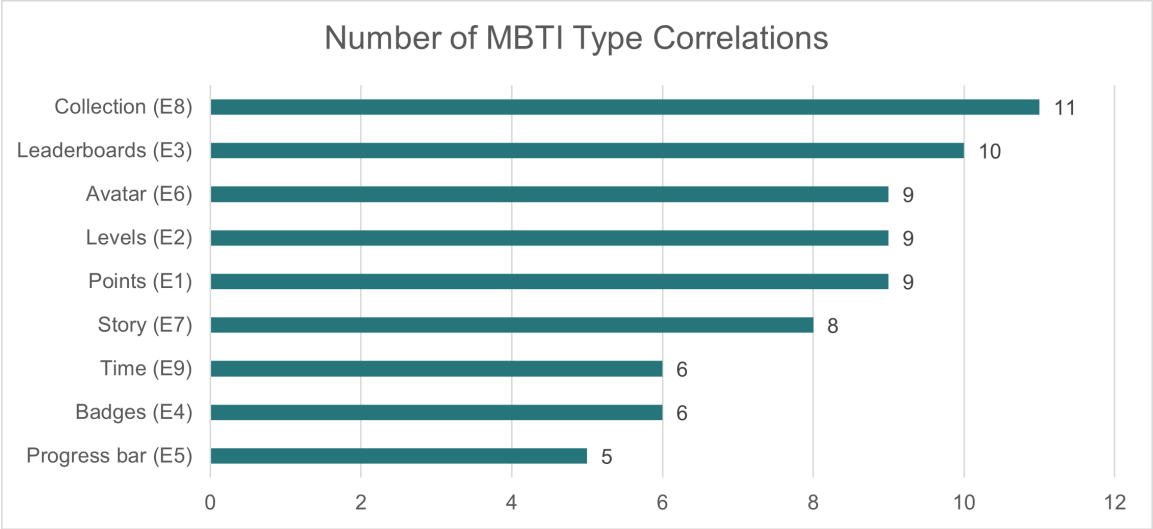

Figure 3. Number of MBTI type correlations

Avatar

Based on observations, five of the 32 participants incorporated avatars into their profiles. These participants included individuals with personality types ESFJ, ENTP, ESTP, ESTJ, and INFP. Based on the data obtained, four participants who used avatars were extroverts, while the remaining one was introverts. This demonstrates extroverts' attraction to avatar gamification elements, supported by Khamparia and Pandey (2018), who state that extroverts are action-oriented individuals who thrive in social interactions and actively engage in society. Extroverts excel in interpersonal communication (Zaric et al., 2017), so this observation suggests that extroverts are more inclined to use avatars to enhance their social presence and facilitate self-expression.

Badges

Participants were awarded badges based on their engagement during their activities. Six badges were designed using specific criteria to enhance participant motivation. Further information regarding the badges is described in Table 3.

Table 3. Badges implementation

Name	Description	Awardee	Badges
Fastest Participant	Badges for participants who complete specific tasks the quickest	ENTP (1), ISTJ (1)	

Name	Description	Awardee	Badges
The Most Active Participants	Badges for participants with the highest activity points in online lectures	ENFP (1), ESTP (1)	
Fastest Group	Badges for the fastest group in collecting group assignments.	ENTP (1), INFJ (1), ISTJ (1)	
The Most Active Group	Badges for active group in presenting specific group assignments.	ENFJ (1), ENFP (3), ENTP (2), ESFJ (3), ESFP (3), ESTP (2), INFJ (1), INFP (3), INTJ (1), ISFP (1), ISTJ (1)	
The Highest Midterm Scores	Badges are awarded to participants achieving the highest Midterm Scores	INFP (1)	
Best Group in Paper Assignments	Badges for groups demonstrating a commitment to completing and publishing the final assignment span the entire course duration from the first to the last week of lectures.	ESFJ (2), ESTP (1)	

Among the 14 MBTI personality types, 11 are awardees of badges, while the remaining three (ESTJ, INTP, and ISFJ) did not receive badges. Based on the Kendall Rank analysis, INTP does not have a minimum score in Badges. This study shows that INTPs demonstrate less interest in badges. However, this observation suggests further investigation, especially given the small population of INTPs in this study. Eleven MBTI types received the 'Most Active Groups' badges; six belonged to extroverts, while the remaining five were introverts. The MBTI personality types with the highest number of badges were ENFP, ESFJ, ESFP, and INFP. Among these, three of the four types with the Most

Active Groups' badges were extroverts, while one was introverted. This finding proves that extroverts derive greater enjoyment and motivation from badge implementation. In addition, sensing individuals may favor concrete goals and tangible incentives in gamification, such as badges (Adewale et al., 2019). As a result of this research, the sensing type possesses a significant number of badges. This finding aligns with Adewale et al. (2019), which suggests that badges are among the preferences of the sensing type.

Collection

The collection was implemented by giving certificates for assignments and completing quizzes. Participants who completed practice questions within the score material and passed a minimum score of 70 were eligible for a certificate. Details regarding certificate attainment are provided in the course materials section. An overview of the collection certificates for appreciation of the questions is presented in Table 4.

Table 4. Summary of acquisition collection certificate

Week	Number of recipients	Percentage (%)
7	23	71.87
9	22	68.75
10	19	59.37
11	15	46.87
12	20	62.50
13	19	59.37
14	19	59.37
15	17	53.12

Based on the summary of the collection recipients, it was noted that the number of participants receiving collections decreased from the 9th week to the 11th week. Following this result, the collection rate increased in the 12th week but decreased again in the 15th week. Based on class observations, this could be due to the students' decreased curiosity about this reward. In addition, among the various MBTI types, ISTJ, ENTP, INTP, INTJ, and INFJ exhibit notably high collection recipient percentages, ranging between 90-100%. This percentage was derived by dividing the number of collection awardees by the total number of participants within each MBTI type and then calculating the average across types. A diagram illustrating the average collection award for each MBTI is shown in Figure 4.

