Adoption Of Adaptive Gamified Learning Systems: A Push-Pool-Mooring Model Perspective

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Abstract: The adoption of digital learning systems is closely related to user engagement and system relevance. This quantitative research aims to explore the factors influencing students' switching intention from traditional Learning Management Systems (LMS) to a gamified LMS platform, using the Push-Pull-Mooring (PPM) framework. A conceptual model was developed to examine how negative experiences with previous systems (push factors), the appeal of a new gamified platform (pull factors), and personal constraints (mooring factors) influence switching behavior. The gamified LMS, named Learning Nova, was designed based on six types of goal orientation, enabling personalization according to students' motivational profiles. Data were collected through a two-stage process: an initial classification using a modified AGQ-R questionnaire, followed by a large-scale survey involving 1,054 university students from various institutions across Indonesia who interacted with the prototype. The findings confirmed the significant influence of both push and pull effects on switching intention. While mooring factors did not moderate these effects, they had a direct impact on students' decisions to switch. These insights offer practical implications for educational institutions and system developers seeking to enhance LMS adoption through motivation-aligned, gamified experiences.

Keywords: Gamified learning, Learning management system, Push-Pull-Mooring model, Goal orientation, Switching intention, Educational technology, Adoption

1. Introduction

The digital transformation in higher education, accelerated by the COVID-19 pandemic, has positioned Learning Management Systems (LMS) as the backbone of online learning. LMS platforms enable flexible distribution of course materials, assessment management, and interaction between instructors and students (Nguyen, 2021; Yuen, Cheng, Chan, 2019;Rau, Hösel, Roschke, Thomanek, Ritter, 2019) However, the widespread adoption of LMS has also revealed several fundamental issues, particularly concerning users' psychological experiences. Students often report stress, decreased engagement, and a loss of control over learning processes that are perceived as overly rigid and structured (Cao, Fang, Hou, Han, Xu, Dong, Zheng., 2020; Xue, Li, Xu., 2022; Lim, Regencia, Dela Cruz, Ho, Rodolfo, Ly-Uson, Baja., 2022). Consequently conventional LMS often fail to deliver learning experiences that are enjoyable, contextual, and meaningful.

One emerging approach to addressing these challenges is gamification—the integration of game elements into learning processes. Numerous studies have shown that gamification can enhance student motivation, engagement, and satisfaction, especially through features such as points, challenges, badges, and reward systems (Hamari, Koivisto, Sarsa., 2014; Khan, Ahmad, Malik., 2017; Robson, Plangger, Kietzmann, McCarthy, Pitt., 2015). However, the effectiveness of gamification is heavily influenced by individual student characteristics. When implemented uniformly without regard to user preferences and motivation, gamification may backfire, leading to boredom, competitive stress, or even manipulative behavior aimed solely at achieving higher scores (Saleem, Noori, Ozdamli., 2022; Almeida, Kalinowski, Feijo., 2021; Antonaci, Klemke, Specht., 2019).

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Therefore, an adaptive gamification approach that aligns with students' learning goal orientations is essential. Previous research has identified various student orientation types—such as mastery-intrinsic, mastery-extrinsic, performance-only, and non-achiever—that demonstrate different preferences for gamified elements (Hakulinen & Auvinen, 2014; Hakim Firdaus & Hendradjaya, n.d.). Even hybrid types, such as mastery ex-in, reflect the complex motivations that cannot be addressed through a single design strategy. This underscores the importance of LMS designs that respond to the emotional, motivational, and cognitive needs of students on a personalized level.

Previous work has developed a gamified LMS tailored to six student orientation types. However, a critical unanswered question remains: does the system actually encourage students to switch from their previous LMS to this new gamified version? This study specifically investigates students' switching intention toward the gamified LMS using the Push-Pull-Mooring (PPM) model through a multiple linear regression approach.

This study specifically investigates students' switching intention toward the gamified LMS using the Push-Pull-Mooring (PPM) model through a multiple linear regression approach. The PPM model is highly relevant as it offers a robust theoretical framework for understanding the interplay of three forces: Push factors (reasons to leave the old system, e.g., dissatisfaction) , Pull factors (attractions of the new system, e.g., features, ease of use) , and Mooring factors (psychological barriers or anchors, e.g., habits or emotional attachment). This application is supported by previous findings in related contexts, for example, studies indicating that perceived enjoyment and comfort positively contribute to switching intention, while prior learning experiences and habits serve as significant moderating factors (Lisana, 2023). In the Indonesian context, (Pramana, 2018) where perceived ease of use and usefulness are key determinants in technology adoption, a comprehensive understanding of how new LMS features are interpreted is crucial.

By testing an LMS prototype personalized based on six types of student goal orientations, this research addresses a literature gap by shifting the focus of the Pull factor from general usefulness to deep motivational alignment, a key driver of technology adoption. Thus far, no study has explicitly examined switching intention toward a gamified LMS using the PPM model that is grounded in user motivation orientation classifications. This research gap establishes the urgency of the present study—not merely to assess whether a gamified LMS is preferred, but to explore why and how students decide to transition from an old system to a new one within a framework that holistically considers technical, psychological, and motivational factors.

Based on survey data collected from 1,054 students, this study applies multiple linear regression analysis, this study aims to provide empirical contributions to the design of personalized, adaptive, and user-centered learning systems. Theoretically, it extends the application of the PPM model to the field of higher education and addresses a notable gap in gamified LMS literature, which has so far overlooked the complexity of users' goal orientations in system design and adoption strategies. This PPM application theoretically bridges the gap by integrating motivational segmentation as a personal and profound key driving factor (Pull Effect) in technology adoption studies.

2. Theoretical Background

2.1 Learning Management System

A Learning Management System (LMS) is defined as a web-based interface that facilitates the delivery of educational content, organizes learning procedures, and enables interaction between educators and learners. LMS platforms support online learning management through the integration of various e-learning modules and are commonly used to complement face-to-face instruction within blended learning models (Felea, Albastroiu, Vasiliu, Georgescu., 2018). Through functions such as discussion forums, self-assessments, and content management, LMS enables adaptive and structured digital learning approaches.

In the context of higher education, LMS has become a primary instrument for integrating technology into the learning process. It allows flexible and real-time access to course materials, supports two-way communication, and enables automated class management. However, the implementation of LMS also demands a higher level of technical competence and self-discipline from students compared to traditional classroom settings. This underscores the need to evolve LMS from being merely a content management tool into an interactive platform that actively fosters learning engagement. Studies in vocational education also emphasize the need for teachers to develop Technological Pedagogical Content Knowledge (TPACK) to optimize LMS usage in instructional delivery (Septian Ferdiansyah, Patmanthara and Suswanto, no date).

Furthermore, project-based and team-based approaches have gained popularity in vocational and applied science courses to improve students' collaboration and problem-solving skills in digital learning environments. The application of team-based project models in LMS settings has shown to significantly improve academic learning outcomes and student engagement (Patmanthara, Hidayat, Anugerah, Ichwanto., 2024). Likewise, the integration of collaborative tools within LMS supports not only content management but also deeper learning experiences through peer interaction and shared goal setting.

LMS typically operates within the framework of e-learning, which refers to the use of electronic devices to access educational content outside conventional classroom environments. E-learning formats include web-based learning, virtual classrooms, computer-based instruction, and digital collaboration through the internet, intranet, or other media (Fang, Li and Wu, 2023). In this context, LMS serves as a central component that coordinates content delivery, monitors participation, and measures learning outcomes.

Beyond content access, LMS-supported e-learning provides rapid feedback on students' learning activities and facilitates personalized learning pathways. E-learning–based LMS offers flexibility in time and location, improves access to up-to-date content, and incorporates advanced learning technologies. According to (Meskhi, Ponomareva and Ugnich, 2019), LMS enables the creation of adaptive and personalized learning environments, allowing students to develop customized learning solutions that suit their individual needs.

Nevertheless, many conventional LMS platforms are designed primarily for technical and administrative efficiency, rather than addressing the affective and motivational needs of users. Therefore, a new approach is needed in LMS development—one that integrates motivational principles such as gamification and is responsive to individual user characteristics, including their learning goal orientations. This is where the urgency arises for adopting gamification-based design strategies and evaluating students' switching intentions using the Push-Pull-Mooring model in this study.

2.2 Gamification in Education

Gamification refers to the application of game elements in non-game contexts, including education, with the aim of enhancing learners' motivation, engagement, and performance. This approach leverages psychological aspects that are inherently present in games—such as challenge, reward, immediate feedback, and a sense of achievement—to create a more engaging and interactive learning environment (Limantara, Meyliana, Gaol, Prabowo., 2022). Within the context of Learning Management Systems (LMS), gamification is integrated to bridge the rigidity of online learning with a more humanistic and participatory approach.

Gamification in LMS is implemented through the integration of various mechanisms such as points, badges, leaderboards, challenges, and real-time feedback. These elements are designed to stimulate intrinsic motivation and increase students' attention to the learning content (Hamari, Koivisto, Sarsa., 2014; Robson, Plangger, Kietzmann, McCarthy, Pitt., 2015). Practical implementations of this approach can be seen in applications like Kahoot!, Quizizz, and Wooclap, which successfully create a competitive and enjoyable atmosphere in online classrooms.

