**RESEARCH ARTICLE**

# The Analysis of Intrinsic Game Elements for Undergraduates Gamified Platform Based on Learner Type

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**ABSTRACT** This paper examines intrinsic motivation-driven game elements and designs an Intrinsic Motivation Gamification Framework to provide undergraduates with a persistent, scaffolded, and satisfying online learning experience based on different user profiles. Gamification has become the primary resolution to the low retention rate in learning platforms for undergraduates. However, most gamified learning studies focus on the player-type profiling method, while no intrinsic motivation-driven game elements are mapped to certain players. This paper refined self-needs and user motivation in the learning experience from different user behaviours through the distinction method of Grasha Learner Style, deriving six types of learners: independent, dependent, participant, avoidance, collaborative, and competitive. Based on the literature review, a gamified framework has been developed to engage undergraduates to persist in using a self-developed gamified platform, GamiClass, for up to 16 weeks. A suggested 20 game elements have been deployed based on the needs of the Octalysis Framework and Self-Determination Theory. The analysis mirrored the positive impact of game elements (group quest, challenges, and time pressure) on the undergraduates. In contrast, choices/consequences and exploration game elements negatively affect the undergraduates' continuity in the gamified platform. Furthermore, the group quest was identified as the critical game element that stimulates various types of undergraduates in competition and collaboration, thus internalising their extrinsic motivation into intrinsic motivation during their learning journey.

**INDEX TERMS** Game elements, gamification, human computer interaction, intrinsic motivation.

## I. INTRODUCTION

Gamification, the use of game elements in a non-gaming context, is now a related field of research in human-computer interaction (HCI). Several practical studies have indicated that gaming integration could boost engagement and construct desired behavioural outcomes in HCI applications [1]. Gamification can be used in various contexts for assorted purposes. For example, it is often used to drive and enhance human activities such as learning experience [2], employee performance [3] and customer engagement [4].

With the threat of the COVID-19 epidemic, universities and colleges have highly used learning platforms, and undergraduates are required to participate in online or hybrid learning [5]. However, the high dropout rate and low completion rate of online courses hindered the continuous development of the platform [6]. As an essential way to stimulate and maintain learning motivation, gamification has become one of the solutions for learning platforms to attract users. When interacting with a gamified learning environment, there would be two different types

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of participation, namely achievement-oriented behaviour and perfection-oriented behaviour. Two aspects of undergraduates' characteristics affect these behaviours: their initial intrinsic motivation and learner type. This paper focuses on the influence of game elements on undergraduates' motivation in the gamified learning platform context.

There are still studies that address or are concerned with the potential adverse effects of game elements on undergraduates in an educational context. For example, all the user models in gamification studies focus on player typologies (Bartle, Hexad, BrainHex), and minimal studies examine the context of learner-type typology. According to Chou [7], some undergraduates needed to be classified into any player type as they were unwilling to play the game. Still, motivating and engaging them is possible if the correct game elements are implemented. For example, Barata's study [8] recommends using challenges, points, and badges to attract achievers, regular learners, and half-hearted learners, but no game elements were mapped to avoidant-type learners. The HEXAD player-type scale proposed game element mapping that only converts reward-oriented Socialiser, Free Spirit, Achiever, and Philanthropist users into intrinsically motivated users [9]. There are no appropriate intrinsically motivating game elements for player and disruptor users. In short, HCI researchers must explore gamification user profiles from personality instead of player types only. In addition, this paper hypothesised that game elements that promote collaboration and competition (such as guild and group quests) could trigger intrinsic motivation for all types of undergraduate learners in gamified learning experiences for more than 16 weeks.

## II. PERSONALISED GAMIFICATION

Personalisation gamification is used to tailor game or interaction mechanics to specific users' preferences to improve engagement [10]. Using user typologies to comprehend individual preferences is one of the common approaches to personalisation.

### A. GAMIFICATION USER PROFILING

A personalised or adaptive gamification system is vital for each user because a personalised interaction system is more effective than a one-size-fits-all approach [11]. Gamification systems are effective when they help users achieve their goals, which often involve teaching them about a specific topic, supporting their attitude or behaviour change, or engaging them in a specific topic [11]. Therefore, personalised gamification that can adapt to personality traits or player types [12], [13] would be more engaging. Several studies have shown the need to tailor gamification systems to suit the user's personality [14], [15]. However, mapping user personality to game elements is complex. Three commonly accepted gamification context classifications are player type, personality, and expertise [16].

The general analysis method comes from Richard Bartle [17], dividing game player users into four types: Achiever, Explorer, Socialiser, and Killer. Marczewsk [9] was inspired

by Bartle's player types and implemented another player-type framework that introduced six user types: Socialisers, Free Spirits, Achievers, Philanthropists, Players and Disruptors. Meanwhile, the RAMP theory in the HEXAD player type (Relatedness, Autonomy, Mastery and Purpose) can only benefit the intrinsic motivation of the four-player types (Socialiser, Free Spirit, Achiever and Philanthropist). The HEXAD user profile believes the 'Player' needs the system to provide extrinsic motivation game elements continuously. Once the rewards are terminated, the ''Player' might stop the gamified learning. Disruptor resists gamification in nature. They wish to disrupt the system and constantly request changes from the platform based on their needs. This research believes this type of user profile only comprehensively covers some types of undergraduates [18]. Therefore, there are still many areas for improvement in this player-type personalised gamification.

In choosing an approach to user profiling based on personality, this research discovered the Grasha-Riechmann Student Learning Styles Scale (GRSLSS). GRSLSS was developed to measure undergraduate and adult learners' cognitive and affective behaviours instead of perceptual [19]. GRSLSS has been validated as stereotypes in an iterative approach to understanding subgroups of undergraduates' usage of gamified platform functionality [20], [21], [22]. According to the GRSLSS, six types can be categorised amongst undergraduates: participant, avoidant, independent, dependent, collaborative, and competitive (Table 1). Furthermore, various behavioural driving forces bring various fun for different types of learners, while fun is the most concerning aspect of game motivation. In addition, this research found many similarities and minor differences between GRSLSS and HEXAD player types. Table 2 displays the mapping between these two user profiling methods on their similarity. Finally, this

**TABLE 1.** Undegraduate's type based on grasha-riechmann student learning styles scale (GRSLSS).

| LEARNER'S STYLE | Characteristic |
|---|---|
| Participant | This undergraduate is happy to be involved in any provided activities and share their fantastic ideas among their peers. |
| Avoidant | The avoidant is forced to participate. As a result, this undergraduate works as little as possible or only shortly before a deadline. |
| Independent | The independent type can figure out their way of participating in the class. This undergraduate works on his/her own and rarely asks for help. |
| Dependent | The strict schedule helps the dependent undergraduate. However, these undergraduate needs lots of support and detailed instruction from peers and instructors. |
| Collaborative | This undergraduate prefers working in a group. This undergraduate is keen to give feedback to others and working together helps the collaborative type to feel comfortable. |
| Competitive | This undergraduate wants to outperform other course participants. |

paper discusses game element preferences for different users, particularly undergraduates, in the following sub-section.

| RAMP INTRINSIC MOTIVATION | HEXAD Player Types | GRSLSS Learner Type | Dynamic Elements | Mechanic Elements |
|---|---|---|---|---|
| Relatedness / Social | Socializer | Collaborative | Relationship | Collaboration Competition Social Status Feedback |
| Autonomy | Free Spirit | Independent | Narrative Self-Expression Choice Freedom of Fail Creativity | Responsibility |
| Mastery | Achiever | Competitive | Emotional creation Progression | Challenge Personal Development Transaction Resources Acquisition Competition |
| Purpose | Philanthropist | Dependent* | Progression Meaningful Objectives | Altruism |
| Rewards | Player | Participative | Enjoyment | Typical Game Reward |
| Avoidant | Disruptor | Avoidant* | Anonymous | Against the Rules |

*Differences between these 2 user profiling methods.

## B. GAME ELEMENT PREFERENCE

Preference refers to an individual's attitude towards a particular object. An individual's assessment of whether one likes something or not is usually reflected in a straightforward decision-making process. Therefore, the user's perception preference is essential to gamification design. Nicholson [23] pointed out that the meaningful gamification model promotes user-centric design. Huotari and Jamari [24] emphasise the critical role of user experience and perception in gamification. Chang and Wei [25] mentioned that integrating gamification and online learning needs to consider selecting game elements from undergraduates' learning experiences. It shows that understanding the psychological needs of undergraduates is essential for adequately selecting game elements.

Some researchers have put forward their opinions on the aspects that characterise users' preferences for gamification elements. For example, Ferro [26] designed a gamification retrieval system based on the Octalysis framework, allowing users to judge their preference for 23 game elements and 28 game mechanics. When exploring why people use gamification services, Hamari and Ukkonen analysed user data from two aspects: pragmatism and hedonism [27]. In addition, Bilgihan's 2016 research found that practicality and enjoyment are the two core requirements for online behaviour [28]. Finally, Krause and his team believed that playful gamified learning experiences could foster undergraduates' retention rates, particularly in online learning [29]. Therefore,

developers should refrain from embedding low-level gamification elements in any educational context.

## III. MOTIVATION

Motivational factors dominate one's behaviour. Motivation theories examine participation behaviours from two perspectives: extrinsic motivation and intrinsic motivation. Extrinsic motivation stimulates people to participate in behaviours through external stimuli such as rewards and other incentives (praise, fame, or money) [30]. On the other hand, intrinsic motivation inspires people to do something out of their inner needs, such as interests, leisure, and hobbies, instead of meeting the outside world's expectations (extrinsic motivation) [31].

### A. INTRINSIC MOTIVATION

The intrinsic motivation mechanism uses the user's altruism or gamification, usually driven by the individual's inherent interest or enjoyment of the task, rather than relying on external pressure or desire for rewards [32]. According to recent scholars' research, the most motivated users are from the aspects of self-actualisation, "play"/enjoyment, social and emotional [33], [34], [35].

According to the Self-Determination Theory, self-centred motivation means undergraduates engage in a particular activity according to their wishes or needs, an intrinsic motivational tendency. Achievement motivation generally refers to the undergraduate's motivation towards honours or pursuing personal value maximisation. Competency motivation represents the undergraduate's professional ability motivation that determines future job performance. It could also refer to the individual's ability to perform a specific task. To a certain extent, the task is used to judge undergraduates' skills or the complexity of a particular task [37]. Self-motivation inspires individuals to believe they are competent for a specific quest [38]. Undergraduates enjoy and achieve a state of flow when participating in particular tasks, which could be recognised as "recreation" motivation [39]. Some undergraduates participate in a specific quest due to their personal preferences, which are associated with interest motivation. Most undergraduates prefer gamified activities that optimise their learning level with proper stimulation.

Social need motivation is divided into social interaction motivation, social responsibility motivation, and social learning motivation. Information learning motivation (reading and communication) and career learning motivation (social roles and individual careers) are examples of social learning motivation. The learning motivation for information refers to the undergraduate's motivation to utilise the knowledge to complete the task given [40]. Learning motivation is determined by its professional nature and has nothing to do with its interests [41]. A person's social needs are controlled by society but not by the individual's needs. Therefore, motivations generated by social needs are motivated by a society-centred and human-centred situation. Undergraduates' social responsibility motivations are generally expressed as service motivations

developed by altruism, i.e., using their free time to do things beneficial to society and others. The main emphasis is on the voluntary behaviour of undergraduates, which is more about emotional identity and unity of values than direct benefits.