Levels

Ten levels were integrated into the classroom as determined by the accumulation of points. Participants can find the level information in the information section and leaderboard. Regarding the level system, the lowest attainable level for participants in the final week of the lecture was Level 8, whereas the highest possible level was Level 10. Detailed information on the application of the levels is shown in Table 5. Twelve MBTI types successfully attained Level 10, with the highest percentages achieved by ENFJ, ENTP, INFJ, INTJ, INTP, ISFJ, and ISTJ. Introverts dominate in obtaining the highest levels, suggesting their interest in the gamification element Level. Conversely, MBTI types ESTJ and ISFP did not reach Level 10 but attained Level 9. The summary of level achievements is shown in Table 5.

Based on the points obtained in week 16, 22 participants (68.75%) had reached the highest level, six participants (18.75%) attained Level 9, and 12.5% of the participants reached Level 8. These results confirm that the participants actively engaged in various classroom activities to accumulate points

and levels through level systems. It demonstrates that the level system effectively motivates participants of all MBTI types, which is supported by Adewale et al. (2019), who state that the level is not limited by the type of extrovert or introvert.

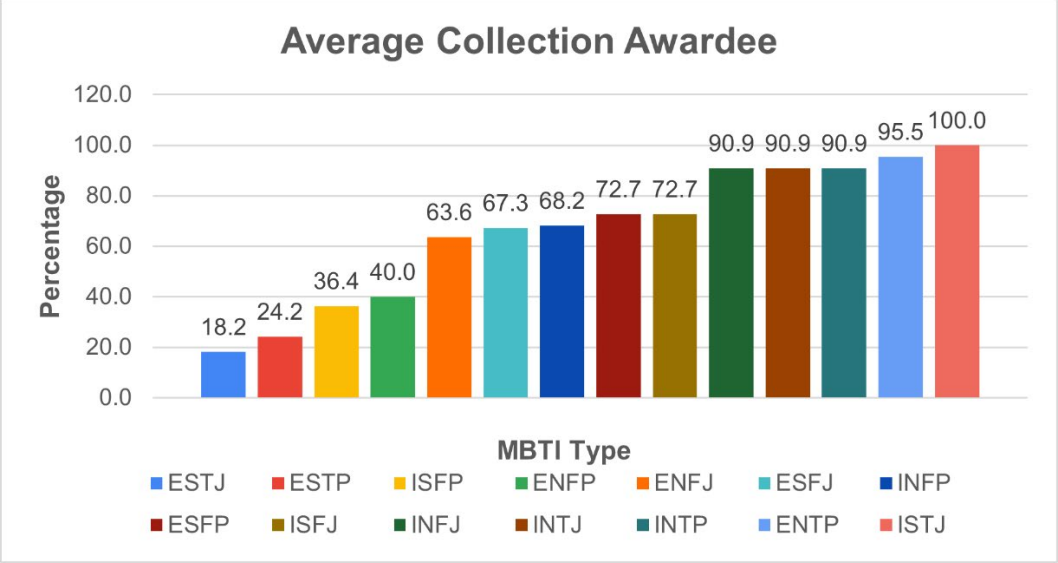

Figure 4. Average collection awardee

Table 5. Summary of level achievements

Level	Minimum XP	Number of participants	Percentage (%)
Level 10	3845 XP	22	68.75
Level 9	2863 XP	6	18.75
Level 8	2110 XP	4	12.5

Leaderboard

The leaderboard was updated automatically when participants received points from classroom activities. The leaderboard allows for real-time comparison of points earned among participants. This study presents a summary of the top 10 rankings in Table 6.

Table 6. Top 10 ranking summary

Ranking	Level	MBTI	XP
1	10	ESFP	5771
2	10	ENTP	5345
3	10	ESFJ	5089
4	10	INFJ	5053
5	10	ESFJ	4855
6	10	ESFP	4791
7	10	ESFJ	4726
8	10	ESFJ	4627
9	10	ENFP	4612
10	10	ISFJ	4501

Based on the top 10 rankings, 80% were dominated by extroverts, and the remaining 20% were introverts. It suggests that extroverts tend to enjoy leaderboard features within the classroom. The top 40% of rankings are dominated by the ESFJ type, which correlates with the leaderboard according to the Kendall Rank results. It implies that ESFJ individuals are interested in the leaderboard, as evidenced by 4 out of 5 ESFJ securing a place in the top 10 accumulation of points.

Points

Participants accumulated points through classroom activities. The participants' total points in the last meeting ranged from 2495 to 5711 XP. A summary of the participants' points earned is shown in Table 7.

Table 7. Summary of participant's points

Point range	Total participants	MBTI	Number of participants
5000-5711	4	ESFP	1
		ENTP	1
		ESFJ	1
		INFJ	1
4000-4999	15	ENFJ	1
		ENFP	3
		ENTP	1
		ESFJ	3
		ESFP	1
		ESTP	1
		INFJ	1
		INFP	1
		INTP	1
		ISFJ	1
		ISTJ	1

Regarding the summary of points obtained in the two highest point ranges, there were four participants in the range of 5000-5711. Three of the seven extroverted participants scored the highest points. Meanwhile, in the 4000-4999 range with 15 participants, 6 of 7 were extroverted, while the other were introverted. It demonstrates that both extroverts and introverts enjoy implementing point systems. Furthermore, four out of five ESFJ were in the two highest point ranges, whereas only two were for the ENFP type. This indicates that ESFJ participants tend to be more engaged with the point system than ENFP participants.