Moreover, gamification has been successfully applied in various learning models, such as flipped learning, where students engage with learning materials prior to face-to-face sessions. Research has shown that gamified flipped classrooms enhance student participation, intensify interaction with learning content, and improve academic achievement (Khaldi, Bouzidi and Nader, 2023). Even in technical fields such as biometrics, the integration of game elements into learning platforms has been shown to significantly improve the learning experience.

Gamification-based mobile learning designs have also demonstrated promising results in digital business education and other vocational contexts (Hidayat, Ulya, Patmanthara, Sari., 2024). Additionally, problem-based learning strategies using digital gamified modules have proven effective in enhancing outcomes in design and programming courses (Yusril Firmansyah, Patmanthara, Gatot Sutapa., 2022; Hidayat, Patmanthara, Tosepu, Sutikno, Wakhidah., 2021). Adaptive gamification platforms like "Learn Web Dev" further show the importance of user-centered design in vocational learning (Soraya, Patmanthara, Hidayat, Damayanti., 2024)

Nevertheless, the success of gamification in online education heavily depends on the careful selection, combination, and adaptation of game elements to suit learners' individual characteristics. Not all students respond positively to point systems or leaderboards; for some, competition may lead to pressure or demotivation. Therefore, adaptive gamification approaches—which align game elements with students' learning goal orientations—are receiving increasing attention in the development of motivation-based learning systems.

In this regard, gamification is not merely the addition of game-like features to educational systems, but rather a pedagogical strategy that is deeply integrated with instructional and psychological design. In this study, the gamification approach is directly linked to students' orientation profiles (e.g., mastery-intrinsic, performance-only, etc.) and its influence on students' switching intention toward a new LMS is evaluated using the Push-Pull-Mooring (PPM) framework.

2.3 Achievement Goal Orientation

The achievement goal orientation theory explains students' internal motives in directing their learning behavior. According to (Elliot and Church, 1997), goal orientation can be classified into several types: mastery-intrinsic (focused on mastering content for personal satisfaction), performance (focused on outcomes and recognition), and avoidance (aimed at avoiding failure). In this study, the classification is expanded into six types—super-achiever, mastery-intrinsic, mastery-extrinsic, mastery ex-in, performance-only, and non-achiever—to more comprehensively capture the diversity of students' learning motivations.

Adapting LMS design to these orientation types allows the system to be more responsive and relevant to users' needs. For example, students with a mastery-intrinsic orientation are more motivated by challenges and content exploration, whereas those with a performance-only orientation respond more positively to reward-based systems such as leaderboards or badges.

A recent systematic review has emphasized the importance of aligning gamification strategies with students' goal orientation types to improve academic performance and LMS engagement (Setyoadi and Patmanthara, 2024). Their review highlights that gamification, when tailored to students' dominant motivational profiles—such as mastery versus performance orientation—results in significantly higher satisfaction and persistence in online courses. The study also notes that mismatched gamification elements can inadvertently reduce learner engagement, particularly among students with avoidance or non-achiever orientations. Therefore, integrating gamification with goal orientation theory is critical to ensure meaningful and effective adoption of gamified LMS platforms.

2.4 Push-Pull-Mooring (PPM) Model in Evaluating LMS Switching Intention

The Push-Pull-Mooring (PPM) model was originally developed by (Bansal, 2005) in the context of customer migration studies and has since been adapted in various technology-related research, including online learning environments. The adaptation of the PPM model has been further extended by (Hou, Chern, Chen, Chen., 2011; Xu, Wang, Tai, Lin., 2021;Lin, Jin, Zhao, Yu, Su., 2021) in studies related to online and mobile learning system adoption.

This model explains switching behavior—or users' intention to move from one system to another—by analyzing three main categories of factors: push, pull, and mooring.

Push Effect

In this study, the push effect refers to the negative conditions perceived by users in the current system, which drive their desire to abandon it. In the LMS context, push factors may include perceptions of low service quality, inconvenient interface design, lack of interactive features, and technology-related frustration. These factors lead to user dissatisfaction with the legacy LMS (Chen & Keng, 2019; Xu, Wang, Tai, Lin., 2021).

Pull Effect

The pull effect is associated with the attractiveness of the new system that encourages users to switch. This attraction may stem from superior features, ease of use, technological compatibility with users' needs, higher user satisfaction, and enhanced motivational or experiential elements. In a gamified LMS, pull factors may include features aligned with students' learning needs and goal orientations, such as leaderboards, challenges, and adaptive reward systems (Alarifi, n.d.; Pramana, 2018).

Mooring Effect

The mooring effect refers to factors that inhibit or moderate the switching process, often related to psychological, social, or habitual barriers. These may include emotional attachment to the current system, loyalty to the institution providing it, or entrenched learning habits. The mooring effect helps explain why users may remain with an existing system despite the availability of better alternatives (Lisana, 2023; Pahnila, Siponen, Zheng., 2011).

The PPM model offers a comprehensive framework for explaining the dynamics of switching intention and has been widely applied in various domains, including banking, telecommunications, and online education. In this study, the model is used to evaluate how perceptions of the existing LMS, perceptions of the new gamified LMS, and psychological resistance influence students' intention to switch.

2.5 Previous Studies

Previous studies have extensively explored the integration of technology in education, particularly using Learning Management Systems (LMS), gamification approaches, and technology adoption models such as the Technology Acceptance Model (TAM), the Unified Theory of Acceptance and Use of Technology (UTAUT), and the Push-Pull-Mooring (PPM) framework for analyzing switching behavior. In digital education contexts, gamification is frequently employed to enhance students' motivation and engagement, while PPM is applied to explain users' transition from one system to another based on push forces, pull attractions, and mooring inhibitors.

The review of 27 relevant prior studies (summarized in Table 1) reveals several key trends and divergences:

Table 1: State of the Art Research on LMS, Gamification, and PPM

No.	Year	Author	Research Focus	Method
A1	2021	(Manzano-León *et al.*, 2021)	Gamification in Education	Literature Review
A2	2020	(Smiderle *et al.*, 2020)	Gamification in Education	Empirical Study
A3	2020	(Dichev, Dicheva and Irwin, 2020)	Gamification in Education	Systematic Review
A4	2023	(Khaldi, Bouzidi and Nader, 2023)	Gamification in e-learning	Literature Review
A5	2022	(Limantara, Meyliana, Gaol, Prabowo., 2022)	Design Gamification in LMS	Model Development
A6	2019	(Lolo, Pratama, Mufarih, Wang., 2019)	Gamification in LMS	Empirical Study
A7	2022	(Limantara, Meyliana, Gaol, Prabowo., 2022)	Gamification in education	Systematic Review
A8	2023	(Alarifi, no date)	Switching Intention with PPM in online learning systems	Structural Equation Modeling
A9	2023	(Lisana, 2023)	Switching Intention with PPM in Mobile Learning	Quantitative Survey
A10	2022	(Wang and Shin, 2022)	Usage Intention with TAM & PPM in metaverse education application platform	Model Integration (TAM & PPM)
A11	2018	(Chen and Keng, 2019)	PPM, explores users intention english learning platform	Survey & SEM
A12	2021	(Xu, Wang, Tai, Lin., 2021)	Switching Behaviour Online Learning Platform with PPM	SEM Analysis
A13	2021	(Raharjo, Handayani and Putra, 2021)	Designing a Gamification of E-learning Applications	Design Research
A14	2020	(Facey-Shaw, Specht, van Rosmalen, Bartley, Bryan., 2020)	Badges affect intrinsic motivation	Experimental
A15	2019	(Karmanova, Chernova and Dokolin, 2019)	Gamification in e-learning technology	Literature Review
A16	2019	(Sriratnasari, Wang and Kaburuan, 2019)	Gamification framework in LMS	Framework Design
A17	2020	(Moreira, Ferreira, Escudero, Pereira, Durao., 2020)	Teaching & learning with gamification	Case Study

No.	Year	Author	Research Focus	Method
A18	2022	(Zhao, Playfoot, De Nicola, Guarino, Bratu, Di Salvadore, Muntean., 2022)	Gamification framework for STEM	Framework Development
A19	2018	(Chen, Huang, Gribbins, Swan., 2018)	Gamified online course	Course Evaluation
A20	2022	(Venter, 2022)	Influence of gamification element in online learning platform	Quantitative Study
A21	2023	(Shayan, Rondinelli, Zaanen, Atzmueller., 2023)	Analysis User Acceptance LMS	Survey Analysis
A22	2020	(Wicaksono, Cholily T, Juliani N, Asrini T, Wahyuni R., 2020)	Analysisis Feature LMS	Feature Analysis
A23	2023	(Modirrousta-Galian, Higham and Seabrooke, 2023)	Effects of inductive & gamification	Mixed Methods
A24	2020	(Panagiotarou, Stamatiou, Pierrakeas, Kameas., 2020)	Gamification e-learning acceptance with TAM	TAM Analysis
A25	2019	(Klock, Gasparini and Pimenta, 2019)	Quantitative & qualitative analysis: gamification for e-learning	Quantitative & Qualitative
A26	2020	(Sanjaya, Ferdianto and Titan, 2020)	Developing gamification mobile application	App Development
A27	2018	(Pramana, 2018)	Adoption Mobile learning with UTAUT & TAM	UTAUT & TAM Analysis