This paper presented a hierarchical classification of motivation that categorises the variety of motivations to trigger the motivation of self-centred and social needs for undergraduates (Figure 1). As depicted in the figure above, intrinsic motivation is divided according to self and social needs. For example, according to the self-determination theory, self-centred motivation is divided into ''play'' motivation, achievement motivation, competence motivation and self-motivation (autonomy). Among these divisions, ''play'' motivation includes interest and recreational motivation for fun purposes. In addition, self-motivation has self-expression motivation, self-selection motivation, and self-protection motivation. This diagram identifies undergraduates' intrinsic motivation behaviours, which provides a solid ground to map with the Octalysis Framework.
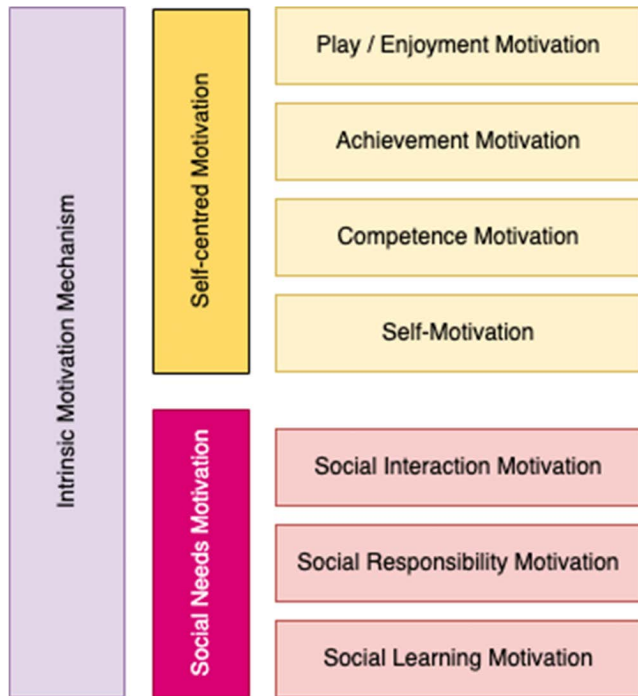


**FIGURE 1. Intrinsic motivation hierarchical classification diagram.**

## B. OCTALYSIS FRAMEWORK

The Octalysis Framework is a model proposed by Yu-kai Chou to establish a user-centred gamification design that focuses on motivation [7]. In this model, he summarised the eight core drives of gamification: Epic Meaning, Accomplishment, Empowerment, Ownership, Social Influence, Scarcity, Unpredictability and Avoidance [42]. Epic Meaning means that users believe that the purpose of what they do is more important than the things themselves, and they give themselves a sense of mission. Accomplishment means the

progress and new skills gained when users complete things. Empowerment means providing innovative channels for users to exert their subjective initiative. Ownership means users own and control their belongings. Social influence refers to the interaction among users. Scarcity means certain things that are only available to specific users. Unpredictability refers to the curiosity of users aroused by restricted items. Finally, avoidance refers to the disadvantages of showing bad events; users might choose to avoid losses. Based on the analysis of 8 driving forces, the gamified system should apply correspondent game elements to motivate the users based on the user model. On the other hand, by exploring the eight-core drives in the user behaviour process, it is possible to clarify how to apply the appropriate drive at each stage to stimulate the undergraduate's behaviour.

This research synopsises and reorganises the eight driving forces above in the educational context. This study summarised the above eight driving forces into two new categories: self-centred and social needs motivation, based on intrinsic motivation hierarchical classification. Before the reorganisation, the eight-core driving forces were relatively scattered. With the new division of driving forces, intrinsic motivation was more focused.
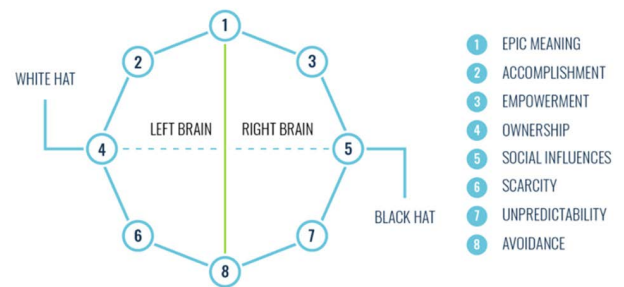


**FIGURE 2. The octalysis framework graphical representation.**

Self-centred motivation mainly refers to the motivation driven by the undergraduate. The relevant core drive includes (1) Empowerment of Creativity and Feedback, (2) Ownership and Possession, (3) Scarcity and Impatience, and (4) Unpredictability and Curiosity. Self-centred motivation is mainly driven by the undergraduate's discovery ability, creativity, and interest. In the scarcity of resources in the gamification system, undergraduates are induced to desire ownership and resources. As the reality is that incentive resources are always scarce and limited. Affected by the real world, people always want to obtain more resources and simultaneously avoid losing resources [43]. When designing a gamified online platform, developers must consider the internal driving force of the individual, enable more exploration modes in the unknown, and provide more creative feedback. In addition, the resources in the learning system must be scarce and limited. The system's ecology must be stable, not expand indefinitely, and have apparent boundaries. These settings require clear rules and maintain the order of the system.

Social needs motivation aims at human beings as a part of a social community that constantly compares and shares with others. The following core drives are related: (1) Epic Meaning and Call, (2) Development and Accomplishment, (3) Social Influences and Relatedness, and (4) Loss and Avoidance. In interacting with other groups, the resulting comparative mentality brings pressure and urgency simultaneously, and undergraduates unknowingly participate in the competition. Appropriate social interaction can drive the motivation of passive undergraduates and make them feel the future impact of their learning. If they think they are recognised for their efforts and know the purpose of the learning quest, they would be more willing to participate in the gamified learning process. In designing gamified learning platforms, economic and social benefits must be considered to help rationally handle human and human-computer interaction processes.

Table 3 lists several potential game elements that meet the eight Octalysis Framework core drives under new categorisation within the scope of the gamified learning platform.
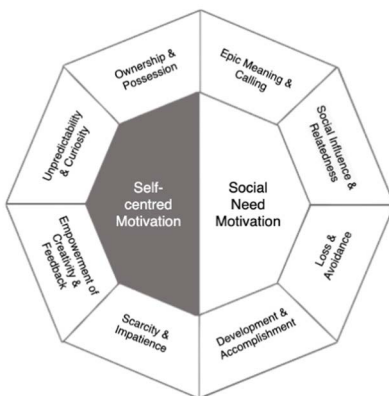


FIGURE 3. New categorisation for core drives from octalysis framework.

TABLE 3. Game elements mapping with new categorisation for octalysis framework core drives.

| NEW CATEGORISATION | Core Drive | Game Elements |
|---|---|---|
| Self-centred Motivation | Empowerment of Creativity & Feedback | Choices/Consequences, Signposting, Voting/Voice |
| | Ownership & Possession | Avatar, Anonymity |
| | Scarcity & Impatience | Time Pressure |
| | Unpredictability & Curiosity | Exploration, Unlockable |
| Social Needs Motivation | Epic Meaning & Calling | Humanity Hero, Meaning, Narrative, Onboard Tutorial |
| | Development & Accomplishment | Badges, Challenges, Competition, Leaderboard |
| | Social Influence & Relatedness | Cooperation, Group Quest, Guild, Social Pressure |
| | Loss & Avoidance | Progress Loss |

Undergraduates' learning motivations include seeking new knowledge, acknowledgement from others, and future career goals. Therefore, the undergraduate's core needs must be analysed via GRSLSS learner types. The result would guide the undergraduates to achieve their goals.

'Participant' undergraduates expect to progress in learning and complete self-established goals. Therefore, the challenge mechanism generated by goal setting in the gamified platform can drive this type of user. Independent undergraduates like to learn what they do not know and explore new and novel areas. The constant exploration and self-defined mechanisms that can exert their creativity can attract them. Collaborative undergraduates are willing to spend time and energy communicating with others about their achievements in learning. They prefer to interact with each other regarding achievements, including educators and coursemates. Therefore, the cooperation mechanism and feedback mechanism can meet their needs. Competitive undergraduates are more willing to achieve high learning goals through self-requirements. Through the competition mechanism, they can enjoy the fun of victory. While learning has achieved success, encouraging others is also the motivation for continuous learning. Dependent undergraduates need more peer pressure and encouragement from other groupmates, and more combined challenges can drive their constant motivation. Only avoidant undergraduates generally choose to avoid them. More rewards and visual narratives might inspire them to participate in the learning platform. Table 4 shows the game-driving mechanisms of various types of learners.

TABLE 4. Core drives needs for six learners type based on octalysis framework.

| LEARNER'S STYLE | Needs | Core Drives (Octalysis Framework) |
|---|---|---|
| Participant | Curiosity, Challenge, Fun, Virtual Identity, Goal | Unpredictability & Curiosity, Ownership & Possession, Epic Meaning & Calling, Social Influence & Relatedness |
| Avoidant | Fun, Privacy, Time Pressure | Ownership & Possession, Unpredictability & Curiosity, Scarcity & Impatience |
| Independent | Control, Progress, Goal | Empowerment of Creativity & Feedback, Scarcity & Impatience, Development & Accomplishment |
| Dependent | Interaction, Social Pressure, Goal | Social Influence & Relatedness, Loss & Avoidance, Epic Meaning & Calling |
| Collaborative | Interaction, Emotion, Challenge | Social Influence & Relatedness, Epic Meaning & Calling, Development & Accomplishment |
| Competitive | Challenge, Competition, Reward | Development & Accomplishment, Social Influence & Relatedness, Loss & Avoidance |

From the characteristics of six different learner types, this research suggests grouping them based on Octalysis Framework Core Drives' needs. For example, avoidant, independent, and participant learners required more self-centred motivation, while competitive, dependent and collaborative learners required social need motivation. Figure 4 below explains the division as mentioned above.
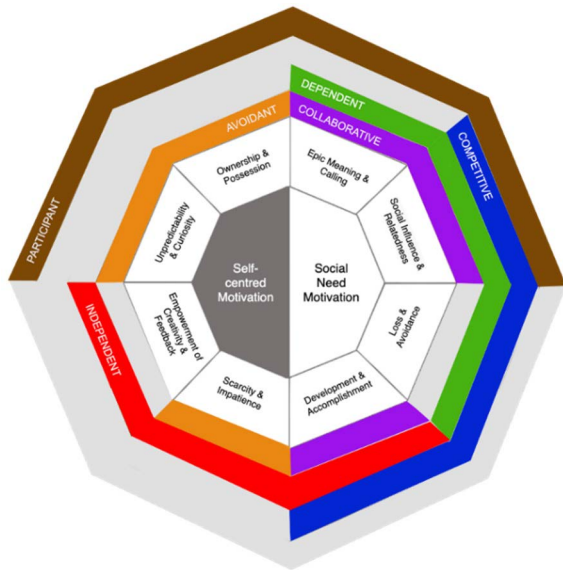
## IV. FRAMEWORK DEVELOPMENT

This paper conducted some learning phases at a typical tertiary education level to establish a framework to evaluate undergraduates' persistent online learning experiences. In addition, this paper further explains the experiential factors that serve as the proposed intrinsic motivation gamification framework in the following subsection.

### A. THE EXPERIENTIAL FACTOR OF GAMIFICATION

In gamified learning platform development, developers need to analyse each learning phase and design corresponding gamified activities accordingly, thus creating meaningful situations for learning so that the game can maximise its value. The activity context should reflect authenticity, constructive interaction and effectiveness. The context should also be conducive to triggering underachievers to ask questions, form tasks, and stimulate interest. Appropriate context could enrich and diversify the learning process, thus effectively reducing the interference of irrelevant information. Simultaneously, it is necessary to make proper adjustments to the game content, time limit, level of difficulty, and rules in consideration of factors such as the undergraduates' cognitive level, game level, and psychological characteristics. Gamified learning includes four phases: introduction, learning, mastering, and summarising.