Time

Providing time limits for completing assignments and quizzes increases participation motivation. Participants could see the time counting down while working on the quiz on the quiz navigation. Incorporating a time limit for assignment submission deadlines was further reinforced by rewarding the fastest group and individual participants with badges. Badges are awarded to the ISTJ, ENTP, and INFJ. According to the Kendall Rank analysis results, both ISTJ and ENTP have minimum scores. Impressively, two out of the three recipients of badges are introverts. It highlights the characteristics of introverts, who tend to find motivation in applying the time element. Additionally, the time element aligns with the preferences of introverts, who are often motivated by activities that do not necessarily involve direct interactions with other participants.

Story

The integration of the gamification story element is manifested through descriptive narratives that accompany the various activities within each classroom section. Within the classroom section, comprehensive information regarding weekly lectures, materials, specific meeting objectives, and associated awards will be obtained. The application of story features in the classroom is illustrated in Figure 5.

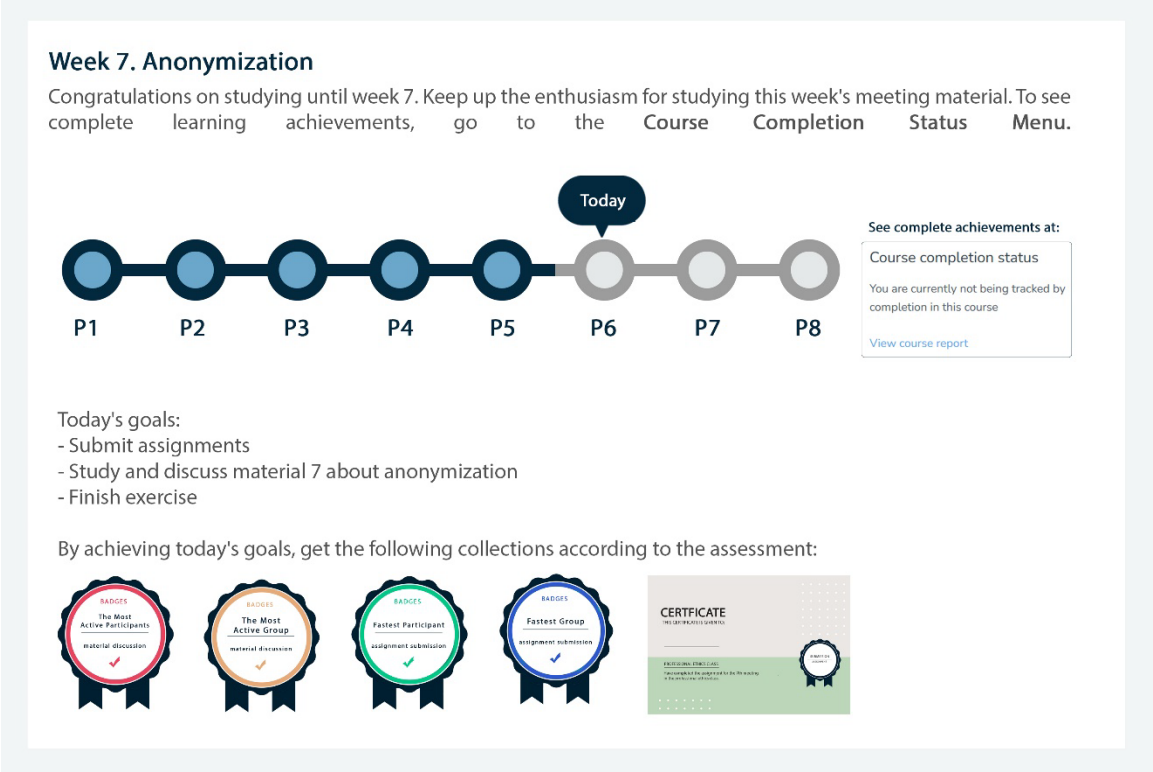

Figure 5. Story implementation

Progress Bars

The utilization of progress bar elements in the classroom environment is realized by tracking learning progress and course reports. Participants can readily access the current level, accumulated points, and the requisite points necessary to advance to the next level in the learning progress feature. Course reports comprehensively represented each participant's classroom engagement and activities. The system maintained a record of each participant's involvement in classroom activities, including completed and outstanding tasks.

Motivation Measure

Motivation assessments were conducted twice: before (pre-test) and after (post-test) the implementation of gamification (treatment). Validity tests applied to each dimension of the AMS Pre-test revealed that every statement achieved calculated r values within the range of 0.579 to 0.928, surpassing the r table of 0.349. These outcomes affirm the validity of all motivation data. Additionally, reliability values spanned from 0.744 to 0.904, all of which exceeded the accepted minimum threshold of 0.70, consistent with recommendations in previous studies (≥0.70) (Al-Rahmi et al., 2020; Celik et al., 2014; Durak et al., 2024), thereby confirming the reliability of all pre-test motivation data. Motivation data from each dimension were aggregated and subsequently categorized using hypothetical categories established based on minimum scores, maximum scores, averages, and standard deviations (Hafilia & Priyambodo, 2022). These categories were divided into five levels: very high (ST), high (T),

medium (S), low (R), and very low (SR). The percentage of participants exceeding a minimum of 75%, indicating a motivation dimension, can be inferred as increasing, decreasing, or remaining constant.