- **Gamification and Motivation (LMS):** Studies confirm that gamification elements (points, badges, leaderboards) positively affect student motivation and engagement (**A1, A2, A3**). However, a critical line of inquiry highlights that gamification's effectiveness is often **context-dependent** and heavily influenced by individual psychological characteristics, suggesting that a one-size-fits-all approach may fail or even demotivate certain learners (**A4, A7**). This divergence underscores the need to align system design with deeper user traits.
- **Switching Intention (PPM):** The PPM model has proven robust in explaining technology migration across various domains, including online learning systems (**A8, A9, A12**). **Alarifi (A8)** and Xu, Wang, Tai, Lin, **(A12)** consistently find that the perceived quality of the new system (Pull) and dissatisfaction with the old one (Push) are significant drivers. However, studies applying PPM in educational technology often overlook the complexity of the *system itself*. For instance, **Wang & Shin (A10)** integrated TAM and PPM but focused on a general metaverse platform, not a personalized, motivation-driven LMS. This indicates that while the mechanism of switching is understood, the content/design factors (like adaptive gamification) driving the Pull remain largely generic.
- **The Goal Orientation-Gamification Gap:** Research on the design and development of gamified LMS exists (**A5, A6, A16**), alongside studies focusing on the importance of aligning gamification with students' goal orientation (e.g., mastery vs. performance) to maximize persistence and satisfaction (**A14, Setyoadi & Patmanthara**). **Facey-Shaw (A14)**, for example, demonstrated that badges affect intrinsic motivation, which is directly relevant to mastery orientation. However, these two streams—the design/effectiveness of personalized LMS and the analysis of switching behavior (PPM)—have yet to be synthesized. Most PPM studies on e-learning focus on perceived ease of use and usefulness (TAM factors) as Pull effects, rather than deep motivational alignment.

To date, there is a notable lack of research that holistically integrates a personalized gamified LMS design based on students' goal orientation with a rigorous measurement of switching intention using the Push-Pull-Mooring (PPM) model.

This study aims to fill this critical knowledge gap by offering an empirical analysis of how the push factors of the traditional LMS, the motivation-aligned attractiveness (Pull) of a new gamified system, and personal inhibitors (Mooring) influence students' intention to switch. By explicitly classifying and accommodating six types of achievement goal orientations in the LMS prototype, this research moves beyond generic Pull factors and

provides a deep, empirically-tested understanding of motivational alignment as a primary driver of technology adoption and migration in higher education.

3. Theoretical Model and Hypotheses Development

This study adopts the Push-Pull-Mooring (PPM) framework to examine the factors influencing students' switching intention from a conventional LMS to a gamified LMS that has been personalized based on their achievement goal orientation types. Each construct in the model is developed from prior literature and adapted to the context of digital learning.

3.1 Push Effect

The push effect represents negative conditions that drive users to leave their current system. In this study, the push effect includes two main constructs:

- Service Quality: Adapted from (*Journal of Management Information Systems*, 2003), this measures students' perceptions of the service quality of the legacy LMS, including system reliability, access speed, and information accuracy.
- Learning Comfort: Adapted from (Lu and Wung, 2020), this refers to students' comfort in using the traditional LMS, including interface design, navigation ease, and interaction usability.

Hypothesis 1 (H1): The Push Effect (perceived discomfort and low service quality of the previous LMS) has a significant positive influence on students' intention to switch to a new LMS.

3.2 Pull Effect

The pull effect reflects the attractiveness of the new system that encourages users to make a switch. In this study, the pull effect includes the following constructs:

- Motivation: Referencing (Afacan Adanır and Muhametjanova, 2021), this measures the ability of the new gamified LMS to foster student motivation through gamification features.
- Challenge: Adapted from (Al-Hunaiyyan, Alhajri, Al-Sharhan, AlGhannam., 2021), this measures the extent to which the new system provides academic challenges that drive engagement.
- Perceived Ease of Use: Derived from (Pramana, 2018) and rooted in the TAM model, this assesses how easy the new LMS is to use.
- Task-Technology Fit: Based on (Alyoussef, 2021), this measures how well the LMS features align with students' learning needs.
- Satisfaction: Adapted from (Chao, 2019), this measures user satisfaction with the experience of using the new LMS.

Hypothesis 2 (H2): The Pull Effect (positive perception of the new LMS features and user experience) has a significant positive influence on students' intention to switch from the old LMS.

3.3 Mooring Effect

The mooring effect serves as a moderating variable that can either strengthen or weaken the relationship between push/pull effects and switching intention. The mooring constructs in this study include:

- Affective Commitment: Adapted from (Xu, Wang, Tai, Lin., 2021), this measures students' emotional attachment to the existing LMS.
- Habit: Adapted from (Pahnila, Siponen and Zheng, 2011), this reflects students' habitual use of the old LMS formed through routine behavior.

Hypothesis 3 (H3): The mooring effect moderates the relationship between pull effect and switching intention, such that higher mooring weakens the influence of pull on switching intention.

Hypothesis 4 (H4): The mooring effect moderates the relationship between push effect and switching intention, such that higher mooring weakens the influence of push on switching intention.

3.4 Switching Intention

Switching intention refers to students' intent to abandon the legacy LMS and adopt the new gamified LMS. This construct serves as the dependent variable, influenced by push and pull factors and moderated by the mooring effect.

Hypothesis 5 (H5): The mooring effect has a significant influence on students' switching intention toward the gamified LMS.

Figure 1 illustrates the conceptual model employed in this study. The model integrates the Push Effect, Pull Effect, and Mooring Effect constructs based on the Push-Pull-Mooring (PPM) framework, which has been adapted to the context of switching intention toward a gamified Learning Management System (LMS).

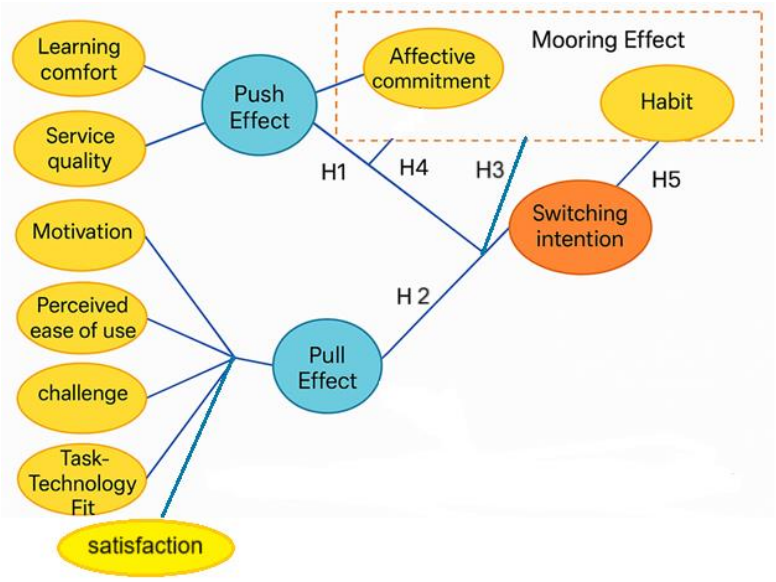

Figure 1: The PPM-Based Research Framework

4. Research Methodology

4.1 Population and Sampling

The target population for this study consisted of university students across various institutions in Indonesia who had prior experience using traditional Learning Management Systems (LMS). The sampling technique employed was non-probability sampling, specifically convenience sampling or purposive sampling, by inviting students who were willing to participate in evaluating the new LMS prototype. This approach was pragmatic given the two-stage data collection process and the need to access a large and diverse group of students for the large-scale survey.

The total sample size for Phase Two (the large-scale survey using the PPM questionnaire) was 1,054 university students from multiple institutions across Indonesia.

4.2 Sample Descriptive Statistics and LMS Usage Details

To ensure clarity on the sample characteristics and the context of data collection, the following descriptive statistics and LMS usage details were recorded:

- Academic Year : Primarily 2nd to 4th year students (e.g., 65% were in their 3rd year)
- Degree Program : Students from various study programs, including Information Technology, Business, and Education.
- Age Range : 18–24 years old (Mean Age: 20.5 years)
- Institutions : Students from Universities across Indonesia

4.3 LMS Usage Details

The 1,054 students in Phase Two were granted access to the gamified LMS prototype, Learning Nova.

- **Mode of Access:** The LMS was a web-based platform, accessible via standard web browsers on personal computers and mobile devices.
- **Subjects/Content:** Participants interacted with course content, primarily centered around an **"Introduction to ICT"** course , which included modules, assignments, pre-tests, and quizzes.