#### 1) INTRODUCTION PHASE

Use game context to introduce new lessons, which can effectively attract attention, stimulate learning interest, strengthen learning motivation, and establish a proactive mental state for the later learning of undergraduates. The gamified activity design of this phase should consider that the duration should be brief. Besides, the content should be straightforward, but it must give undergraduates intense sensory stimulation and

leave a specific room for thinking. It would be more persuasive if the undergraduate felt their participation had epic meaning or helped them achieve their goals. A good narrative could captivate their emotions while learning.

#### 2) LEARNING PHASE

Gamified activities create a context for learning, helping undergraduates remember, understand, and master knowledge. The game context at this phase could effectively invigorate the learning atmosphere, relieve undergraduates' fatigue, and enable undergraduates to maintain their interest and attention in learning. Therefore, the activity in this phase should be more relaxed. As a result, undergraduates could participate more in the activity and perceive their knowledge via the game context. At this time, undergraduates' knowledge is acquired through active emotional experience and deep-level cognitive participation to be more firmly grasped.

#### 3) MASTERING PHASE

Gamified activities provoke the review of knowledge and the creation of a context for consolidation. The undergraduates' long-term memory of knowledge needs to rely on repeated practice, and the "endless quiz" is boring to them. Therefore, it is easier to cause the undergraduates to resent and reject them. However, appropriate game elements could make the quiz answering process more appealing to undergraduates, particularly avoidants and dependents. In this phase, the gamified platform should again emphasise the learning objectives to ensure the undergraduates achieve the learning goal. Generally, the gamified activities in this phase should be random, and the undergraduates should be able to decide which challenge or task to continue.

#### 4) SUMMARISING PHASE

Gamified activities create a context for combing and summarising knowledge. The game context mainly helps learners systematically sort out and summarise the knowledge learned in the lesson. This phrase gives learners a certain amount of space for thinking and exploration to deepen and extend their understanding. It also maintains the learning zeal of the avoidant and dependent undergraduates.

### B. INTRINSIC MOTIVATION GAMIFICATION FRAMEWORK

This research proposed the Intrinsic Motivation Gamification Framework to design a gamified platform that suits undergraduates with different learner types. It suggests game elements for each of the learning phases in online learning. First, the developer should start from the undergraduates' behaviour analysis. According to the undergraduate's typical learning habits, the introduction stage (target motivation), learning stage (behavioural motivation and information transmission), mastering stage (emotional communication and multimodal interaction) and summarising stage (behaviour feedback). Then, developers and academicians should focus on mastering phrases or, more particularly, scaffolding in the player's journey to extend undergraduates' engagement and

motivation. The six factors applied in the four learning phases determine the needed game elements in a typical gamified learning platform. Below is further elaboration on the six factors.

### 1) TARGET MOTIVATION

In the early stages of learning, the content is unknown to undergraduates and can stimulate their curiosity. Gamified platforms often package their content through stories, but this method is no longer engaging for typical undergraduates. Instead, the undergraduates would compare different learning platforms based on their needs.

### 2) MOTIVATED BEHAVIOUR

When using the gamified platform, the medium's experience determines the undergraduate's behaviour, and some user behaviours are expected to happen multiple times by the undergraduate. Therefore, after analysing the users' journey, it is necessary to clarify the user behaviours that can be motivated.

### 3) INFORMATION TRANSMISSION

The goal of the gamified platform is to deliver learning content. Undergraduates are concerned about the usefulness and effectiveness of information. Therefore, undergraduates expect to use efficient learning methods to obtain more information. Undergraduates should be given the authority to choose their learning path and unlock some rare content.

### 4) EMOTIONAL COMMUNICATION

User emotion is an essential factor that needs attention for the gamified platform. The warm emotion that the platform transmits to the undergraduate is conducive to the smoothness of the user experience. Furthermore, communication and interaction among undergraduates could enhance learning exchanges through emotional connections and inspire undergraduates to strive for greater achievements.

### 5) STRATEGIC INTERACTION

Undergraduates rely on actions taken by other learners/teams that also use the platform to achieve their goals. The undergraduates must try to understand what their teammates or others would do. Undergraduates must have long-term strategic planning to have lasting and purposeful collective action.

### 6) BEHAVIOUR FEEDBACK

In the latter stage of learning, undergraduates usually have two feedback methods: to continue learning or quit the platform. Undergraduates' value perception could influence their motivation and stimulate learning expectations. The undergraduates' sentiments and feedback are necessary to comprehend their needs and help them reflect on what they gained along the gamified learning journey.

This framework is expected to suit all learners and increase their motivation in the learning process via the gamified platform. Although their condition level is different (self-centred and social need motivation), the availability of certain game elements/mechanics in different learning phases could motivate the undergraduates without having a fully tailored or personalised gamification system design. Thus, this framework reduces the complexity and the cost of development for the gamified platform. The framework also allows for smoothly progressing from novice to expert learners by giving the undergraduates the right level of difficulty, whatever their skill levels are. The gamified system must provide information to learners on how to overcome the challenges in different learning phases. Smooth learning curves assist undergraduates in developing game mastery skills, which raises their social status and encourages cooperation [44]. This research validates the application of this framework via the GamiClass system—an online gamified learning platform that runs for 16 weeks. Figure 5 displays the Intrinsic Motivation Gamification Framework with examples of six factors and game elements.

| **EIGHT CORE DRIVE (OCTALYSIS)** | | | | | |
|---|---|---|---|---|---|
| **Primary Drive** | | | | | |
| Unpredictability | Accomplishment | | Social Influence, Scarcity | | Accomplishment |
| **Secondary Drive** | | | | | |
| Epic Meaning, Accomplishment, Ownership | Empowerment, Social Influence, Epic Meaning, Scarcity, Unpredictability, | | Empowerment, Ownership, Avoidance, Accomplishment | | Epic Meaning, Social Influence |
| **Player Journey** | | | | | |
| Discovery | Onboarding | | Scaffolding | | Ending |
| **Learning Phases** | | | | | |
| Introduction | Learning | | Mastering | | Summarising |
| **Factors** | | | | | |
| Target Motivation | Motivated Behaviour | Information Transmission | Emotional Communication | Strategic Interaction | Behaviour Feedback |
| **Game Elements Examples** | | | | | |
| Avatar Exploration Meaning Narrative Onboarding | Badges Challenges Competition Cooperation Guilds | Choices / Consequences Signposting Unlockable | Leaderboards Progress Loss Social Pressure Time Pressure | Choices / Consequences Group Quest | Badges Meaning Voting / Voice |

**FIGURE 5.** The proposed intrinsic motivation gamification framework.

## V. RESEARCH METHODOLOGY

Based on the proposed Intrinsic Motivation Gamification Framework, the research attempts to survey undergraduates' preference for gamification elements and then provides a reference for optimising gamified learning platform design. The research questions include core drives that trigger intrinsic motivation among the undergraduates via learner's type categorisation and the preferences for the game elements in the gamified learning platform. Besides, the surveyed subjects must have an online learning experience to obtain the undergraduates' deep feelings. Therefore, undergraduates involved in the studies are expected to have different learner-type characteristics. The experiment and data collection process were conducted for 16 weeks (1 semester), which matches with studies conducted by Hanus and Fox [45]. The researcher strictly abides by the research methods' requirements and

ensures the reliability and validity of the conclusions. For data collection, GamiClass, a self-developed WordPress core gamified learning platform, was used for data collection. It is an educational supplement to change the conventional classroom environment for Malaysia Innovation subjects. This platform uses the suggested game elements deployed in different learning phases in the Intrinsic Motivation Gamification Framework. This platform was developed to encourage coordination of work between teams, increase participants' enthusiasm, and ultimately encourage undergraduates to have more positive behaviour in long-term online learning.

### A. EXPERIMENTAL CONTEXT

Malaysia Innovation is a semester-long compulsory general studies (Mata Pelajaran Umum (MPU)) course offered at a university located in Malaysia. This course delivered the theory and practical elements necessary for determining the potential viability of an innovative solution to problems or questions within Malaysia. Undergraduates from different faculties and years of study must identify the relevant theories and concepts contributing to a Malaysian organisation's innovation attempts. Besides, they need to apply critical thought and analysis to identify genuine issues in Malaysia and develop suitable solutions to Malaysian problems. Lastly, undergraduates must develop, plan, and propose a Malaysian innovation project and present and execute the proposal.

The sampling population comprises eighty-first and second-year undergraduates from various faculties. In the meantime, the learning materials are available through the university's learning management system (LMS) and the GamiClass platform. The learning content was the same between the two platforms. Undergraduates have the freedom to participate or withdraw from GamiClass at any time during the semester. One lecturer with three years of experience teaching the same course conducted this course. The lecturer worked on face-to-face contact (3 hours a week) and online interaction with undergraduates. The learning process and activities for this course were conducted in English.

Before the gamification experiment, the undergraduates were graded based on midterm assignments, online participation, pitching, and a final group presentation. However, undergraduates often focused solely on the primary assessment and overlooked the online involvement of the last few consecutive semesters. Therefore, to further captivate undergraduates and engage them with the course, the lecturer decided to adopt a gamified approach to study and analyse how undergraduates' behaviour and performance were affected. This study used a design-based analysis method. This technique relies on an iterative design cycle in a real-world learning environment. As a result, all the GamiClass participants interact in a defined design environment rather than a laboratory setting, isolated from everyday practice.

### B. QUESTIONNAIRE DESIGN

The data collection instrument of this research is aimed at the gamified learning platform of undergraduates. The researcher analyses the efficiency of game elements that sustain long-term learning behaviour in detail. The research divided the data collection process into two phases: questionnaires, scale development and framework verification (undergraduate survey). These two phases serve as a preparatory stage for research practice and provide a solid and reliable basis for generating research data. At this stage, the researchers obtain the research data through the undergraduates' filling out the scales and conclusions by analysing the data using different statistical methods.

Undergraduates involved in the studies were expected to have different learner-type characteristics. Therefore, they were obliged to take the survey but could skip participating in the GamiClass learning platform. The experiment and data collection process were conducted on a 16-week basis (1 semester including a semester break), matching Hanus's studies in 2015. The researcher strictly abides by the research methods' requirements and ensures the reliability and validity of the conclusions.

Before launching a large-scale questionnaire survey, the researcher conducted a pre-test to determine the user learner type. Grasha Riechmann's learning style survey applied to all undergraduates taking the Malaysia Innovation module in the May 2020 semester.

For the post-test survey, the questionnaire was designed based on the post-test (Hybrid Questionnaire from the Intrinsic Motivation Inventory(IMI)) [46], the Learner Empowerment Scale [47] and the Social Orientation Scale [48]. The questionnaire consists of 63 questions, released using Google Form. Among the 63 questions, only the first four cover the learner's type, year of study, gender and preference for gaming. The remaining 59 questions were related to the research design. Those questions have been broken into four phases: introduction, learning, mastering and summarising. The measurement indicators are all scored using the Likert Scale scale, where "1" stands for "strongly disagree", "2" stands for "disagree", "3" stands for "general", "4" stands for "agree" and "5" stands for "strongly agree". Only undergraduates who persisted in learning until the end of the experiment were required to complete the post-test survey. Table 5 above shows the breakdown of the survey questions based on game elements. Please see the Appendix for more information on post-survey questions.