Based on the pre-test motivation data on each AMS dimension, very high motivation levels were detected in the Intrinsic Motivation for Accomplishment (IMTA). The second-highest level of motivation is found in Extrinsic Motivation External Regulation (IR). It suggests that among the 32 respondents, approximately 16 to 18 engaged in activities due to personal challenges and performed to prevent embarrassment or enhance self-esteem. In contrast, the post-test results reveal that motivation reaches a very high level in Intrinsic Motivation for Knowledge (IMTK) and Extrinsic Motivation Identified Regulation (ER). A pre-test and post-test motivation comparison was conducted to assess motivation variations within each AMS dimension before and after gamification implementation. Each MBTI type experienced changes in motivation across different dimensions. Therefore, this study presents the motivation dimensions for each MBTI type, as illustrated in Figures 6 and 7 for the extrovert and introvert dimensions. A summary of the comparison of categorization between the AMS pre-test and post-tests is presented in Table 8.

Table 8. Summary AMS categorization

MBTI	Decrease	Constant	Increase
ENFP	IR	-	-
ESFJ	-	IMTA, IMTK, AMO	ER
INFP	IMTA	AMO	-
ESFP	-	-	-
ESTP	-	-	-
ENFJ	INR	ER	
ENTP	IMTK, IMTA, ER	IMTE	-
INFJ	IR, ER	IMTK	-
ESTJ	IMTK, IR, INR, ER, AMO	IMTA, IMTE,	-
INTJ	ER	IMTK, IMTA, IMTE, IR, INR, AMO	-
INTP	IMTK, IMTA, IMTE, IR, INR, ER	AMO	-
ISFJ	ER, AMO	IMTA, IR	IMTK, IMTE, INR
ISFP	IMTK, IMTE	IMTA, IR, INR, ER	AMO
ISTJ	AMO	ER	IMTK, IMTA, IR, INR

The most significant decrease in motivation for IR was observed in 15 participants (46.88%). The smallest decline in IMTK and IMTE was 31.25%. Meanwhile, the most significant increase in motivation in IMTE and INR was nine participants (28.13%). The smallest increase in IMTA was 9.37%. Based on a comparison of participants' overall pre-test and post-test motivation, the percentage decrease was more significant than the percentage in motivation. Even though the percentage decrease in motivation is more important, this is also offset by the percentage of motivation remaining at 28.13%–46.88%. The AMO dimension has a different meaning because this dimension is a dimension that identifies a person's lack of motivation. Although the number of participants who remained motivated was quite large (50%), the percentage decrease (28.13%) was more significant than the percentage increase (21 reduction increase in overall motivation can be caused by a reduction of partici-

pants' interest in attending lectures). A comparison of ESTJ motivation following gamification implementation indicated no improvement, unlike installing interactive word puzzles, which can increase ESTJ learning motivation (Khamparia & Pandey, 2018). The comparison results reveal improved motivation for ISTJ, which aligns with Fatahi's (2019) findings, which used gamification elements such as progress bars, highlighted outlines, navigation bars, and time limits to boost ISTJ motivation (Fatahi, 2019). Based on the observations in the number of participants attending, it decreased when entering the last week of the lectures. The decrease in interest can also be caused by the burden of lectures and assignments, not only in professional ethics lectures but also in other lectures, which are generally becoming heavier as the last week of lectures approaches.

Motivation in ENFP and ESFJ

The assessment of the initial and final motivations for ENFP aimed to show the impact of gamification implementation. Initially, ENFP exhibited high motivation in the IR dimension. However, after implementing gamification, the greatest significant decrease in IR motivation was observed in four participants (80%). This implies that 80% of ENFPs lose the motivation to participate in activities for rewards or punishments. 60% of ENFP also experienced a decrease in IMTA, reducing the motivation to overcome challenges.

Meanwhile, 60% of the ENFP participants gained motivation in the IMTK. This implies that ENFP participate in activities, learn, and explore the enjoyment and satisfaction of experiencing something new. A total of 60% of ENFP managed to sustain ER motivation, signifying that this group engaged in activities to attain specific goals with deeper internalization. It leads the individual to recognize the value and importance of the behavior.

Upon comparing pre and post-test motivation for ENFP, the decrease in motivation was less than the percentage increase. Reduced motivation mainly occurred in the intrinsic dimensions, suggesting that intrinsic motivation might not effectively motivate the extroverted ENFP personality type. Conversely, increased motivation stems from an extrinsic dimension. This finding confirms that ENFP is inclined toward extrinsic motivation, consistent with extroverted traits. The elevated motivation resulted from ENFP's positive response to implementing Badges and Time gamification elements. Despite the higher percentage of decrease in motivation, the overall variance was not substantially different. The AMO dimension identifies an individual's lack of motivation. The percentage decrease in AMO was more significant than the constant and increasing motivation (60%). It signifies a decline in motivation levels. A comparison of the initial and final motivations for ENFP is shown in Figure 6.