- **Duration of Use:** Participants were given a defined period, which was a minimum of one session of interaction with the personalized features (including completing a pre-test, module, and challenge) before completing the PPM questionnaire. This interaction was necessary for them to fully experience the personalized gamification elements, such as the Challenge and Leaderboard features, that were adapted based on their six achievement goal orientations. The time spent was sufficient for them to form a perception of the new system's Pull factors and their switching intention.

4.4 Research Type and Approach

This study is a quantitative research employing an explanatory approach, aiming to measure and analyze the influence of Push, Pull, and Mooring factors on students' switching intention toward a gamified Learning Management System (LMS). The LMS evaluated in this study was developed based on gamification principles and segmentation of students' motivational orientation types. Data analysis was conducted using multiple linear regression with the assistance of SPSS.

4.5 Research Framework

Figure 2 illustrates the conceptual logic flow of this study. Traditional LMS platforms have demonstrated negative impacts on students' engagement and learning motivation. Improvements have been attempted through gamified LMS designs; however, not all gamification approaches have shown significant effects on enhancing motivation and learning outcomes.

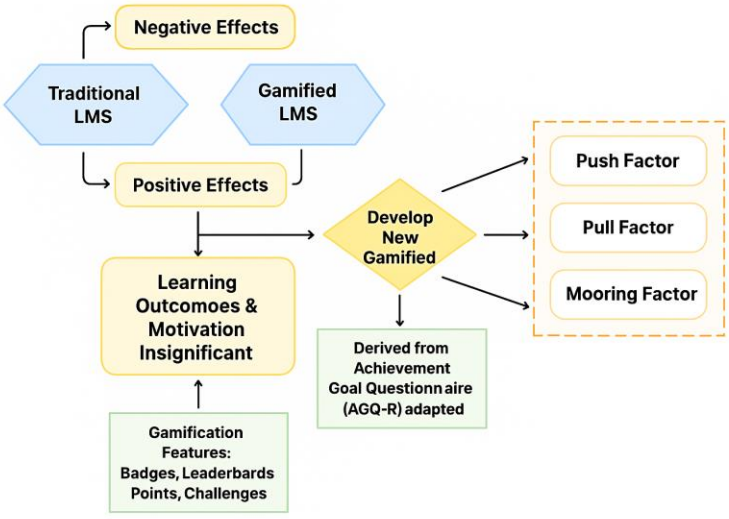

Figure 2: Research Framework

Therefore, this study proposes a gamified LMS design personalized according to users' goal orientation types, as identified through a modified version of the Achievement Goal Questionnaire-Revised (AGQ-R). Gamification elements—such as badges, leaderboards, and challenges—were adjusted based on students' motivational orientation profiles.

The primary focus of this research is not on learning outcomes, but on users' switching intention toward the new LMS. To evaluate this, the Push-Pull-Mooring (PPM) framework is employed as an evaluative model to measure the extent to which push, pull, and mooring factors influence students' decisions to switch from the traditional LMS to the new gamified system.

4.6 Research Procedure

The study was conducted in two main phases:

- **Phase One (Goal Orientation Classification):** Involved 150 initial participants. They completed a modified version of the Achievement Goal Questionnaire-Revised (AGQ-R) to identify their goal orientation types (e.g., Super Achiever, Mastery-Intrinsic). The results formed the basis for the personalized features of the LMS prototype.

- **Phase Two (PPM Survey):** Involved 1,054 university students. These students were invited to **interact** with the gamified LMS prototype (Learning Nova) and subsequently completed the Push-Pull-Mooring (PPM) questionnaire to measure push, pull, and mooring effects in the context of switching intention toward the new LMS. The questionnaire was administered immediately after their interaction to capture responses reflecting their actual experience with the system.

4.7 Research Instruments

The instruments used in this study include:

- AGQ-R (Achievement Goal Questionnaire–Revised): This instrument was used to identify and classify students into six types of achievement goal orientations: mastery-intrinsic, mastery-extrinsic (a newly defined variant), mastery ex-in, performance-only, super-achiever, and non-achiever. The classification process was conducted prior to students interacting with the LMS prototype, serving as the basis for interpreting user responses to the system.
- PPM Questionnaire (Push-Pull-Mooring): This instrument was employed to measure students' perceptions of the gamified LMS based on the three core constructs of the PPM model: Push Effect (factors driving students away from the old LMS), Pull Effect (attractiveness of the new LMS), and Mooring Effect (inhibitors or barriers to switching). The questionnaire was administered after students used the LMS prototype to ensure that their responses reflected their actual learning experiences with the system.

4.8 Design and Implementation of the Gamified LMS Prototype

The Learning Management System (LMS) prototype developed in this study is named Learning Nova—an online learning platform based on gamification principles, designed to adapt to students' achievement goal orientation types. System personalization was implemented based on students' motivational classification results, obtained from responses to a modified version of the Achievement Goal Questionnaire-Revised (AGQ-R).

Home Page and Student Type Classification

When users first access the system, they are presented with the landing page shown in Figure 3, which displays six types of motivational goal orientations: Super Achiever, Mastery Intrinsic, Mastery Extrinsic, Mastery Ex-In, Performance Only, and Non Achiever.

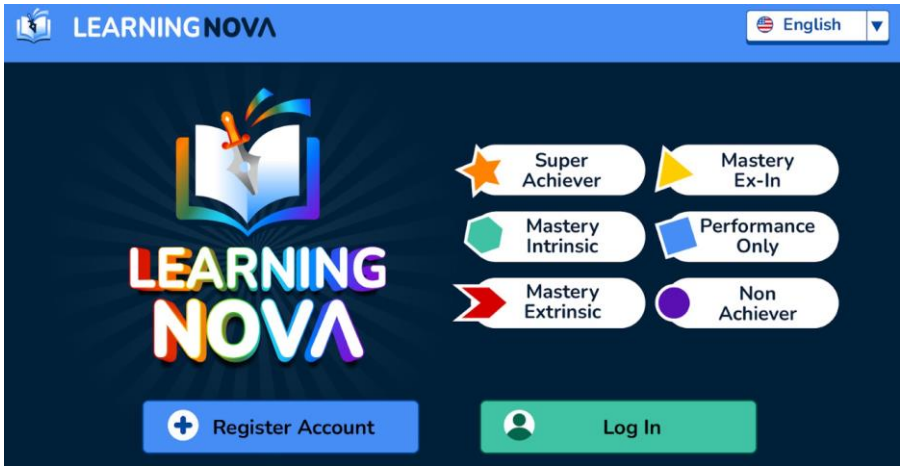

Figure 3: LearningNova Landing Page

Before entering the main learning system, students are required to complete the AGQ-R questionnaire, as shown in Figure 4. This questionnaire consists of several Likert-scale items designed to identify students' dominant motivational goal orientation. Based on the responses, the system automatically classifies each student into one of six orientation types. The LMS interface and gamification features are then personalized accordingly.

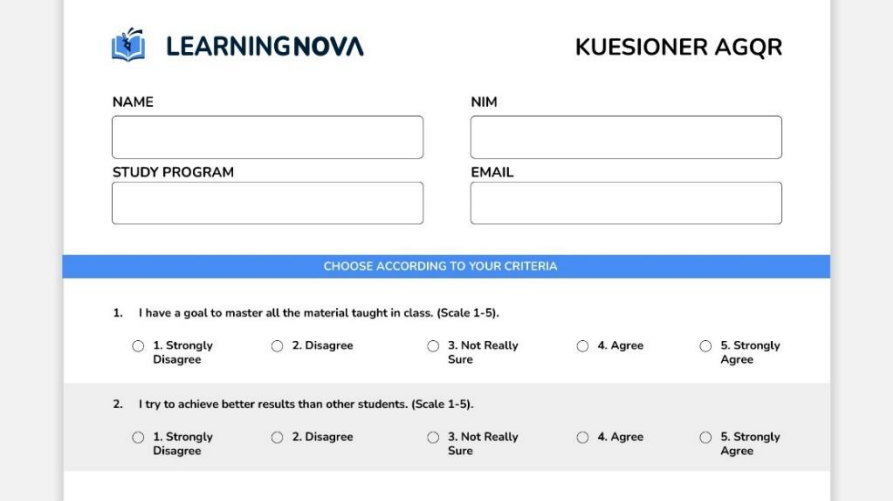

Figure.4: AGQ-R Questionnaire Page

Homepage Display and Learning Navigation

After completing the AGQ-R questionnaire and the gamification preference input, the system automatically classifies the user's motivational orientation, as illustrated in Figure 5. In this example, the user is identified as belonging to the Super Achiever type.