### C. PLATFORM DESIGN

This section details the selected 20 game elements deployed on the platform. In addition, this chapter showcases the experimental scheme for four different learning phases for undergraduates on the GamiClass platform.

In the introduction phase, the gamified online learning system formulates the missions, game rules and narratives according to the learning objectives and the analysis of the

**TABLE 5.** Post-test survey structure.

| TIER 1 | Tier 2 | Tier 3 | Numbers |
|---|---|---|---|
| General | Personal Information | - | 2 |
| | Learner Type | - | 1 |
| | Gaming Preference | - | 1 |
| Game Elements | Dynamics | Exploration | 3 |
| | | Learning / Onboarding | 4 |
| | | Meaning | 3 |
| | | Narrative | 4 |
| | Mechanics | Challenges | 4 |
| | | Choices / Consequences | 4 |
| | | Cooperation | 5 |
| | | Competition | 2 |
| | | Group Quest | 3 |
| | | Guilds | 5 |
| | | Humanity Hero | 3 |
| | | Progress Loss | 2 |
| | | Social Pressure | 2 |
| | | Time Pressure | 2 |
| | | Unlockable | 1 |
| | | Voting / Voice | 1 |
| | Components | Avatar | 2 |
| | | Badges / Achievement | 4 |
| | | Leaderboards | 1 |
| | | Signposting | 3 |
| Feedback | Satisfaction | - | 1 |

undergraduates (based on learner type). While fascinated by the story, undergraduates must know what to focus on in the following gamified missions. Therefore, the system would guide undergraduates to understand the information contained in-game missions and rules, which play an advanced role in sorting out the content to be learned next and paving the way for the learning journey.

The game elements in this stage are avatar, exploration, meaning, narrative and onboarding. The learning phase is to begin to participate in gamification activities formally. First, the undergraduates start taking on challenges under the system's guidance and gradually conduct activities independently after forming a group. At this phase, it is necessary to stimulate the undergraduates' challenging spirits while digesting the absorbed teaching content. Interdependence is essential since undergraduates gain knowledge and level up in a guild. The guild members must establish an emotional and tacit understanding of honour and commonality. The goals of this phase include establishing positive interdependent connections within the guild through active interactions, helping to enhance the effects of the

mastering phase. The game elements that support dynamic interdependence include goals/challenges, roles, cooperation and competition. This research selects the game elements to be applied to this phase based on the participation characteristics: badges, challenges, competition, cooperation, guilds, choices/consequences, signposting and unlockable. This phase helps build positive interdependent connections within the guild. It should be noted that motivation is not a design element directly applied to the gamified system. Only some phases trigger strong motivation in the undergraduates, although the designers wish to achieve it all the time. As the researcher hypothesizes, the persistence of gamified learning platform learners relies on the game elements that promote collaboration and competition. Therefore, all the onboard participants of the platform are required to join any guild and participate in group quest activities weekly to verify the researcher's hypothesis.

The mastering phase is the core of developing practical social negotiation activities. GamiClass uses GamiPress Analytics to assist in effective social negotiation. Undergraduates can discuss and negotiate with the guild through the platform's voice/text communication plugin. The undergraduate's initiative would be mobilised to the highest level in this phase compared to the learning phase. The corresponding cognition becomes active to autonomously understand the task's occurrence and spontaneously pay attention to the activity trend. Educators could monitor undergraduates' activity progress in real-time. The system should promptly point out various knowledge points in the activity, openly lead undergraduates to discuss them, clearly tell them what to learn, and then understand what they have learned through follow-up questions and answers. Although gamification is a trigger for learning, it cannot stay unchanged until the undergraduate triggers it by himself. In addition, educators also need to update game data and observe the task tracking area to timely feedback on errors that deviate too much. Guild members independently choose and play different roles and assume corresponding responsibilities. The guild jointly completes the goal and mission through sharing, generating, negotiating, arguing, and comprehensive and effective social negotiation. Since the relationship between the series of tasks may be parallel or serial, the undergraduates might swap their roles among their guild before completing the final overall mission. The smooth progress of this phase would deepen the positive interdependence among members, enhance the effect of participation, and aggravate the undergraduate's understanding of the learning content, which is helpful for subsequent reflection. The mastering phase should highlight the following game elements: group quest, leaderboards, progress loss, social pressure, time pressure and voting/voice.

The summarising phase is the end of learning activities, and it is also a node for educators to check and fill in the gaps and summarise and review the knowledge points of the platform. Each guild first displays its mission results. Then, the system publishes the periodic (weekly or monthly) ranking information to guide the undergraduates to summarise the

activity process, educator's evaluation, and peer evaluation. This phase aims to guide undergraduates to review and reflect on the learning activities and promote the recall of the mastering phase, thus deepening the understanding of the learning content and ensuring that the undergraduates have mastered the knowledge according to the teaching plan. In addition, undergraduates can improve their behaviours through reflection, which is helpful for the transfer of behaviours and learning in other situations in the future. Their cognitive understanding level also reaches its peak at this phase. After the system summarises the undergraduate's performance, it is still not the end of learning. The gamification system provides updated learning content from time to time and without interruption, thereby encouraging undergraduates to participate in the platform for a long time. Integrating the gamification system with the practical activities is a must, so the undergraduates can also apply them to the actual operation/work/competition after learning on the platform. Game elements in this phase include badges, leaderboards, meaning and voting/voice.

### D. GAMIFICATION INTEGRATION

The GamiClass platform was mainly built on GamiPress and Sensei LMS plugins. GamiPress is a free WordPress gamification plugin. It allows common gameplay elements to be integrated into WordPress-based websites, such as point systems and competition between users. GamiPress provides three types of digital rewards—points, achievements, and ranks—while each can be further broken down into multiple custom "types". The developer could combine rewards and types to create a unique and customised gamification system. At the same time, Sensei LMS is a learning management system plugin built by the original development team of WordPress. This LMS plugin allows the developer to create eLearning courses and platforms via drag-and-drop functionalities. It also allows undergraduates' progress tracking and tests them via quizzes and assignments. Sensei LMS provides all the crucial components needed to create a functional and interactive platform, complete with the correct elements to keep the undergraduates engaged. Besides, undergraduates who complete the lesson could receive a certificate designed by the educator based on their milestone achievements. Judging from its robustness, this LMS uses two-factor authentication to ensure tight security on its platform. Furthermore, Sensei LMS integrates with leading gamification plugins in the WordPress CMS.

Undergraduates could collect points while interacting with the platform. They could exercise their points to level up or unlock certain hidden content. The developer could customise it as GamiClass, hide it from the undergraduates but reflect it as a log in the admin dashboard. Undergraduates could only view a dynamic progress bar with a spectrum of colours (red to green). Besides the typical point system, GamiClass introduced the XP points system, which displays stars. Undergraduates could exchange the stars for a weapon or armour to upgrade their skill or performance during the

group quest. The developer could specify how undergraduates earn and lose points via the setting. Out of the box, some of the available "events" that can trigger gains or losses include registering for an account, completing a lesson within a given duration, completing the quiz, commenting on a post or reaching specific achievements. The daily points limit could be configured to avoid undergraduates abusing the system in point collection.

Achievements are typically applied on gamified learning platforms to reward undergraduates for completing lessons. Upon completion of specific requirements, undergraduates can acquire an achievement. This reward is displayed as a badge that undergraduates can show or hide on their profiles. Besides, undergraduates could be motivated by filling out their account information, logging in regularly, commenting on posts, and contributing to their achievements. The developer could customise how the undergraduates obtain their badges. The platform could introduce some rare badges to challenge the undergraduates, which the undergraduates need help to achieve. The platform could notify users of the inherent rules or requirements for rare badge collection during the onboarding session. With "Badgr" integration, the learning platform could provide credentialing with stackable learning pathways and shareable undergraduate records. Undergraduates could verify and track their award badges. These features are estimated to leverage the power of the digital credentialing solution to create skills-based recognition and guided learning journeys that help undergraduates focus on what matters.

Similar to achievements, ranks are awarded when users complete specific tasks. However, undergraduates could meet the criteria in a particular order in this case. Reaching a higher rank might provide access to exclusive content. This reward encourages undergraduates to interact with the platform to "level up". Ranks could therefore create a sense of friendly competition between undergraduates, providing additional motivation for them to further engage with the learning platform so they can one-up others.

Daily Login Rewards allow the platform to award undergraduates for daily login to the platform. The developer could create calendars with rewards for daily logins and set any limitations, like forcing consecutive logins with penalties or limiting by a period. Time pressure elements could reflect this through "expiration," in which their points and XP are reduced if they are inactive for an extended period. The platform could configure an expiration for all or some ranks of the same type, forcing the undergraduates to reach a new rank in the given time frame.

Undergraduates can access their performance data via an analytic dashboard. In addition, it displays live controls to let undergraduates navigate different periods and see their old activities. Those reports include some functionalities to improve the user experience and make the report easier to understand for undergraduates. For example, all reports include enabling or disabling a legend. The legend lets the undergraduates dynamically show and hide any statistic they

want by simply clicking on the statistic label. The Backend Reports dashboard provides three tabs of analytics based on points, achievements, and rank. It allows the admin and educators to easily view data statistics from undergraduates' points, their earned achievements, and their current rank. Real-time tools load statistics, charts, and tables with all the information about what is happening in the gamification environment. In addition, the dashboard includes comparison charts to show the behaviour trends of the undergraduates in the different periods. That information assists the educator in detecting increments or decrements in behaviour related to points movements (awarded, deducted and expended), achievements interactions (earned and awarded by admins), or rank positions (reached and awarded by admins).

The leaderboard in GamiPress allows the developer to configure any points, achievements, or ranks as metrics to track. For example, filter metrics could be tracked based on a certain number of undergraduates within a specific time. On this leaderboard, undergraduates are ranked by the number of quests they have earned, their current points or XP balance, and their current grade priority. The leaderboard resets weekly, while the visible list of undergraduates is limited to 10 units before or after the undergraduate's performance. The platform live notifications add-on allows the platform to notify undergraduates about new achievements, steps, or points awarded upon completion. By default settings, the undergraduates receive notification from their guild members, which reminds them to follow the pace of the guild.

The ''Mark as Completed'' feature lets developers configure requirements to be marked as completed manually by undergraduates in the task tracking area. This add-on has been designed to indicate a checklist in individual or group quests.

The Nomination add-on lets the undergraduates have the ability to nominate any other guild member to unlock particular achievements or be leaders for any group quest. The add-on could restrict the number of votes cast by undergraduates on a particular event or mission. All the nomination votes and actions need approval from the platform admin.

Undergraduates can use the Progress add-on to track their progress toward completing any achievement, step, point type, or award. The progress of all requirements (achievement steps, points type awards and deducts, and rank requirements) is calculated based on the required time value. A progress map motivates them to progress with visible consequences that match the signposting game element.

The referral system is worth activating to award undergraduates who refer peers and sign-up. Points and badges would be awarded to those undergraduates who actively engage with more participants. This feature could be referred to as the social pressure game element. The undergraduates are allowed to brag about their achievements to other undergraduates. All the undergraduates could enable or disable the bragging feature on the setting page.

The Restrict Unlock add-on allows the educator to configure several restrictions to certain content unlocks until the undergraduate completes all the specified requirements.

Different game elements and new content are unveiled when undergraduates enter different learning phases. The time-based reward encourages the undergraduates to stay longer on the platform, but the reward would not be directly reflected in numeric points. Instead, it gradually adds to the progress bar without the undergraduate's notice.