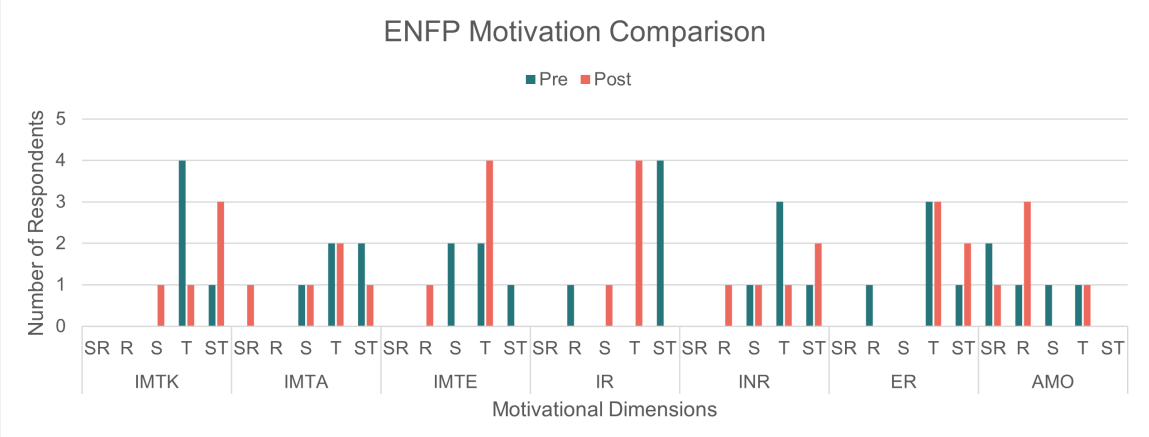

Figure 6. ENFP motivation comparison

The initial motivation test results indicated that the ESFJ exhibited motivation in the IMTK, IMTA, and IR dimensions. 60-80% of ESFJ maintains initial and final motivation on dimensions IMTK, IMTA, and IMTE. It suggests that the implementation of gamification may not significantly influence changes in intrinsic motivation in the ESFJ. 60% of ESFJ lost motivation in the IR dimension. This implies that the implementation of nine elements of gamification in the ESFJ can diminish the ESFJ's motivation to engage in an activity to attain some form of external reward or punishment. 80% of ESFJ successfully acquired ER motivation, signifying a motivation for achieving the correct goals, with a deeper internalization of behavior, leading to the individual feeling the value and importance of that behavior. The increased motivation in several AMS dimensions is driven by the enthusiasm of the ESFJ for gamification elements such as Badges, Leaderboards, and Points. A comparative graph illustrating the number of participants in each category within the AMS dimension of the ESFJ is shown in Figure 7.

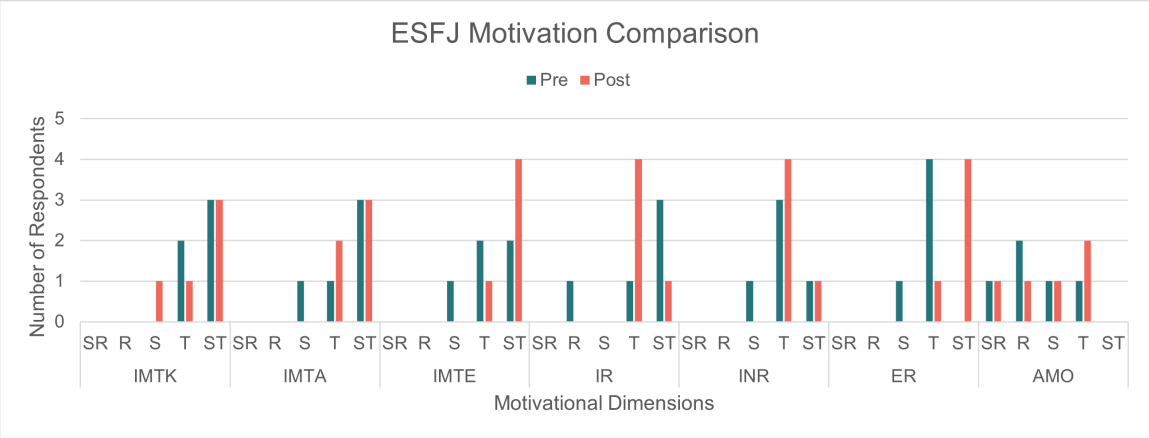

Figure 7. ESFJ motivation comparison

Analysis of Gamification Intensity and Motivation

Implementing these nine gamification elements has varying implications for each AMS dimension. These distinctions were employed to gather data on the frequency of accessing gamification for ENFP and ESFJ preferences. Each personality type exhibits distinct preferences with fluctuations in motivation across various AMS dimensions. To identify significant gamification preferences for AMS dimensions, data on the intensity of accessing gamification elements were collected to determine the most frequently accessed by ENFP and ESFJ. Data on the intensity of accessing gamification are illustrated in Figures 8 and 9.

Utilizing the ENFP intensity data on accessing gamification, it was found that 100% of ENFP engage with the Levels element. The intensity varies, with 40% accessing 1-2 times, another 40% accessing 3-4 times, and 20% accessing more than six times during lectures. However, one participant never accessed the leaderboard and collection elements. The highest intensity (40%) of accessing the leaderboard and level is 3-4 times.