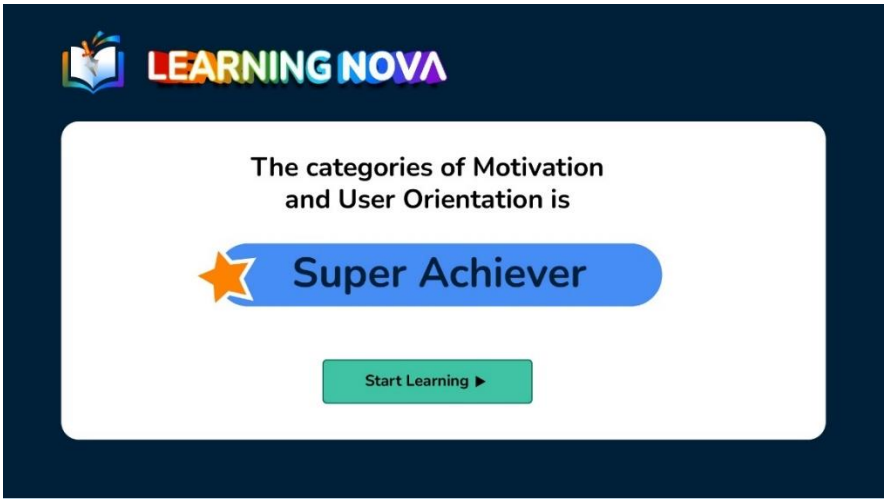

Figure 5: Questionnaire Result Page (Super-Achiever)

Figure 6 shows the homepage interface, which includes a personalized welcome message at the top of the screen, current announcements, and the My Class menu displaying active courses along with their completion progress.

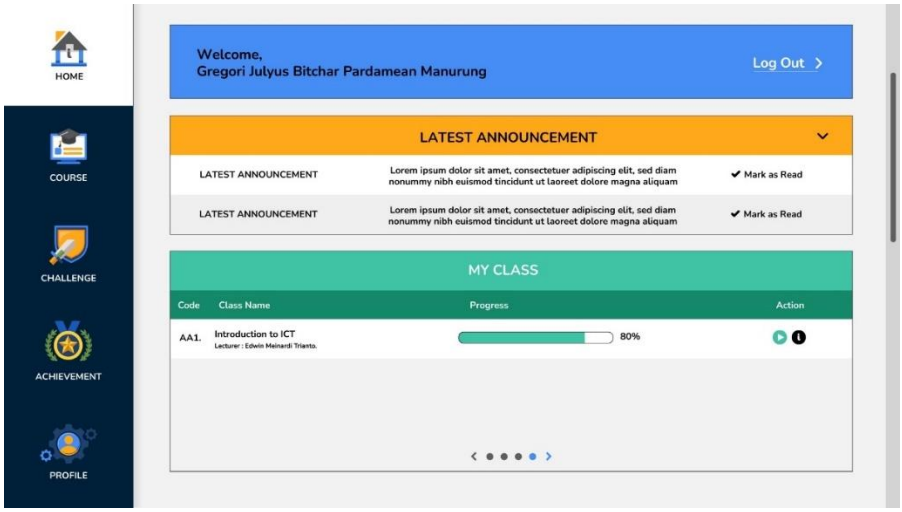

Figure 6: Homepage Interface

A visual progress bar is prominently featured to serve as a motivational prompt, encouraging users to complete their courses up to 100%. An action button is also provided to continue learning—aligned with the Super Achiever type, which tends to pursue all challenges to the maximum extent

Class Features and Assignment Submission

As shown in Figure 7, this page displays downloadable learning materials—such as Material_Midterm—along with information on assignment deadlines.

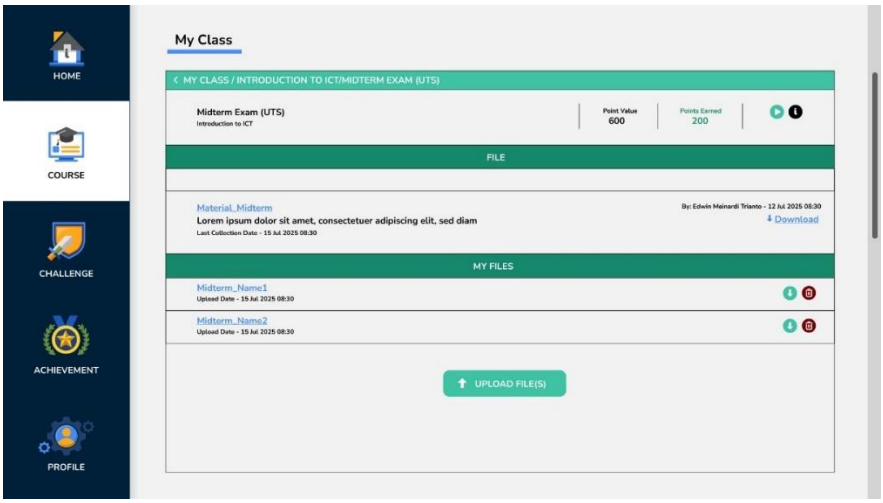

Figure 7: Course Menu Page – Assignment Submission and Points

This interface reflects characteristics typical of Super Achiever students, as it provides clear targets and enables them to monitor their progress in completing assigned tasks.

Figure 8 presents the structure of course content and student progress in the Introduction to ICT course. Each row displays a topic/module along with its completion indicators and associated assessments.

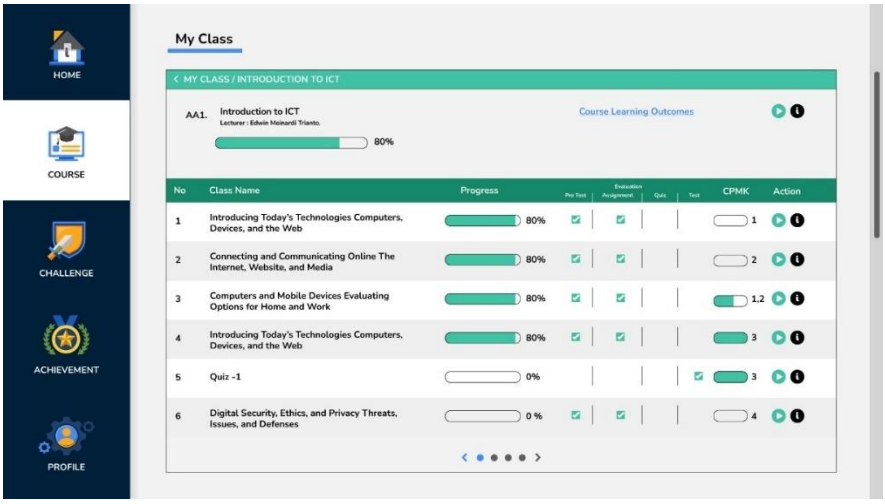

Figure 8: Course Menu Page – Class List and Module Progress

This layout aligns with the characteristics of Super Achiever students, as it provides a systematic and measurable structure—ideal for learners with strong goal-oriented and high-achievement tendencies.

Challenges and Interactive Gamification

The Challenge menu, as illustrated in Figures 9 and 10, displays a series of learning-based challenges. Figure 9 shows the challenge dashboard, which presents a list of learning activities or missions that users are required to complete.

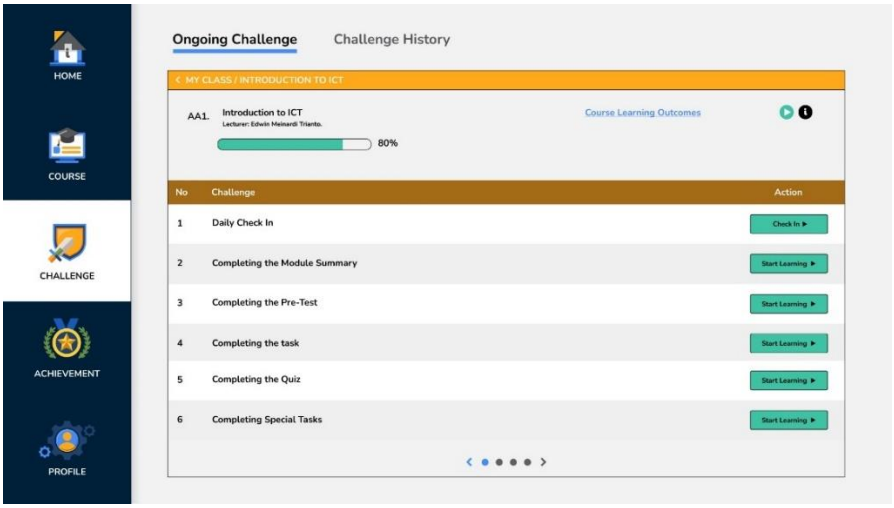

Figure 9: Ongoing Challenge Page

This page is specifically customized for users with the Super Achiever motivation type, who are typically competitive, goal-driven, and motivated by maximum achievement.

The purpose of this page is to enhance learning engagement and motivation through clearly structured academic and daily challenges. It provides incentives in the form of points, progress tracking, and badges, encouraging consistent and performance-oriented learning behavior.