Figure 6 displays the backend of the GamiClass platform. The backend of GamiClass recorded all the undergraduates' activities in a log and displayed them in an analytics format, which is easy for monitoring purposes. Figure 7 provides more screenshots of the GamiClass platform in-game element deployment.
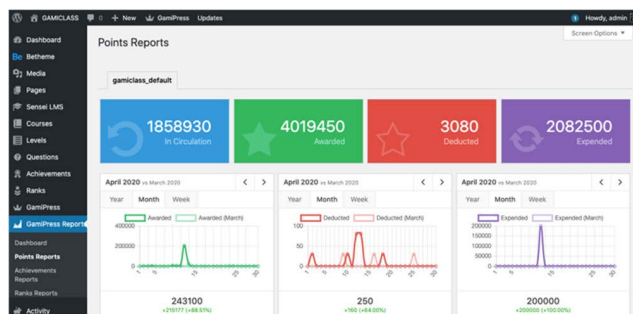


**FIGURE 6. GamiClass backend.**
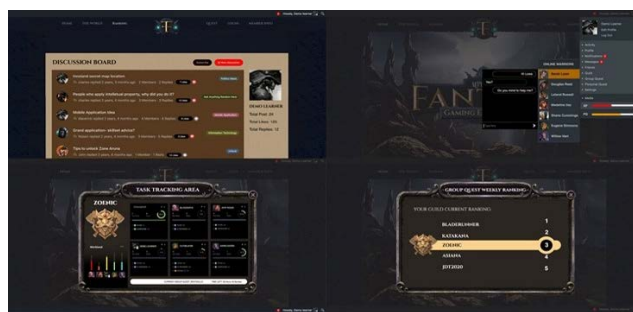


**FIGURE 7. Some GamiClass game elements screenshots.**

Table 6 categorises the GamiClass game elements with the Octalysis framework. Finally, table 7 describes the purpose of each game element embedded into the GamiClass platform. All the game elements cover the Octalysis framework of eight core drives with a minimum of one element for each drive. Therefore, the author believed the 20 game elements employed in 4 different learning phases based on the Intrinsic Motivation Gamification Framework could support six different learner types of undergraduates to complete their gamified learning journey for up to 16 weeks.

## VI. DATA ANALYSIS
This section analyses both pre and post-test surveys results.

### A. PRE-TEST
From the Grasha-Riechmann Learning Styles Survey pre-test survey results, the researcher managed to identify the ratio

**TABLE 6.** Game elements grouping in GamiClass based on octalysis.

| CORE DRIVE | Game Elements |
|---|---|
| Epic Meaning Accomplishment | Humanity Hero, Learning, Meaning, Narrative, Badges, Challenges, Competition, Leaderboard |
| Empowerment | Choices/Consequences, Signposting, Voting/Voice |
| Ownership | Avatar |
| Social Influence | Cooperation, Group Quest, Guild, Social Pressure |
| Scarcity | Time Pressure |
| Unpredictability | Exploration, Unlockable |
| Avoidance | Progress Loss |

**TABLE 7.** GamiClass game elements and purposes.

| CORE DRIVE | Game Elements |
|---|---|
| Avatar | The ability to give undergraduates the feeling that they own and control their digital persona. |
| Badges | Undergraduates' ability to convert their reward into a signal of their accomplishments |
| Challenges | The ability to take expected actions, complete a task, and progress in their collaboration, interaction, and learning processes. |
| Choices / Consequences | The ability to make the undergraduates think about their chosen actions as they are fed the results. |
| Competition | The ability to encourage undergraduates to develop real-life skills and discover the best in themselves. |
| Cooperation | The ability to allow undergraduates to share what they know by answering questions or teaching others. |
| Exploration | The ability for undergraduates to explore uncharted territories and discover the unexpected with freedom. |
| Group Quest | The ability to get undergraduates interested in doing something that benefits the whole guild or defeats other guilds It helps the undergraduates know their roles, strengths, and how they can best contribute to everyone's best. |
| Guilds | The ability to allow undergraduates to form groups based on various factors, whether it's similar or complementary playing styles, interests, or even levels of engagement with a game |
| Humanity Hero | Allowing undergraduates to improve the world every time they perform a desired activity or behaviour improves the world. |
| Leaderboard | The ability to visualise undergraduates' achievements and know precisely where they stand relative to others |
| Learning | The ability to teach undergraduates new skills by imitating other users or through visual representation. |
| Meaning | The ability to inspire undergraduates and get them excited about being part of a bigger purpose or plan |
| Narrative | The ability to supply a continuous and persistent storyline captivates undergraduates and provides all the information undergraduates need to take the appropriate actions in the learning process. |
| Progress Loss | The ability to motivate undergraduates to continue playing through a feedback mechanism is critical because they would lose their status or achievements if they stopped. |
| Signposting | The ability to provide undergraduates with a helping hand when they get lost and stuck in places. |
| Social pressure | The ability to influence undergraduate behaviour based on the actions of others. |
| Time Pressure | The ability to make the undergraduates become more focused on the solution and achieve their goals faster than they would have without time pressure. |
| Unlockable | The constraint allows undergraduates to unlock unique or rare content throughout the game. |
| Voting / Voice | Allowing most undergraduates to decide what they want is the best way to implement changes so that everyone can be on board together. |

based on six learning styles. Table 8 displays the demography based on 80 undergraduates enrolled in the Malaysia Innovation subject in May 2020.

Most of the participating undergraduates belonged to dependent, collaborative, participant and independent categories. On the other hand, only a slim portion of undergraduates (7.5%) belonged to avoidant and competitive undergraduates. Therefore, 41.25% of passive undergraduates could be identified from this sampling (avoidant and dependent undergraduates). Therefore, motivation is the primary challenge for this test as the platform design needs to keep these passive undergraduates active for 16 weeks. Besides, 13.75% of the undergraduates preferred the independent learning method, where they resisted the group quest activity mode.

Similar to the Hanus experiment [43], this sampling consists of 26 male (32.5%) undergraduates and 54 females (67.5%). Only one male undergraduate did not participate in the GamiClass activity, while 5% of female undergraduates refused to involve themselves in the gamified learning activities. Out of 76 participants, 69 persisted on the platform until the end of the experiment. This result is relatively positive and encouraging as it means 90.7% sustain their learning enthusiasm until week 16. The data reflects that seven (3 male and 4 female) undergraduates withdrew before the experiment ended. Compared to several longitudinal gamified studies that reflected decrement in the long-term application, the GamiClass platform managed to engage most participants and trigger the undergraduate's intrinsic motivation [8], [45], [49], [50]. This positive result was relatively caused by the appropriate game elements' usage and novelty at a particular phase, similar to Multimedia Content Production (MCP) by Barata's team [51]. Table 9 compares active and inactive GamiClass undergraduates based on six undergraduate types and gender.

This study examines the scale of relatedness for the six types of undergraduates who managed to persist in learning within the GamiClass platform because 20 game elements have been mapped to eight different core drives of the Octalysis framework. The post-test reflects their preference for the game elements and motivation core drives. Out of 80 undergraduates, 76 participated in the

GameClass platform (95% participation rate). Those 76 undergraduates volunteered to participate and could withdraw or quit the study anytime. At the end of the test, 69 undergraduates (90.8%) were retained on the platform. Among 80 undergraduates, 71 showed an interest or strong interest in gaming, which matches the digital native

**TABLE 8.** Undergraduate's proportion based on grasha-riechmann learner style.

| LEARNER'S STYLE | Numbers | Percentage (%) |
|---|---|---|
| Avoidant | 6 | 7.5 |
| Collaborative | 17 | 21.25 |
| Competitive | 2 | 7.5 |
| Dependent | 27 | 33.75 |
| Independent | 11 | 13.75 |
| Participant | 17 | 21.25 |
| | 80 | 100 |

**TABLE 9.** GamiClass platform engagement mapping based on gender and learner's type.

| LEARNER'S TYPE | Male | Female | Active | Inactive | Total Participants |
|---|---|---|---|---|---|
| Avoidant | 4 | 0 | 2 | 2 | 4 |
| Collaborative | 4 | 12 | 14 | 2 | 16 |
| Competitive | 0 | 2 | 2 | 0 | 2 |
| Dependent | 5 | 21 | 24 | 2 | 26 |
| Independent | 4 | 7 | 10 | 1 | 11 |
| Participant | 5 | 12 | 17 | 0 | 17 |
| | 22 | 47 | 69 | 7 | 76 |

characteristic of Generation Z. This phenomenon is more significant than Generation Y undergraduates because Generation Z grew up in a hyper-connected world with a wealth of information and an on-demand culture [52].

Only four undergraduates from the Malaysia Innovation course who refused to try the platform have a common attribute of strongly disliking gaming activity. Besides, they preferred a typical learning management system and traditional in-class learning activities. Table 11 shows the demography of these four non-participants.

**TABLE 10.** Undergraduate's gaming preference based on learner's type (participant of Gamiclass platform).

| LEARNER'S TYPE | Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| Avoidant | 2 | 2 | - | 1 | 1 |
| Collaborative | 6 | 10 | 1 | - | - |
| Competitive | - | 2 | - | - | - |
| Dependent | 10 | 13 | 2 | 1 | 1 |
| Independent | 5 | 5 | 1 | - | - |
| Participant | 6 | 10 | 1 | - | - |
| Total | 29 | 42 | 5 | 2 | 2 |

## B. POST-TEST

The post-test responses were analysed using the statistical analysis tool IBM SPSS version 26. The survey instrument's reliability was verified by Cronbach's alpha and analysis of the descriptive statistics of skewness and kurtosis. Besides the regression analysis's tolerance limit, this research applies the criteria of multicollinearity to verify the analysis results.

**TABLE 11.** Non-participants demography for the GamiClass platform.

| LEARNER TYPE | Gender | Gaming Preference |
|---|---|---|
| Collaborative | Female | Disagree |
| Dependent | Female | Strongly Disagree |
| Avoidant | Female | Disagree |
| Avoidant | Male | Strongly Disagree |

**TABLE 12.** Regression and coefficients test result based on octalysis core drive.

Model Summary

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | .702ª | .493 | .426 | .49705 |

Predictors: (Constant), Avoidance, Ownership, Social Influence, Unpredictability, Scarcity, Epic Meaning, Accomplishment, Empowerment

| Model | | Unstandardized Coefficients B | Coefficients Std. Error | Standard Coefficients Beta | T | Sig. | Skewness | Kurtosis | Cronbach's Alpha Value |
|---|---|---|---|---|---|---|---|---|---|
| 1 | (Constant) | -.080 | .609 | | -.132 | .896 | | | |
| | Epic Meaning | .402 | .214 | .310 | 1.877 | .065 | .629 | -.032 | .848 |
| | Accomplishment | .097 | .156 | .100 | .625 | .535 | .389 | -.054 | .884 |
| | Empowerment | -.061 | .211 | -.046 | 1.288 | .775 | .658 | 1.492 | .707 |
| | Ownership | -.058 | .106 | -.054 | -.551 | .584 | .186 | 1.532 | .886 |
| | Social Influence | .452 | .142 | .353 | 3.177 | .002 | .044 | 1.561 | .861 |
| | Scarcity | .161 | .099 | .211 | 1.621 | .110 | -.189 | -.377 | .942 |
| | Unpredictability | .056 | .097 | .065 | .573 | .569 | .439 | 1.599 | .920 |
| | Avoidance | -.003 | .102 | -.004 | -.032 | .975 | -.654 | 1.065 | .892 |

a. Dependent Variable: willingness to continue

According to Kline [53], the data used in regression analysis must have normality. The skewness value, the index that verifies the normality, must be at most 3, while the kurtosis value must be at most 10. Table 12 shows the results of the descriptive statistical analysis. The researcher selected eight predictors in the statistical process: eight Octalysis Framework core drives. When the eight predictors predict the standard dependent variable (willingness to continue in a gamified learning platform), one significant variable enters the regression equation and the multivariate correlation—the coefficient is.702, of which the common explained variance is.493. Therefore, the eight variables in the table can jointly predict 49.7% of the variation in learning motivation. Only the fifth core drive (Social Influence & Relatedness) (Sig =.002) is less than 0.05 based on the result, which shows that Social Influence is the only core drive that makes undergraduates continue using the platform. Unstandardised B is the original regression coefficient, and Beta is the standardised regression coefficient.