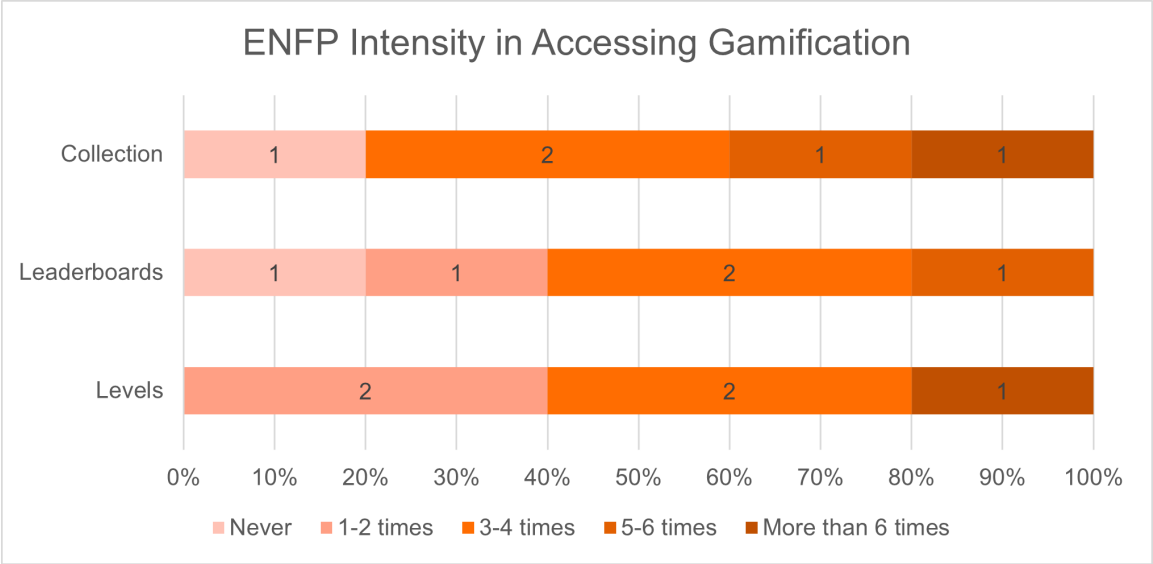

Figure 8. ENFP intensity in accessing gamification

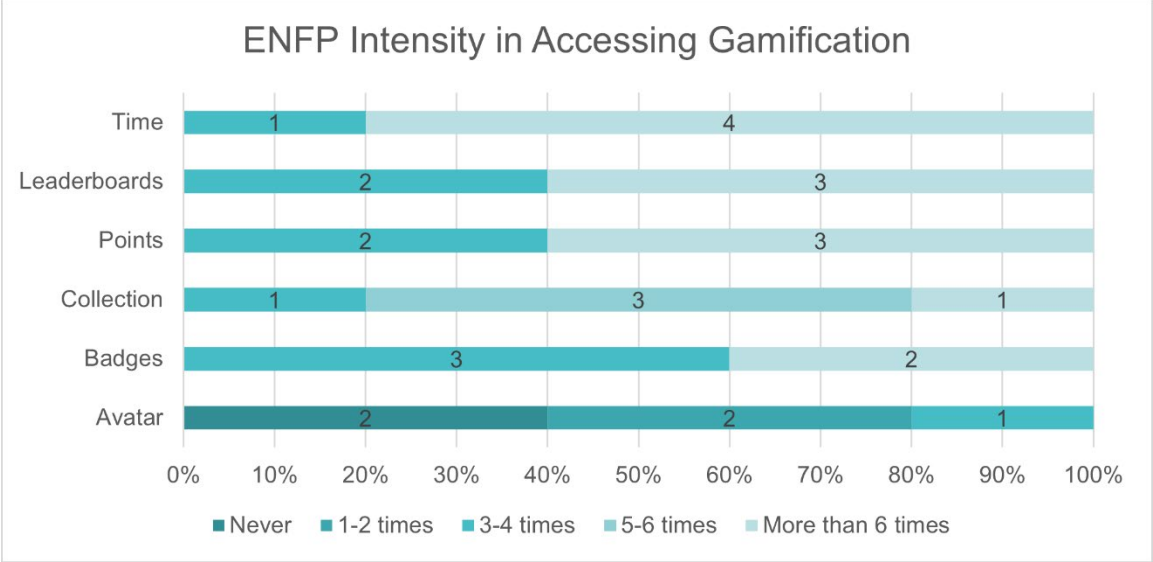

Figure 9. ESFJ intensity in accessing gamification

Based on data regarding ESFJ engagement with gamification, avatars are seldom accessed, as evidenced by 40% of ESFJ never accessing avatars. It is further supported by the fact that ESFJ did not change its profile photo in the myITSClassroom. In contrast, other elements such as Time, Leaderboard, Points, Collection, and Badges are accessed more than twice during lectures. The most frequently accessed element was time, with 80% of ESFJ participants engaging in time more than six times. The time limits of assignments and quizzes reinforce this intensity. Other frequently accessed elements include the Leaderboard and Points, with 60% of ESFJ accessing the leaderboard more than six times during lectures, as evidenced by the domination of the top 10 ranking by the ESFJ.

DISCUSSION

To investigate the gamification preferences of individuals based on MBTI personality type and validate the influence of these preferences on learning motivation, this study employed a pre-experimental design, one group pre-test, and a post-test. Thirty-two information systems undergraduate students, including 21 males and 11 females, participated in the experiment. Based on game-playing habits, 19 had a weekly gaming habit dominated by men, consisting of 15 males and the rest females. According to survey results, gaming activity is predominantly carried out by males, aligning with previous research by Mora et al. (2019), who also reported male dominance in gaming habits.

User preferences for gamification elements are based on MBTI characteristics (RQ1) identified by the preferences questionnaire. From preferences, the gamification questionnaire revealed the dominant elements for each MBTI type, identified by a Kendall rank correlation value above 0.2. These dominant gamification elements were used as preferences for each MBTI type and were then validated through student interactions with personalized gamification in e-learning to assess their impact on learning motivation (RQ2) focus on the dominant MBTI type. The outcomes from the user type survey indicate that the dominant MBTI types are ENFP and ESFJ, making these two types the focal point of the pre-experimental design. Investigating both ENFP and ESFJ enhances the understanding of gamification preferences, complementing previous research on ESTJ and INFP (Khamparia & Pandey, 2018) and ISTJ (Fatahi, 2019).

Levels, Leaderboards, and Collection have a Kendall Rank value above 0.2 for ENFP. The gamification application results demonstrate that ENFP can attain Level 10, indicating that Level is one of the preferences for ENFP. Approximately one in five ENFPs ranks within the top 10 on the leaderboard, with the remaining four placed 11th, 15th, 27th, and 32nd. This suggests that the Leaderboard could be among the preferences of ENFPs. The acceptance rate for the Collection is only around 40%, which is insufficient to establish a preference for ENFP.