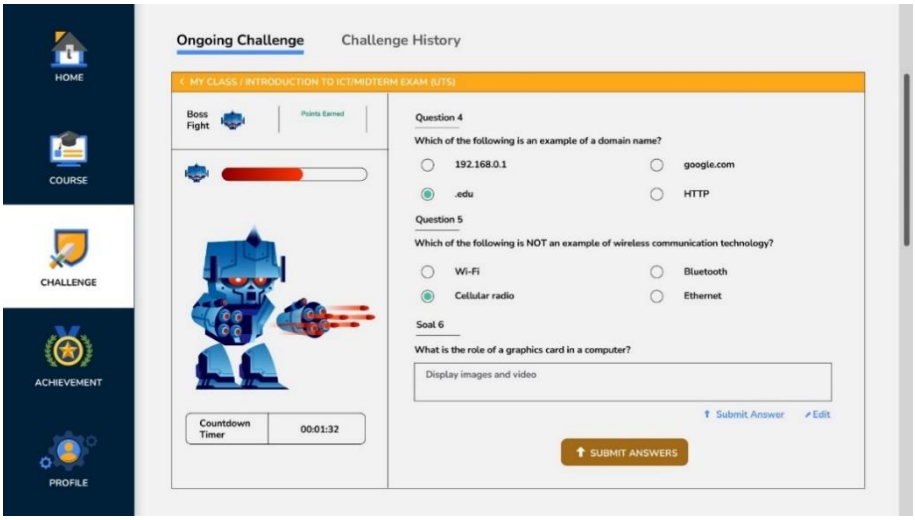

Figure 10: Challenge Page – Active Challenge (Boss Fight)

In the Learning Nova LMS, users with the Super Achiever orientation type are presented with a challenge called Boss Fight, which simulates a final exam or decisive task using game-based visual elements, as shown in Figure 10. This page features key elements such as a boss character representing the ultimate learning challenge, a health bar that decreases with each correct answer, a countdown timer to test both speed and accuracy, and progressively advancing multiple-choice questions. This feature aligns with the Super Achiever student profile, as it transforms the final evaluation process into a more stimulating and psychologically satisfying experience. It creates a sense of competition against the system, framing the final exam as a heroic mission to be conquered.

Leaderboard

As shown in Figure 11, the leaderboard system ranks users based on cumulative performance across various learning components, including level and rank (1st, 2nd, 3rd, etc.), student ID, name and study program, and scores from different activities such as assignments, pretests, module completion, content unlocking, and boss fights.

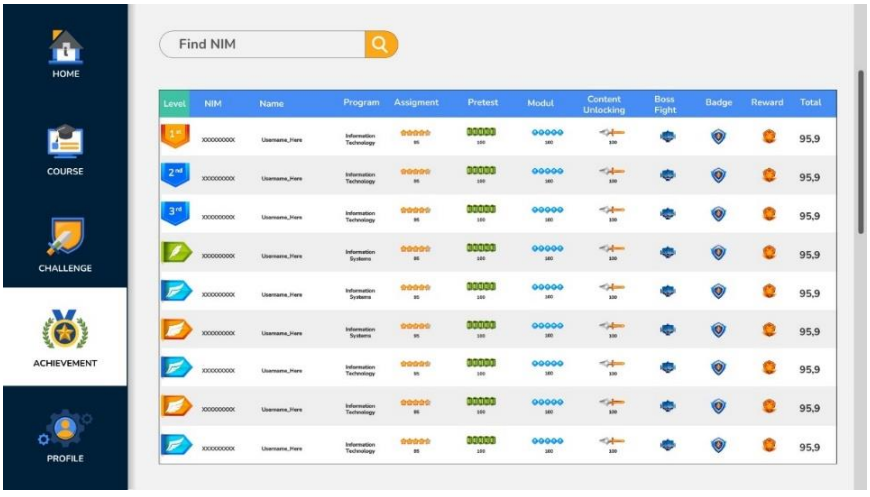

Figure 11: Leaderboard

Users with the Super Achiever orientation are highly driven by ranking systems and recognition of achievement. It also includes visual feedback in the form of badges and rewards. This leaderboard is particularly relevant for Super Achiever users, as it enhances motivation through healthy competition, provides clear feedback regarding one's relative standing among peers, and encourages students to strive for high scores and complete all components to maintain or improve their position.

The core feature of Learning Nova is its adaptive gamification based on students' achievement goal orientations. The design aims to move beyond generic Pull factors and focus on deep motivational alignment.

5. Preliminary Analysis

A preliminary analysis was conducted to ensure that all research instruments possessed acceptable levels of construct validity and internal reliability before hypothesis testing. This analysis includes validity and reliability tests for two main categories of instruments:

- The modified AGQ-R instrument used to classify students' motivational orientation types.
- The Push-Pull-Mooring (PPM) model instrument used to measure switching behavior.

The AGQ-R instrument was used to classify students into six motivational goal orientation types: Mastery-Intrinsic, Mastery-Extrinsic, Mastery Ex-In, Performance-Only, Super-Achiever, and Non-Achiever. A total of 150 students participated in the initial classification phase before accessing the gamified LMS prototype. The validity test of the motivational orientation instrument showed that all 19 items had a correlation coefficient (r-calculated) greater than the r-table value, ranging from 0.249 to 0.577, thus confirming that all items were valid.

- The reliability test was conducted using Cronbach's Alpha, which yielded a value of 0.769, indicating good internal consistency and reliability. Further analysis, by removing each item one by one, showed Cronbach's Alpha values remained stable within the range of 0.752 to 0.764, all exceeding the 0.70 threshold (George & Mallery, 2003), confirming that the instrument has reliable internal consistency.
- In the next phase, a total of 1,054 students from various universities across Indonesia were granted access to use the gamified LMS prototype and subsequently completed the PPM model questionnaire. This instrument measured the three main constructs of the Push-Pull-Mooring model (Push, Pull, and Mooring Effects), as well as Switching Intention.
- The validity test was conducted by comparing each item's item-total correlation with the r-table value, using degrees of freedom (df = N – 2 = 1052) and a significance level of 0.05, resulting in r-table = 0.062. An item was considered valid if its correlation value exceeded 0.062.

As a fundamental step in ensuring the accuracy of this study's measurement, the comprehensive results of the validity test for the Push-Pull-Mooring (PPM) model instrument, which was designed to evaluate the gamified Learning Management System (LMS), are presented in detail in Table 2 below.

Table 2: Validity Test Results of the Instrument for Evaluating the Gamified LMS Model Using the Push-Pull-Mooring (PPM) Framework

Indicator	Pearson Correlation	$r_{\_table}$	Description
X1	0.481	0.062	Valid
X2	0.339	0.062	Valid
X3	0.268	0.062	Valid
X4	0.245	0.062	Valid
X5	0.521	0.062	Valid
X6	0.210	0.062	Valid
X7	0.334	0.062	Valid
X8	0.319	0.062	Valid
X9	0.344	0.062	Valid
X10	0.381	0.062	Valid
X11	0.386	0.062	Valid
X12	0.303	0.062	Valid
X13	0.219	0.062	Valid
X14	0.476	0.062	Valid
X15	0.212	0.062	Valid
X16	0.418	0.062	Valid
X17	0.522	0.062	Valid
X18	0.455	0.062	Valid
X19	0.343	0.062	Valid

Indicator	Pearson Correlation	r_{table}	Description
X20	0.435	0.062	Valid
X21	0.390	0.062	Valid
X22	0.429	0.062	Valid
X23	0.521	0.062	Valid
X24	0.599	0.062	Valid
X25	0.442	0.062	Valid
X26	0.442	0.062	Valid
X27	0.449	0.062	Valid
X28	0.440	0.062	Valid
X29	0.443	0.062	Valid

Based on the calculation results, all items showed correlation coefficient values (r-calculated) greater than 0.062, indicating that all items are valid and suitable for use in measurement. Following the validity test, a reliability test was conducted on the instrument used to evaluate the gamified LMS model using the PPM framework.

The results of the reliability test for the instrument used to evaluate the gamified LMS model employing the Push-Pull-Mooring framework are presented in Table 3.

Table 3: Reliability Test Results of the Instrument for Evaluating the Gamified LMS Model Using the PPM Framework

Indicator	Cronbach's Alpha	r_{table}	Description
X1	0.794	0.062	Reliable
X2	0.800	0.062	Reliable
X3	0.802	0.062	Reliable
X4	0.803	0.062	Reliable
X5	0.792	0.062	Reliable
X6	0.809	0.062	Reliable
X7	0.800	0.062	Reliable
X8	0.801	0.062	Reliable
X9	0.799	0.062	Reliable
X10	0.799	0.062	Reliable
X11	0.799	0.062	Reliable
X12	0.806	0.062	Reliable
X13	0.804	0.062	Reliable
X14	0.794	0.062	Reliable
X15	0.804	0.062	Reliable
X16	0.797	0.062	Reliable
X17	0.792	0.062	Reliable
X18	0.795	0.062	Reliable
X19	0.800	0.062	Reliable
X20	0.796	0.062	Reliable
X21	0.798	0.062	Reliable
X22	0.796	0.062	Reliable
X23	0.792	0.062	Reliable
X24	0.788	0.062	Reliable
X25	0.796	0.062	Reliable

Indicator	Cronbach's Alpha	r_{table}	Description
X26	0.796	0.062	Reliable
X27	0.795	0.062	Reliable
X28	0.796	0.062	Reliable
X29	0.796	0.062	Reliable

After confirming item-level validity, construct-level reliability and validity were calculated to ensure internal consistency and independence among latent variables. For this purpose, Cronbach's Alpha values for each main construct (Push Effect, Pull Effect, Mooring Effect, and Switching Intention) were calculated from the mean of their constituent items. All alpha values must exceed the accepted threshold to demonstrate good construct reliability.