Social Influence and Epic Meaning are predicted to significantly positively impact the undergraduates' continuity in the gamified learning platform. On the other hand, three core drives (Ownership, Empowerment and Avoidance) are predicted to reduce undergraduates' motivation, although they are not too significant. Therefore, gamification design for the learning platform should reduce the usage of these motivation drives and emphasise Social Influence and Epic Meaning core drives game elements.

In the social sciences, most scholars believe that the acceptable minimum reliability value is 0.7. However, from the reliability data of each factor presented in the above table, the reliability value of each item exceeds 0.7. Finally, the

researchers also tested the alpha value of the full scale, and the results are presented in the table below, reaching a very high 0.93. This data concluded that the final prediction analysis of this questionnaire meets the requirements and can be formally measured.

Furthermore, this study checked the tolerance and variance inflation factors (VIF) to verify the validity and reliability of the regression analysis results based on game elements (Table 13). This table shows the descriptive statistical analysis results with undergraduates' satisfaction (dependent variable) and twenty game elements (independent variables)—the coefficient is .867, of which the common explained variance is .751. The twenty variables in the table can jointly predict 38.938% of the variation in learning motivation. The tolerance value must be greater than 0.1, and the VIF value must be less than 10. Since the result fulfilled the requirement, collinearity exists between independent variables. The P-Value for the Group Quest (Sig = 0.001), Challenges (Sig = 0.002), Time Pressure (Sig = 0.015), and Choices/Consequences (Sig = 0.007) elements is less than 0.05. These four key game elements drive the undergraduates to continue using the gamified platform, thus triggering intrinsic motivation. The analysis shows that too many Choices/Sequence elements could reduce the platform's continuous usage (T Value = −.2794) while Challenges, Group Quests, and Time Pressure react.

**TABLE 13.** Regression and coefficients test result based on 20 game elements.

Model Summary

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | .867ᵃ | .751 | .647 | .38938 |

a. Predictors: (Constant), Voting / Voice, Avatar with Anonymity, Choices/Consequences, Exploration, Unlockable, Social Pressure, Humanity Hero, Guilds, Progress Loss, Time Pressure, Competition, Group Quests, Learning / Onboarding, Leaderboards, Signposting, Challenges, Narrative, Cooperation, Badges, Meaning

| Model | | Unstandardized Coefficients B | Std. Error | Standard Coefficients Beta | T | Sig. | Collinearity Statistics Tolerance | VIF |
|---|---|---|---|---|---|---|---|---|
| 1 | (Constant) | -0.190 | 0.580 | | -0.327 | 0.745 | | |
| | Avatar | -0.023 | 0.085 | -0.022 | -0.271 | 0.788 | 0.767 | 1.304 |
| | Badges / Achievement | 0.030 | 0.130 | 0.036 | 0.231 | 0.818 | 0.217 | 4.614 |
| | Challenges | 0.483 | 0.149 | 0.429 | 3.250 | 0.002 | 0.297 | 3.364 |
| | Choices / Consequences | -0.344 | 0.123 | -0.252 | -2.794 | 0.007 | 0.638 | 1.566 |
| | Competition | -0.072 | 0.109 | -0.075 | -0.663 | 0.510 | 0.403 | 2.479 |
| | Cooperation | 0.057 | 0.136 | 0.063 | 0.418 | 0.678 | 0.232 | 4.319 |
| | Humanity Hero | 0.016 | 0.109 | 0.015 | 0.150 | 0.881 | 0.536 | 1.867 |
| | Group Quests | 0.438 | 0.124 | 0.424 | 3.530 | 0.001 | 0.359 | 2.788 |
| | Guilds | 0.107 | 0.131 | 0.100 | 0.814 | 0.420 | 0.343 | 2.917 |
| | Leaderboards | -0.103 | 0.071 | -0.185 | -1.456 | 0.152 | 0.322 | 3.101 |
| | Narrative | 0.016 | 0.137 | 0.016 | 0.118 | 0.906 | 0.288 | 3.466 |
| | Learning / Onboarding | 0.158 | 0.137 | 0.134 | 1.156 | 0.253 | 0.386 | 2.590 |
| | Progress Loss | 0.072 | 0.085 | 0.083 | 0.846 | 0.402 | 0.533 | 1.875 |
| | Meaning | -0.106 | 0.166 | -0.104 | -0.641 | 0.525 | 0.199 | 5.036 |
| | Unlockable | -0.086 | 0.079 | -0.126 | -1.087 | 0.282 | 0.387 | 2.586 |
| | Signposting | -0.031 | 0.130 | -0.031 | -0.236 | 0.815 | 0.291 | 3.435 |
| | Social Pressure | 0.189 | 0.105 | 0.168 | 1.808 | 0.077 | 0.597 | 1.675 |
| | Time Pressure | 0.190 | 0.076 | 0.249 | 2.519 | 0.015 | 0.528 | 1.892 |
| | Exploration | -0.011 | 0.066 | -0.014 | -0.158 | 0.875 | 0.670 | 1.493 |
| | Voting / Voice | 0.009 | 0.078 | 0.011 | 0.118 | 0.906 | 0.632 | 1.582 |

a. Dependent Variable: willingness to continue

Through gamified platform testing and post-test results, the undergraduate's average score is more than 3 points (Likert Scale), indicating that undergraduates who have completed 16 weeks are satisfied with the learning experience and the core drives are in line with learners (Table 14).

**TABLE 14.** Octalysis Core drives effectiveness via learner's type categorisation.

| LEANER TYPE | Octalysis Core Drives | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Epic Meaning | Accomplishment | Empowerment | Ownership | Social Influence | Scarcity | Unpredictability | Avoidance |
| Avoidant | 4.000 | 3.563 | 3.625 | 4.500 | 3.758 | 3.750 | 3.000 | 3.500 |
| Collaborative | 3.435 | 3.571 | 3.373 | 3.242 | 3.782 | 3.536 | 3.821 | 3.321 |
| Competitive | 3.260 | 3.625 | 3.014 | 2.500 | 3.621 | 2.250 | 3.333 | 4.000 |
| Dependent | 3.409 | 3.208 | 3.304 | 3.333 | 3.333 | 3.500 | 3.132 | 3.354 |
| Independent | 3.294 | 3.069 | 3.167 | 3.350 | 3.428 | 3.300 | 2.817 | 3.450 |
| Participant | 3.657 | 3.610 | 3.384 | 3.353 | 3.751 | 3.500 | 2.794 | 3.500 |
| Overall | 3.471 | 3.383 | 3.319 | 3.317 | 3.562 | 3.449 | 3.145 | 3.420 |

Table 14 above shows the eight core drives of the Octalysis framework corresponding to the undergraduate type in the theoretical modelling. Since the number of questions for each core drive is different, the average cannot be directly viewed but needs to be processed twice to calculate the average. In short, the Intrinsic Motivation Gamification Framework contributes to an ideal persistent gamification system. This framework works as the research adapts the concept of Hanus and Fox (2015) that gamification is more effective when individuals can choose whether or not to participate. From the results in the table, Social Influence (M = 3.562), Epic Meaning (M = 3.471), and Scarcity (M = 3.449) belong to the top three most influential core drives. Cognitive psychologists suggest intrinsic motivation requires right-brain core drives (empowerment, sociality, and curiosity). The results show that social influence (M = 3.562) outperforms empowerment (M = 3.319) and predictability (M = 3.145). The results of the GamiClass platform tend to be a fusion of Behavioural Learning Theory and Cognitivist Learning Theory. In this research, social influence is mainly powered by game elements under social interaction and social responsibility motivation. Social interaction motivation consists of collaboration and competition via interpersonal activities, which triggers the effects of gamification on cognitive, motivational, and behavioural learning outcomes across collaborative and avoidant undergraduates.

The response to each gaming element makes it possible to see each type of gaming element (Table 15). Except "exploration" element, all game elements achieve more than 3 points on the Likert Scale. Only the Group Quest game element achieves a high-level score (M = 3.862) among the rest. Group Quest is not just the favourite for collaborative undergraduates; it significantly impacts avoidant and independent undergraduates. This result shows the connection towards the Social Influence core drive in Octalysis Framework. Besides, the Meaning game element (M = 3.62) is relatively relevant to most undergraduates, reflecting the

**TABLE 15.** Regression and coefficients test result based on 20 game elements with learner's type.

| | GE01 | GE02 | GE03 | GE04 | GE05 | GE06 | GE07 | GE08 | GE09 | GE10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Avoidant | 4.500 | 3.625 | 4.125 | 3.375 | 3.000 | 4.200 | 3.670 | 4.000 | 3.800 | 3.500 |
| Collaborative | 3.179 | 3.536 | 3.750 | 3.179 | 3.786 | 3.571 | 3.191 | 4.024 | 3.371 | 3.214 |
| Competitive | 2.500 | 3.875 | 3.375 | 2.875 | 3.250 | 3.400 | 3.500 | 3.670 | 3.700 | 4.000 |
| Dependent | 3.350 | 3.000 | 3.375 | 3.200 | 3.300 | 3.260 | 3.100 | 3.767 | 3.000 | 2.600 |
| Independent | 3.333 | 3.177 | 3.323 | 3.135 | 3.458 | 3.242 | 3.403 | 3.653 | 3.058 | 2.875 |
| Participant | 3.353 | 3.574 | 3.426 | 3.191 | 3.794 | 3.424 | 3.412 | 4.058 | 3.176 | 3.647 |
| | | | | | | | | | | |
| Overall | 3.369 | 3.465 | 3.562 | 3.159 | 3.431 | 3.516 | 3.379 | 3.862 | 3.351 | 3.306 |

| | GE11 | GE12 | GE13 | GE14 | GE15 | GE16 | GE17 | GE18 | GE19 | GE20 |
|---|---|---|---|---|---|---|---|---|---|---|
| Avoidance | 3.375 | 3.875 | 3.500 | 4.000 | 3.000 | 4.000 | 3.000 | 3.750 | 3.000 | 3.500 |
| Collaborative | 3.464 | 3.464 | 3.393 | 3.619 | 3.714 | 3.334 | 3.429 | 3.821 | 2.834 | 3.214 |
| Competitive | 3.375 | 3.000 | 3.000 | 3.165 | 3.000 | 3.165 | 3.750 | 3.000 | 3.665 | 3.000 |
| Dependent | 3.350 | 3.125 | 3.550 | 3.601 | 3.000 | 3.199 | 3.200 | 3.400 | 2.633 | 3.100 |
| Independent | 3.406 | 3.354 | 3.521 | 3.472 | 3.333 | 3.362 | 3.042 | 3.688 | 2.930 | 3.417 |
| Participant | 3.691 | 3.662 | 3.794 | 3.863 | 3.235 | 3.549 | 3.559 | 3.559 | 2.353 | 3.412 |
| | | | | | | | | | | |
| Overall | 3.444 | 3.413 | 3.460 | 3.620 | 3.214 | 3.435 | 3.330 | 3.536 | 2.903 | 3.274 |