To address RQ2, observations of interactions in myITSClassroom reveal an influence on motivation. Extrinsic motivation encompasses EM External Regulation (IR) in ENFPs decreases by 80%. IR refers to the drive to engage in activities to obtain internal satisfaction rather than external rewards (Lavoué et al., 2021) or punishment (Marvianto & Widhiarso, 2018). This suggests that the prizes or rewards, such as points, certificates, and badges, have not effectively stimulated ENFP motivation to enjoy the gamification application in myITSClassroom. The outcomes of gamification interactions do not align with a study conducted by Salajegheh (2022), which asserts that ENFPs exhibit better learning outcomes when engaged in active learning methods such as discussions, competitions, and instructional games. Variations in attributes like age can impact the utilization of games, where younger learners tend to favor enjoyable learning experiences, whereas older learners prioritize objectives beyond mere enjoyment (Hallifax et al., 2020).

According to Kendall Rank's results, Avatar, Badges, Collection, Points, Leaderboards, and Time have the minimum score for ESFJ. However, only one in four ESFJs utilize avatars. This does not support the ESFJ's preference for Avatar. Despite receiving two badges in categories such as The Most Active Group and Best Group in Paper Assignments out of six, this cannot confirm a positive preference between ESFJ and Badges. All ESFJs earned both of these badges, unlike ENFP, which had only four recipients. The findings indicate that ESFJ exhibits greater interest than ENFP, aligning with research by Shabihi et al. (2016), which asserts that Sensing (S) types are more interested in badges than Intuitive (N) types.

Approximately 63.7% of ESFJs received collection gifts during their participation in myITSClassroom, indicating a substantial positive relationship between ESFJ and Collection. This percentage is higher than ENFP, suggesting that ESFJ has a greater appreciation for the gamification element of

Collection than ENFP. Furthermore, four out of five ESFJs achieved points exceeding 4000, providing evidence of a positive relationship between ESFJs and Points. This relationship is further supported by four out of five ESFJs ranking in the top 10, not only ESFJ's positive association with Points but also leaderboard. Judging (J) type participants exhibit a more significant concern ranking than others, thus deriving more motivation from observing the Leaderboard (Shabihi et al., 2016).

ESFJ individuals have a structured personality, adhere to rules, and are inclined towards task completion (Salajegheh, 2022). It aligns with positive outcomes in ESFJ interactions and gamification elements. ESFJ is not among the personality types that are awarded badges for the fastest participation and group accomplishments. However, this alone does not provide sufficient evidence to determine whether ESFJ is related to time. A more in-depth investigation is necessary to establish the connection between ESFJ and Time, as the frequency of ESFJ's engagement suggests a notable intensity in accessing the Time element. The results from ESFJ interactions and gamification contribute significantly to ESFJ motivation, particularly regarding IMTK and ER. These interactions enhance the enjoyment and satisfaction of engaging in new activities, learning, and exploration. Notably, ER motivation in ESFJ increases by 80%, indicating a heightened drive to carry out activities with the specific aim of achieving the right goals (Lavoué et al., 2021) and encouraging a more profound internalization of behavior leads to the individual experiencing the value and significance of that behavior (Marvianto & Widhiarso, 2018).

The findings of this research for answers RQ1 and RQ2 offer valuable scientific insights into gamification and digital learning. The gamification preferences associated with each MBTI type (RQ1) enrich our understanding of MBTI characteristics, particularly in the context of e-learning implementation. These preferences help identify student characteristics, facilitating the adoption of more effective learning approaches and enhancing learning outcomes. Student preferences and learning styles are important factors for teachers to consider in ensuring a successful learning process (Aljabali et al., 2020). The stage of identifying gamification elements enhances the theory of experimentation by incorporating a step to identify user characteristics before experimenting. Educators have the capability to employ personalized adaptive gamification, tailoring it to suit individual student characteristics according to their personality types. This ensures that the applied gamification is more effective and positively impacts students. The influence of implementing gamification preferences on learning motivation (RQ2) assists educators in formulating learning strategies to enhance the learning environment and boost motivation for learning. Moreover, Gamification preferences can be applied to e-learning, not limited to Moodle, as demonstrated by the examples utilized in this research treatment. The study's findings can be used as strategies for implementing personalized gamification in e-learning to the diverse needs of students, fostering a more tailored learning ecosystem and ultimately advancing education.

Limitations and Future Research

Suggestions are aimed at considering future research based on current research processes and constraints. The first suggestion is to expand the identification of gamification preferences based on management learning media and not only on the Moodle Management Learning System. This study aimed to explore the maximum use of gamification elements. This increases the scope of gamification preference data so that the analysis of gamification preferences can be broader with more respondents and not just focus on one university. Thus, a larger number of respondents can represent each MBTI type. Experimental verification uses learning media that can be adaptive to gamification preferences so that the gamification enjoyed follows personality-based preferences. Experiments can involve two groups that are assigned different treatments to each experimental group. This supports the validation of gamification preferences.

CONCLUSION

This study identified gamification preferences based on MBTI characteristics by developing a questionnaire encompassing 45 questions. The gamification preference questionnaire represents nine gamification elements: points, levels, leaderboards, badges, progress bars, avatars, stories, collections, and time. This questionnaire underwent a pilot test, which resulted in a validity value of 0.751-0.95 and a reliability value of 0.805–0.944.

Gamification preferences based on MBTI characteristics were identified through a questionnaire involving undergraduate students focusing on ENFP and ESFJ. These preferences were ascertained by considering the Kendall Rank Correlation Coefficient values, each exceeding or equal to 0.2 for every MBTI type. Gamification preferences were validated through a pre-experimental design by observing student interactions with myITSClassroom. The impact of gamification on learning motivation by conducting a motivation test at the beginning and end of the experiment.