Furthermore, to review simple discriminant validity, inter-construct correlations (Pearson Correlation) were examined. Inter-construct correlation values lower than the square root of the Average Variance Extracted (AVE) (if AVE is calculated, or at least < 0.90) can serve as an initial indication of discriminant validity.

The results of the construct reliability analysis, specifically the values for Cronbach's Alpha, are detailed in Table 4.

Table 4: Construct Reliability Results (Cronbach's Alpha)

Construct	Item Used	Cronbach's Alpha	Description
Push Effect	Service Quality, Learning Comfort	0.88	Reliable
Pull Efect	Motivation, Challenge, Perceived Ease Of Use, Task Technology Fit, Satisfaction	0.81	Reliable
Mooring Effect	Habit, Affective, Commitment	0.84	Reliable
Switching Intentions	5 Statement	0.89	Reliable

The results indicate that all constructs have Cronbach's Alpha values exceeding the 0.70 threshold, confirming strong internal reliability at the construct level.

The reliability test was conducted using Cronbach's Alpha. A commonly accepted threshold for reliability is a value above 0.7; however, values between 0.6 and 0.7 may still be considered acceptable in exploratory research (Nunnally & Bernstein, 1994). Based on the reliability analysis of 29 items, the resulting Cronbach's Alpha values ranged from 0.788 to 0.809. All items also had item-total correlation coefficients (indicated as 'Pearson Correlation' in Table 2) greater than the r-table value of 0.062, which primarily confirms their validity. The high Cronbach's Alpha values demonstrate strong internal consistency for the overall instrument."

6. Result and Discussion

This chapter presents the empirical results of testing the Push-Pull-Mooring (PPM) conceptual model to evaluate the influence of various factors on students' Switching Intention in transitioning to a gamified LMS. The evaluation was conducted using a multiple linear regression approach with the help of SPSS software. This approach was chosen over structural equation modeling (SEM) techniques, as no specialized software such as AMOS or SmartPLS was used.

According to (Hair, 2010), multiple linear regression can be used to test theoretical models when constructs are measured directly (without latent indicators) and the aim is to evaluate causal relationships between variables. Similarly, (Ghozali, 2018) affirms that multiple linear regression remains a relevant analytical tool in quantitative research for testing the significance and direction of relationships between independent and dependent variables simultaneously. Therefore, this method is considered appropriate for examining both direct and moderating relationships among variables within the PPM model.

6.1 Test Data

A total of 1,054 students from various universities in Indonesia participated in the study. All respondents had used the gamified LMS prototype and completed a Likert-scale-based questionnaire. The questionnaire included the following constructs:

- Push Effect: Service Quality, Learning Comfort
- Pull Effect: Motivation, Challenge, Ease of Use, Task-Technology Fit, Satisfaction
- Mooring Effect: Habit, Affective Commitment
- Switching Intention: 5 separate statements

The selection of variables within each construct (push, pull, and mooring) was grounded in a literature review and conceptual analysis as outlined in the chapter Theoretical Model and Hypotheses Development. Each indicator was adapted from previously validated studies and contextualized for use within a gamified LMS environment. Using this approach, the PPM model in this study was systematically developed to identify key factors influencing students' intention to switch from a traditional LMS to a gamified LMS.

6.2 Analysis Technique

Data analysis was carried out in four regression stages, each designed to test different aspects of the PPM model. The regression models employed for hypothesis testing, which were designed to analyze different aspects of the PPM framework across four stages, are outlined in Table 5.

Table 5: Regression Models

Model	Variabel Independent	Variabel Dependent
H1 & H2	Push_Avg, Pull_Avg	Switching_Avg
H3	Mooring_Avg, Push_Avg, Mooring_Push	Switching_Avg
H4	Mooring_Avg, Pull_Avg, Mooring_Pull	Switching_Avg
H5	Mooring_Avg	Switching_Avg

Each construct was measured using several validated indicators. For the purpose of regression analysis, the mean score of all items within each construct was calculated and labeled as follows:

- Push_Avg: The average of all indicators under the Push Effect construct (Service Quality and Learning Comfort).
- Pull_Avg: The average of all indicators under the Pull Effect construct (Motivation, Challenge, Ease of Use, Task-Technology Fit, and Satisfaction).
- Mooring_Avg: The average of indicators for Habit and Affective Commitment under the Mooring Effect construct.
- Switching_Avg: The average of five statements measuring Switching Intention.

Moderation interactions were also calculated by multiplying the relevant construct means, resulting in two interaction terms:

- Mooring_Push = Mooring_Avg × Push_Avg
- Mooring_Pull = Mooring_Avg × Pull_Avg

This technique follows the moderated regression approach as outlined by Aiken & West (1991) and is commonly used in studies testing interaction effects among constructs.

For the moderation regression analysis (testing H3 and H4), a mean-centering procedure was applied to the Pull_Avg, Push_Avg, and Mooring_Avg variables before calculating the interaction terms Mooring_Pull and Mooring_Push. Centering was performed to reduce multicollinearity that might arise from high correlations between the main independent variables and the interaction terms.

6.3 Test Results for H1 and H2: The Effects of Push and Pull on Switching Intention

To examine the effects of Push Effect and Pull Effect on Switching Intention, a multiple linear regression analysis was conducted using SPSS. The purpose of this test was to evaluate the extent to which these two constructs can explain students' intention to switch to a gamified LMS.

- Hypothesis 1 (H1) posits that the Push Effect has a significant positive influence on Switching Intention.
- Hypothesis 2 (H2) tests whether the Pull Effect also significantly influences Switching Intention.

The results of the multiple linear regression analysis, which tested the direct effects of the Push and Pull Effects on Switching Intention (H1 and H2), are presented in Table 6.

Table 6: Regression Results for H1 and H2

Variable	B Regression Coef.	Std. Error	Beta	t	Sig. (p.value)	Description
Push_Avg	0.675	0.046	0.369	14.643	< 0.001	Signifikan (H1)
Pull_Avg	0.960	0.050	0.485	19.238	< 0.001	Signifikan (H2)

The analysis results show that both independent variables have a statistically significant influence on the dependent variable. Pull_Avg yielded a regression coefficient of 0.960 ($p < 0.001$), while Push_Avg produced a coefficient of 0.675 ($p < 0.001$). The coefficient of determination (R^2) reached 0.599, indicating that approximately 59.9% of the variance in Switching Intention can be explained by the combined effects of these two factors. This finding is further supported by an F-statistic of 784.152 ($p < 0.001$), confirming that the overall regression model is statistically significant.

Accordingly, both Hypothesis 1 (H1) and Hypothesis 2 (H2) are supported. These findings confirm that both positive perceptions of the new LMS features (Pull Effect) and discomfort with the old system (Push Effect) play important roles in influencing students' intention to switch to a gamified LMS.

6.4 Hypothesis Testing H3: Mooring as a Moderator of Pull Effect

Hypothesis 3 (H3) aims to test whether the Mooring Effect acts as a moderating variable in the relationship between Pull Effect and Switching Intention. To examine this, a multiple linear regression analysis was conducted involving three predictor variables: Pull_Avg, Mooring_Avg, and the interaction term Mooring_Pull (the product of Mooring_Avg and Pull_Avg).

The results of the regression analysis conducted to test Hypothesis 3 (H3), specifically examining the moderating role of the Mooring Effect on the relationship between Pull Effect and Switching Intention, are detailed in Table 7.

Table 7: Regression Results for Hypothesis H3

Variable	B Regression Coef.	Std. Error	Beta	t	Sig. (p.value)	Description
Pull_Avg	0.609	0.193	0.308	3.164	0.002	Signifikan
Mooring_Avg	0.289	0.203	0.250	1.419	0.156	Not Signifikan
Mooring_Pull	0.065	0.051	0.314	1.281	0.200	Not Signifikan

The regression results show that Pull_Avg still has a significant influence on Switching Intention ($B = 0.609$, $p = 0.002$). However, both Mooring_Avg ($p = 0.156$) and the interaction term Mooring_Pull ($p = 0.200$) do not exhibit statistically significant effects. Although the model's R^2 value reached 0.658 and the overall model was significant ($F = 672.823$, $p < 0.001$), the non-significant interaction term indicates that the Mooring Effect does not moderate the relationship between Pull Effect and Switching Intention.

Therefore, Hypothesis 3 (H3) is rejected. This implies that while Pull Effect has a direct impact, the strength of this relationship is neither enhanced nor diminished by students' emotional attachment or habitual use of the previous system.