\* Level indicators: Means: 1.00-2.33 low; 2.34-3.66 medium; 3.67-5.00 high

\* Game elements indicators:

| | | |
|---|---|---|
| GE01: Avatar | GE08: Group Quests | GE15: Unlockable |
| GE02: Badges | GE09: Guilds | GE16: Signposting |
| GE03: Challenges | GE10: Leaderboards | GE17: Social Pressure |
| GE04: Choices/Consequences | GE11: Narrative | GE18: Time Pressure |
| GE05: Competition | GE12: Learning/Onboarding | GE19: Exploration |
| GE06: Cooperation | GE13: Progress Loss | GE20: Voting/Voice |
| GE07: Humanity Hero | GE14: Meaning | |



**FIGURE 8.** Game elements preference in GamiClass platform.

importance of the learning objective and goal to be briefed at the onboarding stage for all undergraduates. These results prove standard points, badges, and leaderboards (PBL) are not the primary method for undergraduates' continuity in gamified learning platforms. Instead, those game elements receive an average score compared to others. The third most collated game element is the Challenge (M = 3.562). This element affects an individual's flow experience to a certain extent. When undergraduates become obsessed with specific tasks, they are less sensitive to the passage of time and show less self-awareness. The key to gamification is to find the most suitable difficulty, get rewards in that position, and finally strike a balance between challenge and reward. Appropriate challenges reduce the dropout rate of users of gamified learning platforms, and undergraduates are more willing to accept challenges.

Exploration is the major practical game element in the GamiClass platform. The undergraduates were not impressed by the freedom given by the system to explore uncharted territories and discover unexpected content. Moreover, since the undergraduates were aware of the content's purpose and scope, they tended to overlook the privilege of unveiling all the hidden content since that knowledge is optional to let them play continuously. In the following section, the researcher discusses the game elements' impact on six different types of undergraduates. By identifying the undergraduates' preferences, the gamified learning platform could tailor its game elements based on the proportion of undergraduates with different learning attributes. Figure 8 highlights the top 4 game elements that support GamiClass learning: Group Quest, Meaning, Challenge, and Time Pressure.

## C. SUMMARY FOR MOTIVATION DRIVE
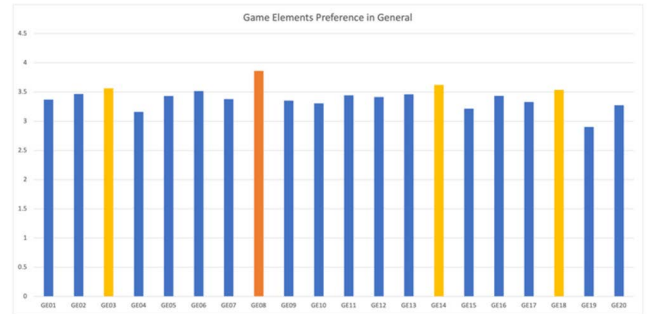The result shows significant differences between the literature review and the post-test result. The result shows that the Social Influence core drive is the most significant motivation for undergraduates to continue participating in the gamified learning platform. In the GamiClass context, 57 out of 69 active undergraduates (82.6%) strongly prefer this core drive. Although Social Influence is both a black hat and a white hat, it provides the undergraduates with a strong reinforcement in continuous learning in the gamified learning platform. On the other hand, the Empowerment core drive did not significantly impact the GamiClass undergraduates; it was ranked as the sixth core drive (M = 3.319) that made the undergraduates continuously learn. These undergraduates were neither actively voicing out their feedback nor positively making a decision (choosing the most cost-benefit path). They instead follow the flow and advice from their peers and rely on their guild leader to state their point of view. The biggest distinctness discovered from the post-test was that the Unpredictably core drive (M = 3.145) is the least dominant drive that stimulates long-term participation in the gamified learning platform. This situation has believed the undergraduates fully understood the learning goal and outcome before onboarding the platform. This phenomenon makes undergraduates reduce their expectations and hardly amazed by the preset story or narrative. At the same time, the GamiClass allows the undergraduates not to complete every single quest and hidden quest along their learning journey, which might reduce their intense passion for exploring all parts of the story. Figure 9 reveals the differences in intrinsic motivation core drives in the gamified learning platform.
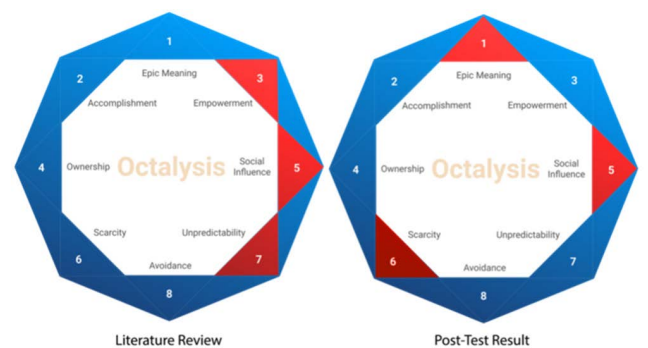


**FIGURE 9.** Intrinsic motivation driven core drives comparison in pre and post-test.

Due to the GamiClass platform's content, the undergraduates know well about taking this subject during their tertiary education programme to develop an innovative solution to Malaysia's existing problems. Therefore, the Epic Meaning core drive (M = 3.471) and Social Influence core drive encourage the undergraduates to work as a team to help improve Malaysia from a socio-economic perspective. The narrative of the GamiClass uses metaphor to enable the undergraduates to apply critical thought and analysis to identify genuine issues in Malaysia and develop suitable solutions to Malaysian problems. Epic Meaning core drive successfully makes the undergraduates believe the thing they are doing is much greater than themselves in doing something significant and impactful. From the insight of the experiment, one particular extrinsic/black hat core drive, Scarcity (M = 3.449), stimulates the undergraduates for their 16-week investigation. The time-pressure game elements compel the undergraduates to complete the individual and group quests within the given time. This occurrence could be triggered by the task tracking area within-group quest, which requires close inspection among peers. Since the Social Influence core drive is playing the primary motivation drive, the impatience among the guild members could provoke self-struggle, thus extending the undergraduate's stickiness to the platform. In short, the post-test result suggested another intrinsic motivation core drive combination that could be a benefit for a gamified learning platform.

The literature review shows that undergraduates with different user profiles have identical motivational needs and preferences. Participant, independent and avoidant undergraduates are expected to demand more self-centred motivation, while competitive, dependent and collaborative undergraduates require social need motivation only. From the post-test results, Social Influence has been certified as the essential core drive that keeps undergraduates engaged with the system. Undergraduates who study in a guild or team can achieve common goals with others, as has been the vogue in massively multiplayer online games. This team-based learning mode helps the undergraduates with problem-solving and critical thinking, thus promoting greater understanding and retention of knowledge. The second and third most desired core drives are Epic Meaning and Accomplishment. By having these two core drives, undergraduates would practice accomplishing any task for the good of the socio-economy. The accomplishment core drives the undergraduates to be self-satisfied while making significant progress towards an individual or common goal. In this context, the undergraduates are driven mainly by their common goal, as the group quest is the most effective game element overall. In general, all undergraduates demand more social-needs motivation than self-centred motivation. This characteristic matches the attributes of undergraduates in the literature review. The comparison is showcased in figure 10.
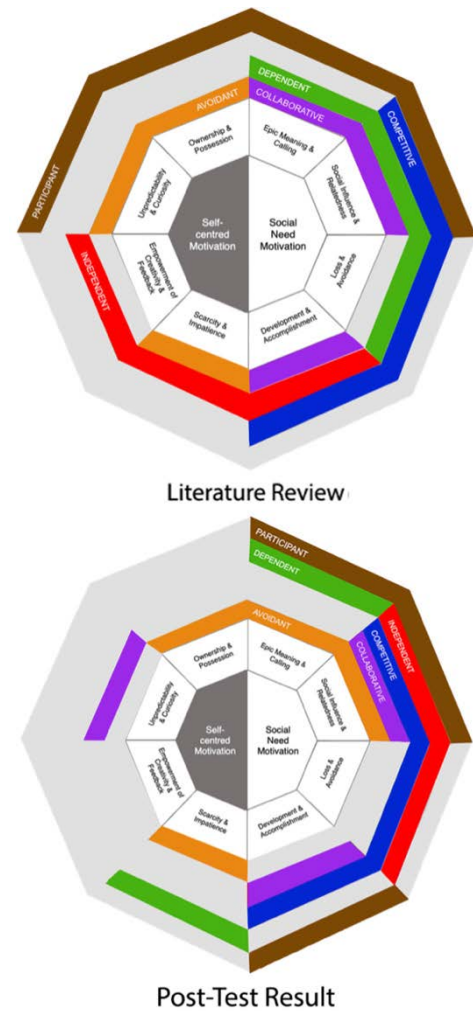


**FIGURE 10.** Undergraduates' motivation need comparison based on octalysis framework core drives.

### D. SUMMARY FOR GAME ELEMENTS
The GamiClass platform identified Group Quest as this study's most compelling game element. Group Quest provides feedback to undergraduates promptly on how well they are doing and facilitates in-game strategy discussion between actions. This element allows undergraduates to develop solid strategies in the interaction between planning and external factors. Although independent learners have a low preference, Group Quest has been marked as the second most influential game element. This element perfectly combines the modes of cooperation and competition, which can further resonate with learners. All learners need companions and the freedom to form their guild and challenge other teams. They should constantly coordinate the weaknesses and strengths of other guild members and ultimately enable undergraduates to get closer to the cooperative relationship of social structure to achieve life-long learning.

Therefore, gamified learning platforms should seriously consider reducing the standard PBL model and introducing

similar game elements to prolong learners' motivation. Other game elements can be hidden or displayed on the interface after the system identifies the participant's learner type. The researcher also found that gamification platforms cannot rely solely on intrinsic motivation-based game elements but gradually reduce extrinsic motivation-based game elements. Two motivational elements must coexist to maximise learners' excitement and enthusiasm for the platform. Table 16 displays the top five highest-impact game elements, and Group Quest is the only game element that is popular for six different types of learners.

**TABLE 16.** Top 5 game elements impacts based on learner type.

| Learner Type | Game Elements Ranks | | | | |
|---|---|---|---|---|---|
| | Top 1 | Top 2 | Top 3 | Top 4 | Top 5 |
| Avoidant | Avatar | Cooperation | Challenge | Group Quest | Signposting |
| Collaborative | Group Quest | Time Pressure | Competition | Challenges | Unlockable |
| Competitive | Leaderboards | Badges | Social pressure | Guild | Group Quest |
| Dependent | Group Quest | Meaning | Progress Loss | Time Pressure | Challenges |
| Independent | Time Pressure | Group Quest | Progress Loss | Meaning | Competition |
| Participant | Group Quest | Meaning | Progress Loss | Competition | Narrative |

Table 17 reflects the preference level of game elements for those undergraduates who persist in gamified learning for up to 16 weeks based on the learner's type.