In the case of ENFP, there is an increase in motivation dimensions for Extrinsic Introjected Regulation (INR) and Extrinsic Motivation Identified Regulation (ER). However, there was a decrease in the motivation dimensions for Intrinsic Motivation for Knowledge (IMTK), Intrinsic Motivation for Accomplishment (IMTA), Intrinsic Motivation Stimulation (IMTE), and motivation (AMO). On the other hand, for ESFJ, motivation dimensions such as Intrinsic Motivation Stimulation (IMTE) and Extrinsic Motivation Identified Regulation (ER) show an increase. However, there is a decrease in motivation in the dimension of Extrinsic Motivation External Regulation (IR).

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APPENDIX

ACADEMIC MOTIVATION SCALE SURVEY INSTRUMENT

Dimension	Code	AMS items
Intrinsic Motivation for Knowledge	IMTK1	Because I experience pleasure and satisfaction while learning new things
	IMTK2	For the pleasure I experience when I discover new things never seen before
	IMTK3	For the pleasure that I experience in broadening my knowledge about subjects which appeal to me
	IMTK4	Because my studies allow me to continue to learn about many things that interest me
Intrinsic Motivation for Accomplishment	IMTA1	For the pleasure, I experience while surpassing myself in my studies
	IMTA2	For the pleasure that I experience while I am surpassing myself in one of my personal accomplishments
	IMTA3	For the satisfaction I feel when I am in the process of accomplishing difficult academic activities
	IMTA4	Because high school allows me to experience a personal satisfaction in my quest for excellence in my studies
Intrinsic Motivation Stimulation	IMTE1	Because I really like going to school
	IMTE2	Because for me, school is fun
	IMTE3	For the pleasure that I experience when I am taken by discussions with interesting teachers
	IMTE4	For the 'high' feeling that I experience while reading about various interesting subjects.
Extrinsic Motivation External Regulation	IR1	Because I think that a high school education will help me better prepare for the career I have chosen
	IR2	Because eventually, it will enable me to enter the job market in a field that I like
	IR3	Because this will help me make a better choice regarding my career orientation
	IR4	Because I want to show myself that I can succeed in my studies
Extrinsic Motivation Introjected Regulation	INR1	To prove to myself that I am capable of completing my high school degree
	INR2	Because when I succeed in school I feel important
	INR3	To show myself that I am an intelligent person
	INR4	Because I want to show myself that I can succeed in my studies
Extrinsic Motivation Identified Regulation	ER1	Because I need at least a high school degree in order to find a high-paying job later on
	ER2	In order to obtain a more prestigious job later on
	ER3	Because I want to have 'the good life' later on
	ER4	In order to have a better salary later on

Dimension	Code	AMS items
Amotivation	AMO1	Honestly, I don't know; I feel that I am wasting my time in school
	AMO2	I once had good reasons for going to school; however, now I wonder whether I should continue
	AMO3	I can't see why I go to school and frankly, I couldn't care less
	AMO4	I don't know; I can't understand what I am doing in school

GAMIFICATION PREFERENCES SURVEY INSTRUMENT

Gamification element	Code	Item in English
Points (E1)	E1.1	I am interested in achieving points rather than awards (medals/badges)
	E1.2	I feel motivated to do activities because I get points
	E1.3	I am happy when I can see my points earned
	E1.4	I love collecting points
	E1.5	I measure my competence with points
Levels (E2)	E2.1	I enjoy moving through levels
	E2.2	I feel motivated seeing my level increase
	E2.3	I feel motivated seeing my level above other users
	E2.4	I'm so excited to unlock new levels
	E2.5	I try very hard to reach new levels
Leaderboards (E3)	E3.1	I like leaderboards that are reset frequently in a period so that beginners are not at a disadvantage.
	E3.2	I was motivated by the leaderboards which displayed the ranking of all participants with different colored highlights
	E3.3	I like leaderboards that only display my friends' points
	E3.4	I feel satisfied surpassing the scores of other people who are ranked higher me
	E3.5	I would be happy if the leaderboard points I have can be shared with others.
Badges (E4)	E4.1	I try very hard to win awards and medals in competitions
	E4.2	I feel happy to receive badges
	E4.3	I feel more enthusiastic because I have certain badges
	E4.4	I like collecting badges
	E4.5	I am motivated to finish tasks/activities because I can earn badges.
	E4.1	I try very hard to win awards and medals in competitions
Progress Bar (E5)	E5.1	I want to see the progress of my lecture activity assessment achievements through the progress bar
	E5.2	I am happy when I can achieve something
	E5.3	I am more motivated when I see my progress through the progress bar
	E5.4	I like it when my learning achievements/progress are displayed/recorded with a progress bar
	E5.5	I feel helped to reach the next goals and targets with the progress bars

Gamification element	Code	Item in English
Avatar (E6)	E6.1	I enjoy seeing my reflection in avatar form
	E6.2	I am more excited to participate in learning with my avatar image
	E6.3	I enjoy having a character that fits my personality through an avatar
	E6.4	I feel connected to my avatar
	E6.5	I like to be known by others through my avatar
Story (E7)	E7.1	I feel motivated reading the narrative/instructions on what I should accomplish
	E7.2	It was made easier for me by having narratives/instructions regarding how I achieved my goals
	E7.3	I feel helped to carry out my activities by having narration/instructions
	E7.4	I enjoy the narration/instructions that create a competitive spirit in class
	E7.5	I feel more enthusiastic when reading narratives/instructions about my activities
Collection (E8)	E8.1	I like collecting items/gifts
	E8.2	I feel challenged to earn something for what I do
	E8.3	I am happy when I get something
	E8.4	I am more excited for the reward things
	E8.5	I enjoy getting awarded with a collection of gift items
Time (E9)	E9.1	I feel challenged to see the time limit
	E9.2	I believe I can manage my time when given a deadline
	E9.3	I was motivated to try faster by the time limit
	E9.4	I am happy when I see the countdown timer
	E9.5	I find it helpful to carry out activities/tasks with a time limit

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