6.5 Hypothesis Testing H4: Mooring as a Moderator of Push Effect

Hypothesis 4 (H4) tests the role of the Mooring Effect as a moderator in the relationship between Push Effect and Switching Intention. The regression model includes three predictors: Push_Avg, Mooring_Avg, and the interaction term Mooring_Push (the product of Mooring and Push constructs).

The detailed findings of the regression analysis used to test Hypothesis 4 (H4), specifically regarding the potential moderating effect of the Mooring construct on the Push Effect and Switching Intention relationship, are presented in Table 8.

Table 8: Regression Results for Hypothesis H4

Variable	B Regression Coef.	Std. Error	Beta	t	Sig. (p.value)	Description
Push_Avg	1.026	0.229	0.561	4.489	< 0.001	Signifikan
Mooring_Avg	0.916	0.228	0.793	4.016	< 0.001	Signifikan
Mooring_Push	–0.078	0.057	–0.390	–1.377	0.169	Not Signifikan

The regression results indicate that both Push_Avg (B = 1.026, p < 0.001) and Mooring_Avg (B = 0.916, p < 0.001) have a significant effect on Switching Intention. However, the interaction term Mooring_Push has a negative but statistically non-significant coefficient (B = –0.078, p = 0.169). The R^2 value of 0.650 indicates that 65.0% of the variation in Switching Intention is explained by the three variables, but the absence of a significant interaction effect confirms no moderation.

As a result, Hypothesis 4 (H4) is rejected. This finding suggests that students' emotional attachment or habitual use of the previous system does not strengthen or weaken the impact of negative perceptions toward the old LMS on their intention to switch to a new system.

The rejection of Hypothesis 3 (H3) and Hypothesis 4 (H4) indicates that while the restraint factor (Mooring Effect) has a significant direct influence, it does not moderate the relationship between the drive (Push) and attraction (Pull) factors and switching intention. This moderation failure can be attributed to two potential factors. First, the strength of the Pull Effect—driven by motivationally aligned gamification features—may be exceedingly strong, effectively overriding the inertia of existing habits and emotional commitment (Mooring) independently. In other words, the emotional and functional benefits of the new system were compelling enough to detach users without merely weakening or strengthening the Push/Pull effects. Second, the Mooring construct in this study focused on habits and affective commitment. Future studies might consider a more specific dimension of Mooring, such such as perceived switching costs or social norms, which may exhibit a clearer moderating effect.

Recommendation for In-Depth Analysis (Goal-Type): Since the LMS prototype was adaptively designed based on six goal orientations, future analysis could extend the model testing using multi-group analysis to explore differences. For instance, does the Pull Effect (feature attraction) have a stronger impact on the Super Achiever group compared to the Non-Achiever group, who might be more sensitive to the Push Effect (discomfort with the old LMS). This testing will provide a more nuanced understanding of which factor is most relevant for each motivational profile.

6.6 Hypothesis Testing H5: Direct Effect of Mooring on Switching Intention

Hypothesis 5 (H5) tests the direct effect of the Mooring Effect on Switching Intention using a simple linear regression. The analysis shows that Mooring_Avg has a significant effect on Switching Intention, with a regression coefficient of 0.850 (p < 0.001). A high t-value of 35.286 and an R^2 of 0.542 indicate that 54.2% of the variation in Switching Intention is explained by the Mooring Effect.

The final regression stage, which tested Hypothesis 5 (H5) regarding the moderating influence of the Mooring Effect on the relationship between the Pull Effect and Switching Intention, yielded the results presented in Table 9.

Table 9: Regression Results for Hypothesis H5

Variable	B Regression Coef.	Std. Error	Beta	t	Sig. (p.value)	Description
Mooring_Avg	0.850	0.024	0.736	35.286	< 0.001	Signifikan

Therefore, Hypothesis 5 (H5) is supported. This finding demonstrates that although the Mooring Effect does not function as a moderator in the relationship between Push and Pull effects and Switching Intention, it still exerts a strong direct influence on users' intention to switch. This indicates that even when students are emotionally attached to the previous LMS, they are still willing to transition to a new LMS—provided that the new system delivers a more enjoyable or emotionally satisfying learning experience.

The finding that the Mooring Effect acts as a direct predictor rather than a moderator suggests that existing habits and emotional attachments, while influential, do not alter the *degree* to which negative experiences (push) or positive new features (pull) drive switching. Instead, these mooring factors independently contribute to the decision-making process. This might be because the emotional incentives from a new, more satisfying system are strong enough to overcome the inherent inertia of existing habits and attachments, directly impacting the willingness to switch regardless of the perceived 'push' or 'pull' strength."

6.7 Basic Regression Assumption Checks

Before hypothesis testing (H1–H5), assumption checks were conducted to ensure the data's suitability for the linear regression model. The assumptions examined included residual normality, linearity, homoscedasticity, and the absence of multicollinearity.

Specifically, the issue of multicollinearity was tested using the Variance Inflation Factor (VIF). The VIF values for all predictor variables (including the centered interaction terms) in each regression model were below the threshold of 10 (e.g., below 5), indicating that multicollinearity was not a significant concern in the model. This check is crucial following the creation of the interaction terms (Mooring_Pull and Mooring_Push) to ensure a valid interpretation of the coefficients.

7. Conclusion

This chapter provides a comprehensive summary of the research findings, derived from the empirical testing of the Push-Pull-Mooring (PPM) model using data collected from 1,054 students regarding their intention to switch from a conventional LMS to a newly designed gamified LMS prototype. The primary objective was to determine the key motivational factors driving this Switching Intention.

Based on the results of the multiple linear regression analysis, the study confirms that the intention to switch is significantly influenced by all three PPM constructs as direct predictors:

- **Pull Effect (Dominant Factor):** The Pull Effect, representing students' attraction to the new gamified system, proved to be the most dominant factor. Positive perceptions regarding motivation, challenge, ease of use, and user satisfaction significantly contributed to the willingness to adopt the new LMS.
- Push Effect (Significant Factor): Dissatisfaction with the previous conventional LMS (the Push Effect), related to poor service quality and low learning comfort, also had a significant positive influence on Switching Intention.
- Mooring Effect (Direct Predictor): While the Mooring Effect (emotional attachment to the old system) was rejected as a moderating variable for the Push and Pull relationships (Hypotheses H3 and H4), its direct relationship with Switching Intention was statistically significant. This finding is crucial: even when students retained emotional ties or habit to the old LMS, the meaningful and relevant learning experience offered by the new system was sufficient to overcome this inertia and maintain a strong intention to switch.

Practical Implications of this study suggest that the development of gamified LMS must not only focus on designing engaging and motivating features (Pull Effect) but also proactively address student dissatisfaction with existing systems (Push Effect) and directly acknowledge underlying personal habits and emotional ties (Mooring Effect). For example, developers can integrate features that explicitly help users migrate data from the old system or provide transitional support to ease habit change.

Practical Examples of Applying Goal Profiles in Onboarding: Onboarding strategies and feature design should be tailored to motivational profiles:

- **Mastery-Intrinsic:** Provide quick access to in-depth content and exploration challenges without an immediate focus on rankings, emphasizing the intrinsic value of learning.
- **Performance-Only:** Prominently place leaderboards and reward/recognition notifications on the homepage to trigger competition-based motivation.
- **Non-Achiever:** Use simple progress bars and daily small achievement visualizations to reduce anxiety and gradually build positive momentum.

8. Future Research

Despite these robust findings, this study is subject to several methodological limitations that temper the generalizability of the conclusions:

- **Context and Sampling:** The data collection was limited to a specific student population and a prototype system. The generalizability of these results to other educational levels, different cultural contexts, or fully deployed commercial LMS platforms may be limited.
- **Intention vs. Behavior:** This research measured Switching Intention, which is a proxy for actual adoption. There can be a significant gap between what an individual intends to do and their eventual switching behavior when faced with real-world institutional or cost-related barriers.
- **Possible Common-Method Bias (CMB):** As all data was collected through self-reported surveys from a single source at one point in time, there is a possibility of Common-Method Bias. This could potentially inflate the observed correlations among the PPM constructs.

To build upon this work and address the current limitations, the following future research steps are recommended:

- **Longitudinal and Behavioral Data:** Future studies should adopt a longitudinal research design to track students after the gamified LMS is fully deployed, validating the findings by measuring actual adoption behavior and continued usage over time, thereby bridging the intention-behavior gap.
- **Richer Mooring Factors:** The Mooring construct should be expanded to include a richer set of factors beyond emotional attachment. This includes exploring concrete switching costs (e.g., effort to learn a new interface, institutional policies, data migration difficulty) and perceived risk factors associated with changing systems.
- **Tests by Goal Type:** The practical implication regarding motivational profiles should be empirically tested. Future research should segment the sample based on established student goal types (e.g., mastery-intrinsic vs. performance-only) and test whether the influence of Push and Pull factors on switching intention varies significantly across these different profiles.

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