### E. FRAMEWORK REVISED

From the analysed result, the Intrinsic Motivation Gamification Framework brings more positive and longer-lasting usage than other frameworks used in other gamified online platforms in the past. The researcher believes that the key to the success of this framework lies in the game elements related to team competition. The essence of social interaction is brought into play, making the challenge more dynamic and uncertain. Under the cognitive apprenticeship strategy, the team's strengths are more willing to assist the weak, and the weak are more daring to try under the virtual identity. Ultimately, this relationship is imperceptible to promote cooperation and consolidate learners' knowledge mastery. This framework best assists both avoidant and dependent learners. These two types of learners who no longer feel that learning is a personal agenda become part of a larger group working together to challenge a variety of learning tasks. This framework emphasises the mode of social collaboration and cooperation, so it is closer to the motivational needs of adult gamification. By removing exploration and choices/consequences game elements that caused a minor negative impact on the undergraduate's continuity on the learning platform, this research proposes a revised version of the Intrinsic Motivation Gamification Framework via figure 11.

### F. EMPIRICAL RESEARCH LIMITATION

There are several limitations to the actual empirical approach of this research. The experiment's results support the

**TABLE 17.** Learner's type and game elements preference mapping for continuous learning behaviour.

| | GAME ELEMENT | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Avatar | Badges | Challenges | Choices / Consequences | Competition | Cooperation | Humanity Hero | Group Quests | Guilds | Leaderboards |
| Avoidant | H | M | H | M | M | H | H | H | H | M |
| Collaborative | M | M | M | M | H | M | M | H | M | M |
| Competitive | M | H | M | M | M | M | M | H | H | H |
| Dependent | M | M | M | M | M | M | M | H | M | M |
| Independent | M | M | M | M | M | M | M | M | M | M |
| Participant | M | M | M | M | M | M | M | H | M | M |
| | Narrative | Learning / Onboarding | Progress Loss | Meaning | Unlockable | Signposting | Social Pressure | Time pressure | Exploration | Voting/Voice |
| Avoidant | M | H | M | H | M | H | M | H | M | M |
| Collaborative | M | M | M | M | H | M | M | M | M | M |
| Competitive | M | M | M | M | M | M | H | M | M | M |
| Dependent | M | M | M | M | M | M | M | M | M | M |
| Independent | M | M | M | M | M | M | M | M | M | M |
| Participant | H | M | H | H | M | M | M | M | M | M |

\* INDICATORS:
L = LOW (MEANS: 1.00-2.33)  M = MEDIUM (MEANS: 2.34-3.66) H = HIGH (MEANS: 3.67-5.00)

hypothesis that uncertainty might affect the result, which can often be expressed as a statistical probability value. Furthermore, with a sample size of 80 participants, this cross-section study without testing the residuals combined with the Ordinary Least Squares (OLS) regression approach might raise doubts about the rigorous research approach. Furthermore, since the tabulation of the game elements relies on the learning phase, the researcher did not use the standard longitudinal method, as long-term research is more likely to give unpredictable results. Longitudinal studies involve the same subjects over a long period. What happens to them outside of data collection times can influence the data collected in the future. Besides, it needs a larger sample size for investigation, which is not achievable by the research due to the population of undergraduates at Raffles University. Lastly, the cost of the longitudinal survey is higher because it is more complex and expensive, although it could provide more significant validation. With the researchers' constraints, the cross-sectional study has been selected as the primary research approach.

| EIGHT CORE DRIVE (OCTALYSIS) | | | | | |
|---|---|---|---|---|---|
| Primary Drive | | | | | |
| Unpredictability | Accomplishment | | Social Influence, Scarcity | | Accomplishment |
| Secondary Drive | | | | | |
| Epic Meaning, Accomplishment, Ownership | Empowerment, Social Influence, Epic Meaning, Scarcity, Unpredictability, | | Empowerment, Ownership, Avoidance, Accomplishment | | Epic Meaning, Social Influence |
| Player Journey | | | | | |
| Discovery | Onboarding | | Scaffolding | | Ending |
| Learning Phases | | | | | |
| Introduction | Learning | | Mastering | | Summarising |
| Factors | | | | | |
| Target Motivation | Motivated Behaviour | Information Transmission | Emotional Communication | Strategic Interaction | Behaviour Feedback |
| Game Elements Examples | | | | | |
| Avatar Meaning Narrative Onboarding | Badges Challenges Competition Cooperation Guilds | Signposting Unlockable | Leaderboards Progress Loss Social Pressure Time Pressure | Group Quest | Badges Meaning Voting / Voice |

**FIGURE 11.** Revised intrinsic motivation gamification framework.

## VII. CONCLUSION

Common game elements deployed focusing on extrinsic motivation (such as points badges and leaderboards) are effective for kids or teenagers. At the same time, undergraduates or adult learners need to find intrinsic rewards in the learning they undertake (the learning contains its reward). Therefore, it is necessary to identify intrinsically motivation-driven game elements that suit different types of undergraduates.

For undergraduates, the gamified learning platform should provide a much less confrontational way to correct them without pointing out their previously held knowledge or ideas as wrong. The gamified platform does not require undergraduates to expose themselves by revealing what they know or believe in front of others. In gamification design, the cost of failure is much lower than in reality, allowing and encouraging a cycle of experimentation until the right solution is discovered. The platform must provide non-linear content in a game-like way to satisfy the principle of self-direction. Undergraduates should be able to make meaningful decisions that have a real impact within the game setting and see how that decision informs the current and next steps they take in their learning path. Non-linear content delivery must be limited to the parallel path method as the narrative collapses in on itself, allowing the undergraduates to make choices but eventually collapsing all of them into several mandatory events. These mechanics allow the undergraduates to make some decisions while keeping the total amount of narrative manageable.

An intrinsic motivation-driven gamified platform for undergraduates must fully understand their learning preferences and motivation needs. Below are five statements that summarise their attributes even though they have been categorised under six different learner types.:

   a. Undergraduates are most interested in learning courses that have immediate relevance to their future job or personal life.

   b. Undergraduate learning is problem-centred rather than content-oriented.

   c. Experience (including mistakes) provides the basis for learning activities.

   d. A desire to learn. Effective learning only occurs when the undergraduates have engaged with the specific course or skill offered by the platform.

   e. A collaborative online learning environment allows greater autonomy and understanding of undergraduate goals.

According to the Octalysis Framework, humans' motivations vary from day 1 to day 100. However, all the user's behaviour is affected by eight-core drivers. If there is no core driving force in a stage, the user has no reason to continue or progress to the next stage, thus leaving the platform. Entering the end phase means something other than the end of the learning journey. Excellent gamification design should be renowned for new content and playing modes, thus stimulating the learners. Using the correct game elements allows students to experience the challenge and eventually reach the realm of flow.

Based on the experiment, the researcher identified Social Influence and Relatedness as the vital core drives that drove all the learners to continue learning on the GamiClass platform. Undergraduates want open discussions where all group participants can share their thoughts and want their input to be valued by the organisation. They value inclusivity, and all participants willingly contribute to the conversation. Therefore, it is essential to have clear user guidelines that do not leave any room for intolerance, discrimination or abuse. Social influence is tightly associated with competition and collaboration. Suitable matches can mitigate any isolation effect by creating groups. However, at the same time, the lack of a collaborative element can lead to learners who may become isolated, which can increase the likelihood that learners become demotivated or disengaged. Therefore, a hybrid game element of competition and collaboration is expected to amplify learners' engagement on a particular learning platform.

## VIII. LIMITATION OF THE STUDY

First, the practice study is limited by how the gamification platform is used, so the selected object for the practice study is a private university in Malaysia, leading to a lack of horizontal comparisons, mainly when only a few undergraduates belong to avoidant and competitive groups. In subsequent research, scholars should compare different universities. At the same time, it needs to be expanded to various subjects. Lastly, researchers could compare the characterisation and application effects of different combinations of game elements.

Second, the accumulation time for this study is based on a cross-sectional method of intrinsic motivation in gamification. Raffles University has 14 weeks a semester, so this study ends with a two-week break at the end of the semester,

proving that undergraduates need to stay active in the platform to cope with the assessment at the end of the semester. However, other researchers applied a longitudinal study method of game elements' application in the motivation context for sixteen weeks (Hanus) and a three-year study (Barata). Compared with this study, the accumulation time of this study is relatively short, while cross-sectional studies may be susceptible to reverse causality.

Third, there is room for further improvement in the validity of practical research. Because the research tool used in the experiment was a self-developed gamified learning platform, the application of gamification elements can promote the effect of each other. Scholars could use a single-function gamified learning aid software to affirm the effectiveness of subsequent research. For example, use gamification assessment software to verify the application of feedback.

Finally, the practice study is an open study without any mandatory experimental controls, so the analysis of the results may be affected by factors not considered by the researcher, for example, free choice of individual or group learning mode. Abandoned independent undergraduates have mentioned this consideration, but mainstream online learning is individual-oriented, and the researcher excludes this factor. Therefore, researchers can combine the previous limitations in subsequent research, select different combinations of gamification elements, conduct experimental research and control variables, and draw more accurate research conclusions.

## IX. SUGGESTION AND FUTURE WORKS
Different gamification elements have various internal mechanisms that affect undergraduates' emotions, behaviours, and cognition [54]. While creating the engagement for an online gamification platform, game elements must also achieve a particular knowledge dissemination purpose. Based on the findings of this research, future practices that could include: the interactive data generated by the undergraduates in the gamified platform can be used as a basis for objective evaluation. Secondly, creating an excellent competitive relationship during task setting allows undergraduates to freely participate in the group, creating a psychological need to surpass the opponent's team and stimulating their learning potential [55]. While competing, it also helps undergraduates establish a harmonious and cooperative relationship to cooperate and helps complete the learning goals [56]. These methods help enhance the emotional communication proposed by the Intrinsic Motivation Gamification Framework. In addition, formulating detailed and reasonable rules to make specific restrictions for undergraduates to achieve their goals can stimulate undergraduates' desire to explore.

In recent years, there has been limited educational gamification design research specifically based on the user preference of GRSLSS. The researcher expects more researchers to choose this alternative method to continue and conduct a more in-depth analysis. Since the ratio of learners of different institutions of higher learning or learning platforms could differ in the ratio of learner types in 6, gamified learning

platforms urgently need to combine artificial intelligence to optimise the delivery of game elements. At the same time, the researcher hopes to find or develop a learning platform that can replace GamiClass, carry out a gamification application design that focuses entirely on competition and collaboration, and explore and verify its effects in depth. In the analysis of the research results, it is mentioned that the gamification elements used by GamiClass tend to target the Octalysis Framework white hat core drives. Therefore, follow-up research needs to be conducted to analyse the combination of all game elements. In addition, there is a need for a study to select other analogous binding knowledge or subjects to test the attitude change of undergraduates. Undergraduates are most likely to have different needs for knowledge or subjects in gamified learning mode.

Controlling undergraduates' learning emotions through game elements could trigger positive orientation and adaptive adjustment of personal goals. Furthermore, these settings can accumulate the undergraduates' learning experiences and promote their growth in the learning journey. Finally, the customised design for classifying various undergraduates could enhance the course content so that they could better communicate and interact with others and promote a persistent learning environment.

The suggestions above provide practical ideas for the implementation of gamification. Since GamiClass is not automated in adjusting the balance and fun of the game based on big data, the survey population is relatively limited. Subsequent research could consider expanding the sample size and focusing on competition-collaboration-based game elements such as Group Quest, Guild and Cooperation. The preferences above further enrich the theoretical basis of gamification design. Curriculum designers should comprehensively and systematically combine courses and game elements based on the design, organisation and arrangement of content to achieve sustainable online learning behaviour among undergraduates.

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